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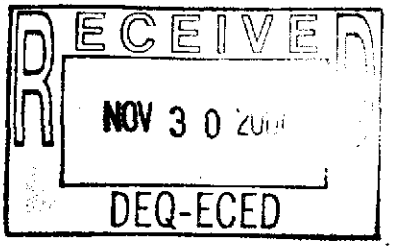

November 30, 2001

Mr. Scott Mills
Mississippi Department of Environmental Quality
2380 Highway 80 West
Jackson, Mississippi 39204

via: ***Federal Express***

Re: Vicksburg Chemical
Draft Groundwater Assessment Report
URS File 35-092B007C.00 03013

Dear Scott:

Per Steve Boswell's directive, attached is a copy of the Draft Groundwater Assessment Report. Copies have additionally been sent to the U.S.EPA.

You may find Table 4-17, all of the figures and Section 5 of particular interest.

Very truly yours,

Dick Karkkainen

URS Corporation
2822 O'Neal Lane
Baton Rouge, LA 70816
Tel: 225.751.1873
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D R A F T

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DRAFT GROUNDWATER ASSESSMENT REPORT

Prepared for
Vicksburg Chemical
Vicksburg, Mississippi

November 2001

File No. 35-092B007C.00-03013

URS

URS Corporation
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

D R A F T

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LIST OF ACRONYMS

Acronym	Meaning
AOC	Area of Concern
bgs	below ground surface
CCC	Cedar Chemical Corporation
CMS	Corrective Measures Study
EPA	United States Environmental Protection Agency
MSDEQ	Mississippi Department of Environmental Quality
PECMT	Preinvestigation - Evaluation of Corrective Measures Technologies
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFA	RCRA Facility Assessment
SWMU	Solid Waste Management Unit
SWMU 1	Hazardous Waste Container Storage Area
SWMU 2	Inactive Landfill will include AOC 4
SWMU 4	Activated Carbon Treatment Unit
SWMU 5	South Plant Drainage System
SWMU 7	Former Dinoseb Production Area
SWMU 8	Dinoseb Loading/Unloading Area
SWMU 9	Dinoseb Drumming Area
SWMU 11	Former MSMA Production Area
SWMU 12	Former MSMA Unloading Area
SWMU 13	South Plant Drainage Ditches
SWMU 14	Former Toxaphene Production Area
SWMU 15	Former Methyl Parathion Production Area
SWMU 16	Former Atrazine Production Area
SWMU 17	Returned Product Storage Area
SWMU 18	Former Blue Tank
SWMU 20	Railroad Car Loading/Unloading Station
SWMU 22	North Plant Neutralization System Concrete Sump
SWMU 25	North Plant Subsurface Wastewater Pipes
SWMU 29	Floor under North Plan Oil Collection Unit
SWMU 30	North Plant Waste Accumulation Area
SWMU 31	North Plant No. 6 Fuel Oil Area
TCL	Toxic Compound List
TAL	Toxic Analyte List
URS	URS Corporation
VCC	Vicksburg Chemical Company

Vicksburg Chemical Company (VCC) retained URS Corporation (URS) to perform activities associated with a RCRA corrective action program. The corrective action program is in response to a Consent Decree which became effective July 1, 1991. The Consent Decree requires that a RCRA Facility Investigation (RFI) be conducted at the Vicksburg, Mississippi manufacturing facility, and that it be followed up by corrective measures as needed.

The purpose of the RFI is to determine the nature and extent of releases of hazardous wastes and/or constituents from regulated units, solid waste management units (SWMUs), and other areas of concern (AOCs) at the facility and to gather all necessary data to support any corrective action required.

The RFI constitutes the second phase of the RCRA corrective action program. The program's first phase consists of the RCRA Facility Assessment (RFA) which is conducted by the EPA and precedes the RFI. The RFI itself is divided into several separate tasks. The tasks include the Preliminary Report, the RFI Work Plan, the Facility Investigation, and the Investigative Analysis Report (RFI Report). Subsequent phases of the RCRA corrective action program concern defining and implementing any needed measures that will protect human health and the environment. In addition, a Groundwater Assessment (GWA) Work Plan, a Closure Plan for SWMU 1 and SWMU 17, and Annual Groundwater Assessment Reports are required by the Consent Decree.

VCC submitted the Preliminary Report and Closure Plan for SWMU 1 and SWMU 17, and subsequently updated the Preliminary Report. The Preliminary Report and Closure Plan for SWMU 1 and SWMU 17 have been approved. VCC submitted the RFI Work Plan and the GWA Work Plan and has updated both plans. The RFI Work Plan was approved, and has been implemented in two phases in the field. The RFI effort is described in the Draft Final RFI Report which is submitted concurrently with this document.

This document is a Draft Groundwater Assessment (GWA) Report. The purpose of GWA is to evaluate the groundwater quality, monitoring system and program, as well as the groundwater pollution abatement measures at the facility.

The Groundwater Assessment program consists of the following tasks:

- Implementation of the groundwater assessment field work
- Publication of the results and conclusions
- Continuation of a groundwater monitoring program

- Annual Groundwater Assessment Reports written directly by Vicksburg Chemical

The Groundwater Assessment program field activities have been implemented during the RCRA Facility Investigation, the last phase of which occurred in May 2001, and another investigation, specifically directed to complete groundwater investigative activity in September 2001. Data needed for Groundwater Assessment activities and requisite activities such as borings and well installations were obtained during the RFI implementation programs. As will be described subsequently, a portion of the RFI program was expedited because of VCCs need to expand its manufacturing and storage capability in some of the SWMU areas.

The GWA includes the following elements:

- Number, location, depth of wells, and the rationale for any new well placement
- Monitoring Zone
- Groundwater Flow Direction
- Groundwater Flow Rate
- Construction logs for each existing monitoring well
- List of the monitoring parameters
- Geologic cross-sections
- Sampling and analytical methods for those hazardous wastes or hazardous constituents at the facility
- Evaluation procedures, including any use of previously-gathered groundwater quality information
- Schedule of implementation of additional work

The GWA is in part guided by the information contained in the Amended and Supplemental Preliminary Report (February 1994 with November 1995 Revisions) and by the information obtained during the RFI.

The following is a summary description of the SWMUs. It is followed by a tabulation of reports which describe SWMU activity at the site. Some of the activity was expedited because of VCC's plans to construct new manufacturing facilities and also utilize some of the SWMU areas for storage and for transportation related activity. The summary discussion of the SWMUs is obtained from the RFI Report. The SWMU locations are depicted on Figure 1-1 "SWMU Locations, RFI Soil and Concrete Sample Points, GWA Monitor Well Locations". For additional information, including data on soil contamination, the RFI Report should be examined. Groundwater quality information related to the SWMUs is found in Section Three and Appendix H of this Groundwater Assessment Report.

SWMU 1 – Container Drum Storage Area, SWMU 16 – Former Atrazine Production Area, SWMU 17 – Returned Product Storage Area

SWMU 1 is a "less than ninety day hazardous waste drum storage area" that was located at the South Plant adjacent to the Former Atrazine Production Area (SWMU 16) across a walkway from the Returned Product Storage Area (SWMU 17). This area was diked. The roof over the area was destroyed by a windstorm during mid-1990. Spills were collected in a sump common to both this area and the Returned Product Storage Area (SWMU 17). The floor has been cleaned through sweeping, scraping, chipping, and reacting the dinoseb with hydrogen peroxide and a ferrous iron catalyst. A closure plan for the Container (Drum) Storage Area (SWMU 1) and the Returned Production Storage Area (SWMU 17) was developed by URS for VCC. The closure plan is consistent with RCRA rules and regulations. The closure plan was originally submitted in June 1992 as a 60-day deliverable to the EPA and MSDEQ by VCC.

A facility for the manufacture of potassium phosphate has been constructed on the SWMU 1 site.

The Former Atrazine Production Area (SWMU 16) is located adjacent to the Container (Drum) Storage Area (SWMU 1) and the Returned Product Storage Area (SWMU 17). In addition to producing atrazine, this process area manufactured the herbicide cyanazine under the packaged name Bladex. The former atrazine warehouse is located adjacent to the Former Atrazine Production Area (SWMU 16). The warehouse was used to store dinoseb as well as atrazine.

The warehouse continues in service in order to store various fertilizer products manufactured by VCC. The Atrazine Production Area was demolished and was reconstructed for the production of potassium phosphate.

The Returned Products Storage Area (SWMU 17) was located across a walkway from the Container (Drum) Storage Area (SWMU 1). Product formulations returned by consumers and off-spec product were stored here until they could be reblended, re-containerized, and sold or disposed of as a hazardous waste. The floor has been cleaned through sweeping, scraping, chipping, and reacting the dinoseb with hydrogen peroxide and ferrous iron catalyst. A closure plan for the Container (Drum) Storage Area (SWMU 1) and the Returned Production Storage Area (SWMU 17) was submitted by VCC as a 60-day deliverable pursuant to the Consent Decree.

The SWMU 17 site was part of the site of a potassium phosphate manufacturing facility. As noted above the potassium phosphate groundwater facility encompasses SWMU 1, the production area of SWMU 16 and SWMU 17.

SWMU 2 – Inactive Landfill

SWMU 2 is a hill with a natural elevation approximately 30 feet above immediate surrounding areas. A landfill and four pits or ponds were constructed on the hill and utilized from 1972 to 1975. One pit was constructed to store dinoseb process wastewater. Three pits were used as disposal locations for pallets, empty fiber and steel drums. In 1977 many of the drums in the pits, but not the landfill, were removed and disposed off-site. The location of the closed pits and closed landfill are based on a March, 1979 aerial photograph. The boundary lines of the pits were partially destroyed during regrading efforts in late 1979. In 1979 all the pits were drained, regraded so the hill was flattened and covered with a soil cap. Some of the soil was obtained off-site and placed on the landfill area. In 1983, there was additional grading and capping of the entire area consistent with an engineered plan approved by the MSDNR. In 1988 the SWMU 3 wastewater ponds, which are adjacent to SWMU 2, were lined and a repository for pond sediments (SWACA) was constructed. The SWACA was constructed in a pond location. The sediments from the SWMU 3 wastewater ponds and most of the sediment of the pond are within the SWACA. The pond lining and SWACA construction is consistent with RCRA guidelines.

In the year 2000 a diked area was constructed atop SWMU 2 to settle and dewater the sludge from the wastewater impoundment. The sludge was submitted for TCLP analysis prior to being pumped to the diked area and was determined to be non-hazardous. On September 13 and 14, 2001, two composite samples were obtained by blending grab samples at three locations of the six to twelve inch soil depth interval, representing the settled sludge. The entire diked area is covered by dense vegetation. The composite samples were analyzed for toxaphene and dinoseb. One sample contained 3,513.9 ppb toxaphene and 27.4 ppb dinoseb. The other contained 5,170 ppb toxaphene and 100.8 ppb dinoseb.

SWMU 4 – Activated Carbon Unit

The Activated Carbon (Adsorption) Treatment Unit treats wastewater from the Surface Impoundment (SWMU 3) to remove organic materials before the water is pumped to the Mississippi River in accordance with the NPDES permit. Secondary containment for the unit consists of a concrete pad approximately 100 feet long, 20 feet wide with 1-foot tall containment curbs. The concrete containment unit is cracked and stained. There is visual evidence of spillage of carbon on the east side of the containment area. The carbon was sampled, tested by TCLP and found to be non-hazardous.

SWMU 5 – South Plant Drainage System

The South Plant Drainage System was designed to transfer storm water and process water to the Surface Impoundment (SWMU 3) for containment prior to treatment. Sumps exist within the former MSMA, dinoseb and toxaphene production, packaging and shipping areas of the South Plant. At one time, some of the sumps carried water to the Surface Impoundment (SWMU 3); however, due to regulations which became effective in November 1985, sumps in the pesticide process and handling areas were blocked. This precluded the possibility of pesticide spills from entering the Surface Impoundment (SWMU 3) by gravity flow through the Drainage System.

SWMU 6 – Wastewater Storage (Hill) Tanks Area

The Wastewater Storage Tanks were located on the hill in the northern area of the South Plant. They were surrounded by dikes. Three 98-foot diameter storage tanks were once used to store ammonium nitrate. Two of these tanks were emptied, cleaned and used for warehouse storage. The westernmost tank (1,600,000 gallon) was converted to store neutralized process wastewater generated during the production of dinoseb.

The dinoseb process wastewater was originally pretreated by pumping through 2 columns, each containing 20,000 pounds of carbon, in a Activated Carbon System (SWMU 4) and discharged into the Surface Impoundment (SWMU 3). Contents of the Surface Impoundment were additionally treated by pumping through 2 additional columns, each containing 20,000 pounds of carbon, in the Activated Carbon Treatment System prior to discharge to the Mississippi River. The plant increased dinoseb production capacity and increased generation of process wastewater in the early 1980s. This increased production capacity caused the wastewater discharged to the Mississippi River to exceed the NPDES permit levels. As of January, 1983 the process wastewater was stored in the westernmost storage tank and then sent off-site for deep-well injection, thereby eliminating the cause of the NPDES permit violations. This off-site disposal continued until the dinoseb plant was shut down in December, 1986.

The storage tanks have been demolished and removed from the site. The tank ring foundations still remain in the area. There are no stains on the tank foundations or soil in this area. This diked area was used to settle and dewater the sludge from the wastewater impoundments in 1998. The sludge was submitted for TCLP analysis prior to being pumped to the hill tank area and was determined to be non-hazardous. On September 13, 2001 a composite sample was obtained by blending grab samples at three locations of the six to twelve inch depth soil interval, representing the settled sludge. The composite sample was analyzed for toxaphene and dinoseb and was found to contain 1,141.8 ppb toxaphene and 29.8 ppb dinoseb.

SWMU 7 – Former Dinoseb Production Area

The Former Dinoseb Production Area is located near the railroad tracks. The production area and foundation have been demolished and removed and a portion treated in a CAMU. Some discolored soil has been removed. Due to the acid involved in the manufacturing of the herbicide, the concrete and cement in the process area had been badly corroded and etched. The dinoseb manufacturing process consisted of sulfonation and nitration reactors, two formulation blending tanks, and a settling tank. At one time, acidic process wastewater was neutralized with sodium hydroxide or ammonia and then discharged to the Surface Impoundment (SWMU 3) through carbon adsorption beds. Emission from the nitration reactor was controlled by a butane-fired flare. Flare failure required immediate plant shut down; however, the soil in the area surrounding the flare is suspected to be contaminated.

The area is surrounded by the Railroad Area (SWMU 20) and is adjacent to the Toxaphene Area (SWMU 14).

SWMU 8 – Dinoseb Loading/Unloading Area

The Dinoseb Truck Loading/Unloading Area is located in the central section of the South Plant adjacent to the Dinoseb Drumming Area (SWMU 9). It is a concrete pad that used to contain spillage associated with the truck loading/unloading operations at the Former Dinoseb Drumming Area (SWMU 9). The pad is approximately 25 feet long and 15 feet wide.

The loading/unloading area is now covered with asphalt and within a warehouse/operations area for production of Multi Cote (coated fertilizers for slow release of nutrients). It continues to be used as a loading/unloading area.

SWMU 9 – Dinoseb Drumming Area

Drumming of the dinoseb and toxaphene formulations took place in the south end of a warehouse in the central section of the South Plant. In the drumming operation of the dinoseb and toxaphene, an absorbent was placed on the floor to prevent material reaching the Surface Impoundment from spills. Yellow stains were evident on the floor.

The SWMU 9 site is presently the site on which a facility to coat and then store various fertilizer mixtures has been constructed. Prior to the construction the area was sampled and cleaned up. The entire surface of the concrete in SWMU 9 was treated by grinding off a veneer of concrete then by placing a layer of compost atop it in an attempt to draw contaminants from the surface of the concrete into the compost where biological degradation would occur. The effort was experimental and results were uncertain. Subsequently, concrete and some soil were removed from a section comprising the middle third of SWMU 9. All concrete grindings, concrete debris, and soil removed were taken to the Treatment Unit for eventual biodegradation/composting within the provisions of the CAMU permit.

SWMU 11 – Former MSMA Production Area, SWMU 12 – Former MSMA Salt Unloading Area, SWMU 15 – Former Methyl Parathion Production Area

The MSMA Production Area (SWMU 11) was constructed over the remains of the Former Methyl Parathion facility (SWMU 15) in 1983. Subsequently, the MSMA process was shut down and equipment from the area was removed and the concrete foundation of the area was cleaned with high-pressure water equipment.

The MSMA Salt Unloading Unit was an integral part of the MSMA Production Area (SWMU 11). Salts were discharged directly from a centrifuge into containers located within the area.

The original process unit was constructed in the early 1970s to produce methyl parathion. The methyl parathion manufacturing facility was destroyed in an explosion and fire on March 7, 1978.

SWMU 13 – South Plant Drainage Ditch

There is one major Drainage Ditch which runs along the western border of the South Plant and empties into Hennessey's Bayou. No contaminated Drainage System (SWMU 5) water or NPDES permitted discharge is received by the major Drainage Ditch. However, some storm water runoff has discharged into the major Drainage Ditch from the South Plant. Additionally, drainage from a portion of SWMU 34 – The Junkyard discharges into the drainage ditch.

SWMU 14 – Former Toxaphene Production Area

The Former Toxaphene Production Area is adjacent to SWMU 7 - The Dinoseb Production Area and is surrounded by SWMU 20 – The Railroad Area.

Raw material used in the toxaphene manufacturing process included sodium hydroxide, xylene, epichlorohydrin, chlorine, carbon tetrachloride, and camphene. Caustic scrubber water from the toxaphene operation was discharged to the sump adjacent to the Former Dinoseb Processing.

The processing equipment from the Toxaphene plant has all been removed. The foundations and secondary containment concrete structure were in good repair and were not demolished. The foundation presently serves as a repository for soil excavated from various parts of the South Plant during construction activity. The soil is to be treated by a biological degradation composting process.

SWMU 18 – Former Blue Tank Area

The Former Blue Tank Area (SWMU 18) received unneutralized dinoseb process wastewater prior to off-site disposal by deep well injection. The unit was located northwest of the Former Dinoseb Production Area (SWMU 7) and adjacent to the Nitric Acid Production Area in the South Plant. A gravel covered area exists at the location of the Former Blue Tank (SWMU 18). The original 16,000-gallon tank was fiberglass. The fiberglass tank leaked. Two repair attempts failed in 1983 causing the fiberglass tank to be replaced by a stainless steel tank at the dinoseb plant. The fiberglass tank was demolished and removed from the site.

SWMU 20 – Railroad Area

The Railroad Area (SWMU 20) including the Railroad Car Loading/Unloading Station is located at the eastern boundary of the manufacturing portion of the South Plant. The railcar station was the primary area for the loading/unloading of materials for the various operations conducted at the South Plant. The area spans several hundred feet along the multiple-lane railyard. The ground in the surrounding area has received spillage from the loading/unloading operations. In addition to railyard operations, the flare for the dinoseb production area nitration reactor was located directly across the tracks from the railyard. Incomplete flaring discharged constituents onto the ground in the area surround the flare. The flare area is indistinguishable from the Railroad Area (SWMU 20).

SWMU 20 also surrounds SWMU 7 – The Former Dinoseb Production Area and SWMU 14 – The Former Toxaphene Production Area. SWMU 4 – The Activated Carbon Unit is on the eastern edge of SWMU 20.

SWMU 23 – Equalization/Neutralization Pond

This unlined pond also known as the North Pond was located on the North Plant site and was utilized for neutralization of acidic wastewater from the potassium nitrate production process.

The neutralization of the water in the Neutralization Pond was achieved using limestone. The potassium nitrate production wastewater is no longer routed through the equalization and neutralization ponds. The pond at the North Plant is inactive. The pH of the rainwater in the pond has been checked and found to be near neutral. URS conducted an RFI in the North Pond Area in November and December 1993.

SWMU 30 – North Plant Waste Oil Accumulation Area

The Waste Oil Satellite Accumulation Area (SWMU 30) is an outdoor drum staging area located in the south section of the North Plant. The unit is downgradient from the Inactive North Plant Surface Impoundment (SWMU 23). The unit consists of a concrete pad with secondary containment in the form of concrete curbing used to stage drums of new and waste lubricant oils prior to of-site recycling. The area is situated in the vicinity of a lubricant storage area. The area is roofed.

SWMU 34 – Surplus Equipment Storage

The Surplus Equipment Storage Areas are located at the western edge of the South Plant at the head of the South Plant Drainage Ditch (SWMU 13) and at the western edge of the North Plant. The main storage area is the one located in the South Plant. The storage areas were used for temporary storage of old equipment, and other scrap material. Most items have been removed for recycling.

SWMU 29 – North Plant Oil Collection Unit, SWMU 31 – North Plant No. 6 Fuel Oil Area, SWMU 25 – North Plant Waste Water Pipes, SWMU 22 – North Plant Neutralization System

The four items are grouped together. They were mentioned in the RFA. In the Preliminary Report, it was suggested that inspections of the areas should be made during the field investigations of the RFI prior to determining if field sampling was required. Some cleaning effort was required prior to inspection.

SWMU 29 is a drum that collects oil drips from the potassium nitrate cooling cylinder. The oil collection system has been modified so that oil drips are now directly piped to the drum.

SWMU 31 is a concrete sump that formerly housed pumps to move fuel oil from tanks to boilers. The tanks and pumps had been removed prior to the writing of the Preliminary

Report; however, deposits of soil in the sump made it impossible to observe whether there had been cracks in the concrete. The cracks would be potential avenues of escape of fuel oil in the event it leaked from pumps into the sumps.

SWMU 25 is the system of waste water pipes carrying waste water that can be acidic from the North Plant Manufacturing to a sump from which it is pumped to the neutralization system.

SWMU 22 is the sump collecting wastewater as noted above and the neutralization system itself. The neutralization system was not questionable in the Preliminary Report as a source of contamination into the soil and groundwater; however, the integrity of the sump was questioned. The old sump was removed and was replaced with a new sump in March 2001.

The following is a tabulation of published reports on SWMU activity:

TABLE 1-1

REPORT DESCRIBING SWMU ACTIVITY

Report	Date	Status	Comment
RFI Work Plan SWMUs 9 and 16	August 1994	Submitted	--
RFI Report SWMUs 9 and 16	September 1994	Submitted	--
SWMU 23 North Pond RFI Work Plan FRI Report	October 1994	Submitted	14 piezometers were installed.
Closure Plan SWMUs 1 and 17	February 1995 (Modified 10-26-95)	Approved by the U.S. EPA and MSDEQ	--
RFI Work Plan Entire Site	June 1996	Modified 12-16-99 and subsequently approved	Incorporated investigative phase of "Closure Plan SWMUs 1 and 17".
GWA Work Plan Entire Site	June 1996	Modified 12-16-99. To be revised after completion of Final RFI Report	--
RFI Expedited Work Plan SWMUs 12, 11, 15, 16, 1 and 17	January 1997	Submitted	VCC planned to expand manufacturing capability into SWMU 12, 11 and 15 area or SWMU 16, 1 and 17 area.

TABLE 1-1 (Continued)

REPORT DESCRIBING SWMU ACTIVITY

Report	Date	Status	Comment
RFI Report, Corrective Measures Study, RCRA Corrective Measures Implementation Plan SWMUs 16, 1 and 17	June 1997	Approved by the U.S. EPA and MSDEQ	--
Corrective Action Management Unit Application	June 1997	Approved by the U.S. EPA and MSDEQ	--
RFI Report SWMUs 12, 11 and 15	April 1998	Submitted	--
Corrective Measures Implementation Plan SWMUs 12, 11 and 15	April 1998 (as amended July 15,1 998)	Submitted	To be revised by 11-15-00
Corrective Action Observation Confirmatory Sampling and Analysis SWMUs 1 and 17	July 1998	Submitted	--
Arsenic Data Sets Arsenic Data Sets – Addendum	October 15, 1998 October 26, 1998	Submitted Submitted	Evaluation of arsenic background data.
SWMU 9 Corrective Action Observation	March 11, 1999	Submitted	--
Observations and Sampling of Ditch	September 8, 1999	Submitted	Surficial dinoseb contamination of soil noted during excavation of a ditch for a new water drainage line.
Response to July 3, 1999 Comments by the U.S. EPA on the "Amended and Supplemental Groundwater Assessment Work Plan"	July 31, 2000	Submitted	Summarized previously written description of SWMUs and work accomplished at each SWMU. Additionally responded to questions.
RCRA Facility Investigation SWMU 2 – Inactive Landfill Interim Report	October 2000	Submitted	--

TABLE 1-1

REPORT DESCRIBING SWMU ACTIVITY

Report	Date	Status	Comment
Interim Revised Corrective Measures Implementation Plan SWMU 12 – Former MSMA Salt Unloading Area SWMU 11 – Former MSMA Production Area SWMU 15 – Former Methyl Parathion Production Area	November 2000	Submitted	Need agreement of arsenic clean up standards based on background. Need completion of RFI and GWA to completely verify and define problem.
RCRA Facility Investigation Interim Report and Phase II Workplan	December 15, 2000	Submitted (Later revised by VCC)	Contained some analytical laboratory calculation errors.
RCRA Facility Investigation Interim Report and Phase II Workplan	March 16, 2001	Submitted and Approved	Corrected analytical errors and added results of a surface and soil pile sampling program completed on February 16, 2001
Final RFI Report	August, 2001	Submitted	Contains information on entire RFI program, including the Phase II effort.

The technical approach in the Groundwater Assessment Report consists of pulling together the studies and data related to the groundwater flow and groundwater quality at the VCC site. Much of the information has been previously submitted; however, it is focused herein on groundwater flow and quality.

The information is presented in three sections:

- **Section Three – Site Characterization.** This section presents information from literature which is supplemented by observations made in the field and the laboratory. The observations lead to cross sections describing geologic features, groundwater flow direction and groundwater flow rate.

- **Section Four – Nature and Extent of Contamination.** This section presents results of groundwater sampling and analysis and presents information on contaminant plumes in groundwater.

- **Section Five – Groundwater Monitoring.** The relationship between the plumes and monitor wells is presented. Proposals for future groundwater monitoring are discussed.

The following information describes the environmental setting on a regional and local basis.

3.1 REGIONAL GEOLOGY

The Vicksburg area lies on the eastern flank, near the axis, of the Mississippi Embayment, containing unconsolidated sediments of Cretaceous to Quaternary Age, the sediments thicken in the structural trough toward the axis of the Embayment and the Gulf of Mexico.

Wind-borne silty sediments, named Pleistocene loess, were deposited in the Vicksburg area. The Pleistocene loess in the Vicksburg area is a homogeneous, massive silt with variable clay content. The loess underlies the ground surface through the local region. Loess generally is characterized by a higher vertical permeability in comparison to its horizontal permeability.

Underlying the Pleistocene loess is the Oligocene Vicksburg formation. This formation consists of alternating beds of sandy marl, clay marl, montmorillonitic clay and thin beds of limestone.

3.2 SITE GEOLOGIC FEATURES OF THE PLANT SITE

Developers International Services Corporation (DISC) provided the initial descriptions of the geology of the site in a November 1981 report "Hydrogeological Investigation." A second description was provided by IT Corporation in a January 1985 "Final Report: Groundwater Assessment Program". Both reports provided hydraulic conductivity data from laboratory testing on soil obtained from borings on site and supplemented the information by generalized descriptions obtained from U.S.G.S. publications.

It was observed in both reports that the loess with variable clay content extends from about 6 to 48 feet below the surface across the site. Immediately below the loess, a thin layer (1 to 2 feet) of greenish-gray sandy clay is usually present. Underlying the sandy clay is a marl from the Vicksburg formation called the Byram marl. The top of the marl varies across the site from 60 to 65 feet mean sea level (msl). This marl serves as the bottom of a shallow confined aquifer. Various cross sections of the geology beneath the South Plant are shown in Figures 5 through 11. The cross sections portray silt with variable clay content as interpreted by individual loggers; the formation is Pleistocene loess to approximately 60 feet msl.

The bedrock underlying the facility is a layer of Glendon limestone of the Vicksburg Formation and, beneath the limestone, is the Jackson Formation. The top of the Glendon limestone is expected to be 80 to 100 feet beneath the plant site and ranges from 25 to 65 feet thick. The Glendon is a dark gray to brown, dense, fine-grained limestone. The underlying non-permeable Jackson Formation is 40 to 150 feet thick.

Information in the 1965 Bulletin 105 "Mississippi Geological, Economic and Topographical Survey" by William H. Moore describes the Glendon limestone and the Byram marl which is located at the top of the highest hard limestone ledge of the Glendon:

> "The Glendon limestone consists of alternating beds of gray, fossiliferous, glauconitic, slightly sandy limestone and gray-green, glauconitic, fossiliferous, sandy marl. The Glendon weathers to a yellowish or buff color. The limestone beds in the Glendon are not constant with the number, thickness and stratigraphic position varying from place to place. A hard bed about 10 feet from the top of the Glendon is the most consistent and usually the thickest. On the outcrop the marls weather more rapidly and the limestone ledges tend to stand out. The Glendon weathers completely in places leaving a dark-brown residual clay. ... At some localities the residual clay contains white, partly weathered limestone and contains at other localities a white, waxy, clayey material. ... The material is a clay giving an x-ray pattern of major montmorillonite and halloysite in which kaolinite is still a trace constituent.
>
> Thick beds of bentonite are present between ledges of Glendon limestone in Smith County. In Warren and Yazoo Counties thin beds of bentonite are present in the same stratigraphic position. ...
>
> The Byram marl consists of gray-green, glauconitic, fossiliferous, clayey marl and gray-green, glauconitic, fossiliferous, limy clay."

The site is in a valley with process areas cut into the hillside. As a generalization the following is a table of notable elevations:

TABLE 3-1 NOTABLE ELEVATIONS	
Area	Approximate Elevation (feet MSL)
Surface of Inactive Disposal Area (SWMU 2)	135
North Pond Area (SWMU 23)	133
South Plant	120
North Plant	115
Railroad Track, Surface Pond Area, Area Surrounding Inactive Disposal Area	100-110
Stout's and Hennessey's Bayou	85

3.3 REGIONAL GROUNDWATER HYDROLOGY

A shallow confined loess aquifer underlying the VCC plant is on top of the Byram marl formation. Reported wells in the area are upgradient of the plant and are producing water from deeper, more productive aquifers such as the Catahoula and Forrest Hill formation. These deeper aquifers are apparently hydraulically separated from the shallow groundwater aquifer.

The shallow aquifer underlying the VCC plant is, however, hydraulically connected to Stout's Bayou and Hennessey's Bayou. Hatcher Bayou and Stouts Bayou merge southeast of the plant site to form Hennessey's Bayou, which flows to the Mississippi River. Noted as intermittent streams on USGS topographical maps these bayous are limited to fresh water fish and wildlife habitat. They are not drinking water or recreational water sources. The major use of the Mississippi River downstream of its confluence with Hennessey's Bayou is as a marine transportation route. There are no drinking water intakes in these waters within three miles downstream of the facility.

3.4 SHALLOW GROUNDWATER HYDROLOGY BENEATH THE PLANT

The Byram marl in the Vicksburg Formation constitutes the bottom of the uppermost water-bearing zone underlying the facility. The Byram marl is described as representing mixed clastic and carbonate sedimentation in an open shelf or platform environment. The argillaceous, massive and medium dense character of the marl would inhibit any significant movement of water through this unit, and there is no indication of secondary permeability. The uppermost water bearing zone is approximately 40 feet thick consisting almost exclusively of Pleistocene loess (silt). The clayey fill material placed atop the loess is acting as a "cap"

inhibiting the vertical migration of the groundwater. The presence of the marl on the bottom of the aquifer creates a slightly artesian confined aquifer which is not hydraulically connected to any potential water-bearing zones at greater depths. The artesian property is characteristic of an aquifer which is under pressure from above and below. The background water quality of this aquifer is marginally acceptable for drinking water; however, due to its low lateral flow and yield characteristics its usefulness as a domestic water supply is severely limited.

3.5 GEOLOGIC AND HYDROGEOLOGIC FEATURES

The following is a list of geologic cross sections that describe the site. Well screen and piezometric elevations have been added to the cross sections. The piezometric data was obtained in November 1993.

- Figure 3-1 – Potentiometric Contours with Cross Section Locations
- Figure 3-2 – Section A-A'; generally north/south at the railroad track elevation from the north plant to the south plant.
- Figure 3-3 – Section B-B'; generally east/west at the southern boundary of the south plant.
- Figure 3-4 – Section C-C'; generally east/west through the center of the south plant.
- Figure 3-5 – Section D-D'; generally east/west on the northern boundary of the south plant.
- Figure 3-6 – Section E-E'; generally east/west through the North Pond.
- Figure 3-7 – Section F-F'; generally north/south on the eastern boundary in the south plant.

The various cross sections depict the wind-borne deposited silty sediments, or Pleistocene loess, underlying the Vicksburg Chemical site. The Pleistocene loess is a homogeneous, massive silt with variable clay content. SWMU 2, historically called the "hill area", is

entirely a loess deposit. There may be less clay content in the SWMU 2 than is present in the loess underlying most of the plant.

The shallow aquifer underlying the VCC plant site, is hydraulically connected to Stouts Bayou and Hennessey's Bayou. Hatcher Bayou and Stouts Bayou merge southeast of the plant site to form Hennessey's Bayou, which flows to the Mississippi River. Existing monitor wells MW-2, MW-8, MW-7, MW-6, MW-5, MW-12, MW-10, MW-16, MW-1A, MW-11, MW-14, PZ-25B, PZ-24B, along with monitor wells MW-12C, MW-10C, MW-16C, PZ-26A and PZ-26B, which were installed during the RFI Phase II, effectively intercept and monitor the shallow aquifer between the site and Hennessey's Bayou.

There are additional observations that can be made from the piezometric and well screen elevations on the geologic cross sections:

- Cross section A-A'. The piezometric elevations do not vary with the variations in screen elevations thus demonstrating the interconnectivity of the zones in the aquifer. Nonetheless, due to the proximity of SWMUs 4, 7, 14 and 20 to the line of wells in cross section A-A', shallow wells were installed at MW-12C, MW-10C and MW-16C locations during the RFI – Phase II to make certain that any potential plume be intercepted.

- Cross section B-B'. The cross section of the "valley" demonstrates the potential for seepage from spills in the southern edge of the south plant to discharge. Another observations is that the groundwater level observed in LS-5 (temporary well installed during SWMU 2 investigation) is consistent with levels at MW-8 and MW-7 without mounding or any evidence of a perched zone.

- Cross section C-C'. The groundwater levels observed in LS-1, LS-2, LS-3 and LS-4 are consistent with levels at MW-12 and MW-6. Nested wells at MW-17A, MW-17B, MW-18A, and MW-18A were installed during the RFI – Phase II to intercept the entire aquifer.

- Cross section D-D'. Hennessey's Bayou is shown to be a likely location of contaminated groundwater discharge.

- Cross section E-E'. Evidence of a perched zone of groundwater is exhibited by the difference in groundwater elevations in shallow wells versus deeper wells. The perched groundwater connects with the aquifer at locations PZ-22, PZ-23 and PZ-24. Wells PZ-26A and PZ-26B were added in the RFI – Phase II to yield additional information on the extent of the perched water table. The perched water table does not extend to locations PZ-26A and PZ-26B; shallow and deep wells at this location have the same groundwater elevation.

3.6 MONITORING ZONE

The monitoring zone is generally from ten to fifty feet below ground surface. The well screen and piezometric elevations are depicted on the geologic cross-sections on Figures 3-2 through 3-7.

3.7 GROUNDWATER FLOW DIRECTION

The potentiometric contours are shown on Figure 3-1. Flow direction is perpendicular to the potentiometric contours. Flow direction is generally south-southeast toward Hennessey's Bayou.

3.8 GROUNDWATER FLOW RATE

The groundwater flow rate in the monitored zone is estimated by the following equation:

$$V = \frac{Ki}{e}$$

Where:

V	=	Linear velocity
K	=	Hydraulic conductivity
i	=	Hydraulic gradient
e	=	Effective porosity

Permeability values obtained by IT Corporation during various investigations prior to 1993 ranged from 3.0 x 10^{-6} ft/sec to 8.5 x 10^{-6} ft/sec. Porosities were estimated at the same time to vary from 42 to 46%. Using hydraulic gradients based on differences in elevation and

scaled distances along flow lines perpendicular to contours shown on Figure 3-1, the following velocities are calculated:

TABLE 3-2

GROUNDWATER FLOW RATE

Monitor Well Number	Porosity (%)	Hydraulic Conductivity (ft/sec)	Hydraulic Gradient (ft/ft)	Velocity (ft/day)	Velocity (ft/year)
1	46	3.0×10^{-6}	0.044	0.025	9.1
6	45	3.0×10^{-6}	0.028	0.016	5.8
11	44	8.5×10^{-6}	0.059	0.098	35.9
12	42	4.3×10^{-6}	0.05	0.044	16.1

3.9 PUMPING YIELD TESTS

During the May 2001 field activities a pump test was run on monitor wells MW-17A and MW-17B. Monitor wells MW-17A and MW-17B were installed to monitor the arsenic plume from SWMU 11, 12, and 15. MW-17B is the shallow well, screened at 10 to 20 feet below ground surface and MW-17A is the deep well, screened at 30 to 40 feet below ground surface. The piezometric groundwater elevations in both wells are the same; therefore, the wells may be screened in different zones but the zones are interconnected.

The pump tests were runt utilizing a bladder pump inserted in the well. The pump was pneumatically activated. Pumping rate was controlled by the rate of pneumatic pulsing. Flow rate was measured with a laboratory graduated cylinder and a stop watch. The water level in the well was continuously monitored during pumping. Experimental procedure consists of lowering the water elevation then varying the pumping rate until a rate was found that maintained a constant elevation in the well. The data are presented in Tables 3-3 and 3-4.

TABLE 3-3

WATER WELL YIELD TESTING LOG – MW-17A

Date	Time (hours)	SWL (ft)	PWL (ft)	Discharge			Remarks
				Q	Time* (min)	Rate	
05/17/01	1341	3.0	0	0	0	0	Began pumping with pump set at center of screen (35 ft) Water murky
05/17/01	1346	NA	4.4	2 liters	5	400 ml/min	Reduced discharge rate
"	1350	NA	4.8	NM	9	NA	Aborted test due to compressor failure
"	1502	NA	4.2	NM	0	NA	Began pumping again Water very murky with high solids content
"	1507	NA	4.2	146 ml	5	28 ml/min	Increased discharge rate
"	1510	NA	NM	NM	8	NA	Adjusting discharge rate
"	1514	NA	4.35	NM	0	NA	Began pumping at adjusted rate water very murky with very high solids content – pump clogging
"	1519	NA	4.40	280 ml	5	56 ml/min	Pulled pump up 15 feet (20 ft depth) to clear water Pump operating at variable rate due to prior clogging
"	1520	NA	4.40	NM	0	NA	Began pumping at adjusted rate
"	1525	NA	4.70	1 liter	5	200 ml/min	
"	1530	NA	4.9	NM	0	NA	
"	1535	NA	5.2	NM	5	NA	
"	1538	NA	5.30	NM	8	NA	Test aborted due to compressor failure
"	1656	NA	4.70	NM	0	NA	Began pumping again Water clear, pumping at steady rate
"	1658	NA	4.75	NM	2	NA	
"	1700	NA	4.90	650 ml	4	167.5 ml/min	

TABLE 3-3 (Continued)

WATER WELL YIELD TESTING LOG – MW-17A

Date	Time (hours)	SWL (ft)	PWL (ft)	Discharge			Remarks
				Q	Time* (min)	Rate	
"	1702	NA	5.00	NM	1	NA	
"	1705	NA	5.15	NM	0	NA	
"	1710	NA	5.40	650 ml	4	130 ml/min	Reduced rate
"	1715	NA	5.50	NM	0	NA	Began pumping at new rate
"	1720	NA	5.76	650 ml	5	130 ml/min	Adjusted rate
"	1722	NA	5.85	NM	0	NA	Began pumping at new rate
"	1724	NA	5.90	210 ml	2	105 ml/min	Adjusted rate
"	1726	NA	5.95	NM	0	NA	Began pumping at new rate
05/17/01	1728	NA	5.98	210 ml	2	105 ml/min	Adjusted rate
"	1730	NA	6.02	NM	0	NA	Began pumping at new rate
"	1735	NA	6.15	400 ml	5	80 ml/min	Test terminated

NOTE:

* Time elapsed since discharge measuring began.

TABLE 3-4

WATER WELL YIELD TESTING LOG – MW-17B

Date	Time (hours)	SWL (ft)	PWL (ft)	Discharge			Remarks
				Q	Time* (min)	Rate	
05/17/01	1741	4.25	0	0	0	0	Set pump at 15 ft depth
"	1745	4.25	0	NM	0	NA	Began pumping at 80 ml/min Water clear
"	1746	NA	4.30	NM	0	NA	Began discharge measurement
"	1750	NA	4.37	350 ml	4	87.5 ml/min	Pumping variable due to drawdown in well
"	1752	NA	4.40	NM	0	NA	Began discharge measurement
"	1755	NA	4.47	240 ml	3	80 ml/min	Pumping steady

TABLE 3-4 (Continued)

WATER WELL YIELD TESTING LOG – MW-17B

Date	Time (hours)	SWL (ft)	PWL (ft)	Discharge			Remarks
				Q	Time (min)	Rate	
"	1756	NA	4.47	NM	0	NA	Began discharge measurement
"	1800	NA	4.56	320 ml	4	80 ml/min	Terminated test

HYDRAULIC CONDUCTIVITY

Data from the pumping tests can be utilized to determine the hydraulic conductivity (K). The K value of the aquifer indicates the rate at which water flows through a rectangle measuring one foot by the thickness of the saturated aquifer and is expressed as distance per time. Hydraulic conductivities listed in Table 3-2 vary from 3.0 (10^{-6}) ft/second to 8.5 (10^{-6}) ft/second.

Hydraulic conductivity was calculated using an estimation method published by the Texas Natural Resources Conservation Commission Risk Reduction Program, Section VIII.6, Method 1. The empirical equation for aquifer yield for a confined unit is:

$$Q = \frac{60\ (Hc)\ K\ (b)}{9.3 + \log\ (Kb)}$$

Hc = hydraulic head above the aquifer = 115 feet

b = saturated thickness of aquifer in feet = 30 feet; however, well is screened in only 10 feet, therefore, use b = 10 feet.

Q = yield in gallons per minute. From the data in Tables 3-3 and 3-4, steady state is reached at Q = 0.2 gallons per minute.

K = hydraulic conductivity in ft/sec.

By trial and error calculation K is determined to be 1.5 (10^{-6}) ft/sec.

TABLE 3-5

GROUNDWATER FLOW RATE AT MW-17A AND MW-17B

Monitor Well Number	Porosity (%)	Hydraulic Conductivity (ft/sec)	Hydraulic Gradient (ft/ft)	Velocity (ft/day)	Velocity (ft/year)
17A and 17B	0.3	1.5 (10^{-6})	0.027	0.012	4.3

The hydraulic conductivity determined from back calculation of well pump tests in relative agreement with values presented in Table 3-2. The values presented in Table 3-2 were determined in the laboratory from cores of soil obtained during field sampling.

COEFFICIENT OF TRANSMISSIVITY

The data can also be used to determine the coefficient of transmissivity (T). The T value of the aquifer indicates the quantity of water that will flow through one foot of saturated aquifer over the entire thickness of the aquifer, and is expressed as gallons per day per foot.

The coefficient of transmissivity was determined using specific capacity approximation data presented in Groundwater Resource Evaluation, William C. Walton, McGraw-Hill, 1970, pages 311-321.

$$\frac{Q}{s} = \frac{T}{264 \log \frac{Tt}{2{,}693\, r_w{}^2 S} - 65.5}$$

Where:

Q = specific capacity , in gpm/ft
s
Q = discharge, in gpm
s = drawdown, in feet
T = coefficient of transmissivity, in gpd/ft
S = coefficient of storage, fraction = assumed 0.02
r_w = nominal radius of well, in feet = 0.167 ft
t = time after pumping started, in minutes = assumed 10 minutes

In MW-17B the drawdown while pumping 0.02 gpm was 0.07 feet in three minutes; by extrapolation the drawdown in ten minutes would be 0.233 feet and Q/s = 0.085. In MW-17A the drawdown while pumping 0.02 gpm was 0.13 feet in five minutes; by extrapolation the drawdown in ten minutes would be 0.26 feet and Q/s = 0.077. Using an average Q/s = 0.08, the coefficient of transmissivity was calculated by trial and error to be 50.

4.1 GROUNDWATER SAMPLING AND ANALYSIS

The initial groundwater monitoring program at the Vicksburg site involved several wells; however, only four compounds were included in the analysis. At the request of MSDEQ, VCC expanded their existing quarterly groundwater monitoring program to include analysis for methyl chloride, dinitrobutyl phenol, arsenic, and toxaphene. In the second quarter of 1991, VCC added four more compounds to be analyzed. These four compounds are carbon tetrachloride, chloroform, TCE, and Methyl Ethyl Ketone. More recent quarterly sampling has also tested for volatile compounds using the SW846b Method 8240 (GC/MS). The results of the sampling has been reported to the MSDEQ and is included in the Groundwater Analytical Data Summary provided as Appendix H. The TCL and TAL analyses for groundwater from piezometers PZ-12-B, PZ-12B, PZ-20A, PZ-20B, PZ-21A, PZ-2B, PZ-22A, PZ-23A, PZ-23B, PZ-24B, PZ-25A and PZ-25B are also included in Appendix H. The water level data for permanent wells and piezometers are also included within Appendix H.

In addition to the years of groundwater analytical data accumulated and summarized in Appendix H, groundwater analytical data has been obtained during the RCRA Facility Investigation. This RFI data is summarized and the following is a list of tables.

TABLE 4-1

LIST OF TABLES OF GROUNDWATER DATA OBTAINED DURING RFI

Table Number	Relevant SWMU	Table Title
4-2	1, 16, 17	Phase II 1997 Groundwater Samples
Table 4-3	1, 16, 17	Summary of Groundwater Data Obtained from Temporary Wells 16-1 and 16-2 in May 2001
Table 4-4	2	MW-5, MW-6, MW-7 Summary of Hits, Groundwater Sampling and Analysis
Table 4-5	2 – Hill	LS1-W, LS2-W, LS3-W, LS4-W, LS5-W Summary of Hits, Groundwater Sampling and Analysis
Table 4-6	2 – Valley	Summary of Groundwater Data from Temporary Well 2-15 – May 2001
Table 4-7	9	Inorganics in Groundwater
Table 4-8	9	Organics in Groundwater
Table 4-9	11, 12, 15	Arsenic Concentrations in Groundwater
Table 4-10	11, 12, 15	Arsenic, Dinoseb, and 4-Nitrophenol Concentrations in Groundwater from Semi-Permanent Well
Table 4-11	11, 12, 15	Summary of Groundwater Data Obtained from Wells MW-17A, MW-17B, MW-18A, and MW-18B
Table 4-12	13	Summary of Groundwater Data Obtained from Temporary Well 13-10

TABLE 4-1 (Continued)

LIST OF TABLES OF GROUNDWATER DATA OBTAINED DURING RFI

Table Number	Relevant SWMU	Table Title
Table 4-13	20	Summary of Groundwater Data Obtained from Permanent and Temporary Wells in Phase II at SWMU 20
Table 4-14	23	*Contamination Detected in Groundwater*
Table 4-15	23, 29, 31, 25, 22	Summary of Groundwater Data Obtained from Temporary Wells 22-1 and 22-2 and Monitoring Wells PZ-26A and PZ-26B During the Phase II Investigation in May 2001
Table 4-16	2	Summary of Groundwater Data Obtained from Temporary Wells 2-18, 2-19, 2-20 and 2-21 During the Investigation in September 2001.

The following are the tables of groundwater data:

TABLE 4-2

SWMU 1 (CONTAINER STORAGE), 16 (ATRAZINE PRODUCTION), 17 (RETURNED PRODUCT STORAGE) PHASE II 1997 GROUNDWATER SAMPLES

	A-W-T	D-W-T	1-W-T	2-W-TA	MDEQ Tier 1 TRG Table µg/l (ppb)
Arsenic	NR	NR	NR	538	50
Dinoseb	NR	NR	NR	NR	7
Toxaphene	ND	ND	ND	ND	3

TABLE 4-3

SWMU 1 (CONTAINER STORAGE), 16 (ATRAZINE PRODUCTION), 17 (RETURNED PRODUCT STORAGE) SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS 16-1 AND 16-2 IN MAY 2001

Compound	16-1-W	16-2-W	MDEQ Tier 1 TRG Table µg/L (ppb)
Arsenic	7	ND	50
Atrazine	ND	ND	3
Cyanazine	ND	ND	0.0797
Dinoseb	ND	ND	7
Toxaphene	ND	ND	3
Volatile Organics Component			
Choromethane	ND	ND	1.49
Bromomethane	ND	ND	8.52
Vinyl Chloride	ND	ND	2.0
Chloroethane	ND	ND	3.64
Methylene Chloride	ND	ND	5.0
Acetone	ND	ND	3,650
Carbon Disulfide	ND	ND	1,040
1,1-Dichloroethene	ND	ND	7.0
1,1-Dichloroethane	ND	ND	798
1,2-Dichloroethene (total)	ND	ND	70
Chloroform	ND	ND	0.152
2-Butanone	ND	ND	1,910
1,2-Dichloroethane	ND	ND	5.0
1,1,1-Trichloroethane	ND	ND	200
Carbon Tetrachloride	ND	ND	5.00
Bromodichloromethane	ND	ND	1.08
1,2-Dichloropropane	ND	ND	5.0
c-1,3-Dichloropropene	ND	ND	0.765
Trichloroethene	ND	ND	5.0
Benzene	ND	ND	5.0
Dibromochloroemethane	ND	ND	5.0
t-1,3-Dichloropropene	ND	ND	0.0765
1,1,2-Trichloroethane	ND	ND	5.0
Bromoform	ND	ND	2.33
4-Methyl-2-pentanone	ND	ND	2,920
Tetrachloroethene	ND	ND	5.0
1,1,2,2-Tetrachloroethane	ND	ND	0.0527

TABLE 4-4

SWMU 2 (LANDFILL)
MW-5, MW-6, MW-7 SUMMARY OF HITS, GROUNDWATER SAMPLING AND ANALYSIS

Compound	MW-5 Range/Average/ June 2001 µg/L (ppb)	MW-6 Range/Average/ June 2001 µg/L (ppb)	MW-7 Range/Average/ June 2001 µg/L (ppb)	MDEQ Tier 1 TRG Table µg/L (ppb)
Arsenic	ND-70 / 4.7 / ND	ND-15 / 1.8 / ND	ND-30 / 10 / ND	50.0 MCL
Dinitrobutylphenol (Dinoseb)	ND-12 / 0.3 / ND	ND-75 / 1.3 / ND	ND-4.5 / 0.1 / ND	7.0 MCL
Toxaphene	ND-ND / ND / ND	ND-2.5 / 2.1 / ND	ND-2.8 / 0.05 / ND	3.0 MCL
VOAs	ND-ND / ND / ND	ND-ND / ND / ND	ND-ND / ND / ND	
Atrazine	ND-ND / ND / ND	ND-ND / ND / ND	ND-0.4 / ND / ND	3.0 MCL

TABLE 4-5

SWMU 2 (LANDFILL)
TEMPORARY WELLS LS1-W, LS2-W, LS3-W, LS4-W, LS5-W SUMMARY OF HITS, GROUNDWATER SAMPLING AND ANALYSIS

Compound	LS1-W	LS2-W	LS3-W	LS4-W	LS5-W	MDEQ Tier 1 TRG Table µg/L (ppb)
Chloroform	ND	221	ND	17.3	105	0.152
2-Butanone	ND	69.1	ND	126	63.4	1,910
Carbon Tetrachloride	ND	71.4	ND	126	ND	5 MCL
Ethylbenzene	ND	ND	ND	ND	12.3	700 MCL
Xylene (total)	ND	19.5	ND	ND	40.0	10,000 MCL
Acetaphenone	ND	ND	ND	ND	18.92	0.0416
Caprolactam	15.51	ND	12,202.74	38.96	11,475.73	18,300
Dimethylphthalate	ND	ND	ND	28.99	ND	365,000
4-Nitrophenol	ND	547.61	ND	ND	2,358.87	292
Diethylphthalate	11.29	11.36	21.73	15.9	8.2	29,200
Di-n-butyl-phthalate	43.62	160.65	132.92	54.13	149.77	3,650
Bis-(2-ethyl)hexylphthalate	213.44	34.93	474.04	42.03	130.9	6.0
Atrazine	ND	478	ND	ND	6.33	3 MCL
Dinoseb	ND	8,714	ND	597	797	7 MCL

TABLE 4-6

SWMU 2 (LANDFILL)
SUMMARY OF GROUNDWATER DATA FROM
TEMPORARY WELL 2-15 – MAY 2001

Compound	SWMU 2 2-15-W	MDEQ Tier 1 TRG Table µg/L (ppb)
Arsenic	9	50
Atrazine	123	3
Cyanazine	ND	0.0797
Dinoseb	ND	7
Toxaphene	ND	3
Volatile Organics Component		
Choromethane	ND	1.49
Bromomethane	ND	8.52
Vinyl Chloride	ND	2.0
Chloroethane	ND	3.64
Methylene Chloride	ND	5.0
Acetone	ND	3,650
Carbon Disulfide	ND	1,040
1,1-Dichloroethene	ND	7.0
1,1-Dichloroethane	ND	798
1,2-Dichloroethene (total)	ND	70
Chloroform	ND	0.152
2-Butanone	ND	1,910
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	200
Carbon Tetrachloride	ND	5.00
Bromodichloromethane	ND	1.08
1,2-Dichloropropane	ND	5.0
c-1,3-Dichloropropene	ND	0.765
Trichloroethene	ND	5.0
Benzene	ND	5.0
Dibromochloroemethane	ND	5.0
t-1,3-Dichloropropene	ND	0.0765
1,1,2-Trichloroethane	ND	5.0
Bromoform	ND	2.33
4-Methyl-2-pentanone	ND	2,920
Tetrachloroethene	ND	5.0
1,1,2,2-Tetrachloroethane	ND	0.0527

TABLE 4-7

SWMU 9 (DINOSEB DRUMMING)
TEMPORARY WELL TP-1, INORGANICS IN GROUNDWATER

	Groundwater Sample TP-1 (µg/l)	MDEQ Tier 1 TRG Table µg/l (ppb)
Selenium	ND	50
Silver	ND	183
Thallium	ND	2
Vanadium	ND	256
Zinc	70	11,000
Cyanide	ND	200
Arsenic	378	50

TABLE 4-8

SWMU 9 (DINOSEB DRUMMING)
TEMPORARY WELL TP-1, ORGANICS IN GROUNDWATER

	Groundwater Sample TP-1 (µg/l)	MDEQ Tier 1 TRG Table µg/l (ppb)
1,2-Dichlorobenzene	11	606
Cis-1,2-Dichloroethene	26	70
Trans-1,2-Dichloroethene	6	100
Trichloroethene	68	5
Xylenes	14	10,000
1,2-Dichlorobenzene	4	600
m-Nitrosodiphenyl amine	2	13.7
Atrazine	ND	3
Dinoseb	ND	7
Toxaphene	ND	3

TABLE 4-9

SWMU 11 (MSMA PRODUCTION), 12 (SALT UNLOADING),
15 (METHYL PARATHION PRODUCTION)
TEMPORARY WELLS, ARSENIC CONCENTRATION IN GROUNDWATER µg/l (ppb)

	G-W-G	D-W-G	I-W-G	K-W-G	R-W-G	X-W-G	Z-W-G	MDEQ Tier 1 TRG Table µg/l (ppb)
Arsenic	14,300	253	288,000	297	5,260	730	1,720	50
	DD-W-G	V-V-G	WW-W-G	YY-W-G	ZZ-W-G	7-W-G		MDEQ Tier 1 TRG Table µg/l (ppb)
Arsenic	1,260	14	56	26	216	51,000		50

TABLE 4-10

SWMU 11 (MSMA PRODUCTION), 12 (SALT UNLOADING), 15 (METHYL PARATHION PRODUCTION)
SEMI-PERMANENT WELL (OCTOBER 12, 2001) CONCENTRATION IN GROUNDWATER µg/l (ppb)

	Groundwater Sample (µg/l)	MDEQ Tier 1 TRG Table µg/l (ppb)
Arsenic	244,000	50
Dinoseb	1,387	7
4-Nitrophenol	4,777	292

TABLE 4-11

SWMU 11 (MSMA PRODUCTION), 12 (SALT UNLOADING), 15 (METHYL PARATHION PRODUCTION) SUMMARY OF GROUNDWATER DATA OBTAINED FROM WELLS MW-17A, MW-17B, MW-18A AND MW-18B

Compound	MW-17A	MW-17B	MW-18A	MW-18B	MDEQ Tier 1 TRG Table µg/L (ppb)
Arsenic	ND	8	319	194	50
Atrazine	ND	ND	ND	ND	3
Cyanazine	ND	ND	ND	ND	0.0797
Dinoseb	ND	ND	1.3	132	7
Toxaphene	ND	ND	ND	ND	3
Volatile Organics Compound					
Chloromethane	ND	ND	ND	ND	1.49
Bromomethane	ND	ND	ND	ND	8.52
Vinyl Chloride	ND	ND	ND	ND	2.0
Chloroethane	ND	ND	ND	ND	3.64
Methylene Chloride	ND	ND	ND	ND	5.0
Acetone	ND	ND	ND	ND	3,650
Carbon Disulfide	ND	ND	ND	ND	1,040
1,1-Dichloroethene	ND	ND	ND	ND	7.0
1,1-Dichloroethane	ND	ND	ND	ND	798
1,2-Dichloroethene (total)	ND	ND	ND	ND	70
Chloroform	ND	1.43	ND	ND	0.152
2-Butanone	ND	ND	ND	ND	1,910
1,2-Dichloroethane	ND	ND	ND	ND	5.0
1,1,1-Trichloroethane	ND	ND	ND	ND	200
Carbon Tetrachloride	7.25	2.59	ND	ND	5.0
Bromodichloroemthane	ND	ND	ND	ND	1.08
1,2-Dichloropropane	ND	ND	ND	ND	5.0
c-1,3-Dichloropropene	ND	ND	ND	ND	0.765
Trichloroethene	ND	ND	ND	ND	5.0
Benzene	ND	ND	ND	ND	5.0
Dibromochloromethane	ND	ND	ND	ND	5.0
t-1,3-Dichloropropene	ND	ND	ND	ND	0.0765
1,1,2-Trichloroethane	ND	ND	ND	ND	5.0
Bromoform	ND	ND	ND	ND	2.33
4-Methyl-2-pentanone	ND	ND	ND	ND	2,920
Tetrachloroethene	ND	ND	ND	ND	5.0
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	0.0527
2-Hexanone	ND	ND	ND	ND	1,460
Toluene	ND	ND	ND	2.38	1,000
Chlorobenzene	ND	ND	ND	ND	100
Ethylbenzene	ND	ND	ND	296	700
Styrene	ND	ND	ND	ND	100
Xylenes (total)	ND	ND	6.52	948	10,000

TABLE 4-12

SWMU 13 (DRAINAGE DITCH)
SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELL 13-10 IN PHASE II AT SWMU 13

Compound	13-10-W		MDEQ Tier 1 TRG Table µg/L (ppb)
Arsenic	ND		50
Atrazine	ND		3
Cyanazine	ND		0.0797
Dinoseb	4		7
Toxaphene	ND		3
Volatile Organics Component			
Choromethane	ND		1.49
Bromomethane	ND		8.52
Vinyl Chloride	ND		2.0
Chloroethane	ND		3.64
Methylene Chloride	ND		5.0
Acetone	ND		3,650
Carbon Disulfide	ND		1,040
1,1-Dichloroethene	ND		7.0
1,1-Dichloroethane	ND		798
1,2-Dichloroethene (total)	ND		70
Chloroform	ND		0.152
2-Butanone	ND		1,910
1,2-Dichloroethane	ND		5.0
1,1,1-Trichloroethane	ND		200
Carbon Tetrachloride	ND		5.00
Bromodichloromethane	ND		1.08
1,2-Dichloropropane	ND		5.0
c-1,3-Dichloropropene	ND		0.765
Trichloroethene	ND		5.0
Benzene	ND		5.0
Dibromochloroemethane	ND		5.0
t-1,3-Dichloropropene	ND		0.0765
1,1,2-Trichloroethane	ND		5.0
Bromoform	ND		2.33
4-Methyl-2-pentanone	ND		2,920
Tetrachlorethene	ND		5.0
1,1,2,2-Tetrachloroethane	ND		0.0527
2-Hexanone	ND		1,460
Toluene	ND		1,000
Chlorobenzene	ND		100
Ethylbenzene	ND		700
Styrene	ND		100
Xylenes (total)	ND		10,000

TABLE 4-13

SWMU 20 (RAILROAD AREA)
SUMMARY OF GROUNDWATER DATA OBTAINED FROM NEW PERMANENT AND TEMPORARY WELLS IN PHASE II (MAY 2001) AT SWMU 20

Compound	Sample Results											MDEQ Tier 1 TRG Table µg/L (ppb)
	MW-1C	MW-12C	MW-10C	MW-1C	20-18-W	20-19-W	20-20-W	20-21-W	20-22-W	20-23-W	20-24-W	
Arsenic	ND	9	ND	ND	7	ND	ND	ND	19	ND	ND	50
Atrazine	ND	ND	ND	ND	65	ND	ND	140	146	30	ND	3
Cyanazine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0797
Dinoseb	ND	277	717	ND	ND	ND	18,821	ND	396	27	ND	7
Toxaphene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3
Volatile Organics Component												
Chloromethane	ND	ND	ND	ND	ND	ND	3.36	126	ND	ND	ND	1.49
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.52
Vinyl Chloride	ND	13.0	ND	ND	ND	ND	ND	5.46	46.5	ND	ND	2.0
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.64
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	908	45.7	ND	ND	5.0
Acetone	ND	ND	ND	ND	ND	ND	ND	126	ND	ND	ND	3,650
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1,040
1,1-Dichloroethene	ND	7.39	ND	ND	ND	ND	ND	54.6	3.33	ND	ND	7.0
1,1-Dichloroethane	ND	3.91	ND	ND	ND	ND	ND	142	12.1	ND	ND	798
1,2-Dichloroethene (total)	ND	88.3	ND	ND	ND	ND	ND	1,758	125	ND	ND	70
Chloroform	1.38	3,879	1,076	1.38	21.5	ND	10.2	37,380	5,120	ND	ND	0.152
2-Butanone	ND	ND	ND	ND	ND	ND	5.14	ND	ND	ND	ND	1,910
1,2-Dichloroethane	ND	113	ND	ND	ND	ND	ND	321	68.2	ND	ND	5.0
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200
Carbon Tetrachloride	ND	23,350	1,486	ND	13.3	2.39	46.2	357,500	4,705	ND	ND	5.00
Bromodichloroemthane	ND	ND	ND	ND	ND	ND	ND	296	75.8	ND	ND	1.08
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	42.3	11.2	ND	ND	5.0
c-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.765
Trichloroethene	10.8	90.8	ND	10.8	ND	ND	ND	1,346	44.6	ND	ND	5.0

TABLE 4-13 (Continued)

SWMU 20 (RAILROAD AREA)
SUMMARY OF GROUNDWATER DATA OBTAINED FROM NEW PERMANENT AND TEMPORARY WELLS IN PHASE II (MAY 2001) AT SWMU 20

Compound	Sample Results											MDEQ Tier 1 TRG Table µg/L (ppb)
	MW-1C	MW-12C	MW-10C	MW-1C	20-18-W	20-19-W	20-20-W	20-21-W	20-22-W	20-23-W	20-24-W	
Benzene	ND	13.9	ND	ND	9.58	7.21	ND	23.7	9.33	ND	ND	5.0
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.0
t-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0765
1,1,2-Trichloroethane	ND	84.2	1.63	ND	ND	ND	ND	290	74.4	ND	ND	5.0
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.33
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	7.37	ND	ND	ND	ND	2,920
Tetrachloroethene	ND	174	4.05	ND	ND	ND	ND	180	55.2	ND	ND	5.0
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0527
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1,460
Toluene	ND	ND	ND	ND	ND	ND	2.05	31.9	ND	ND	ND	1,000
Chlorobenzene	ND	1.47	ND	ND	ND	ND	ND	3.2	1.39	ND	ND	100
Ethylbenzene	ND	ND	ND	ND	ND	ND	1.4	87.4	1.58	ND	ND	700
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
Xylenes (total)	ND	8.11	ND	ND	ND	1.15	10.7	490	1.60	ND	ND	10,000

TABLE 4-14

SWMU 23 (NORTH POND)
MONITOR WELLS – CONTAMINATION DETECTED IN GROUNDWATER

Organic Compound Detected	PZ-19-A	PZ-19-B	PZ-12-RA	PZ-12-RB	PZ-20-A	PZ-20-B	PZ-21-A	PZ-22-A	PZ-22-B	PZ-23-A	PZ-23-B	PZ-24-A	PZ-25-B	MDEQ Tier 1 TRG Table (ppb)
Chloroform	ND	ND	ND	ND	ND	1,700	ND	44	1,600	ND	79	ND	ND	0.152
Carbon Tetrachloride	ND	ND	ND	ND	ND	4	ND	ND	ND	ND	ND	ND	ND	5.0
Bromodichloromethane	ND	ND	ND	ND	ND	36	ND	ND	66	ND	ND	ND	ND	1.08
Trichloroethene	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	5.0
Dibromochloromethane	ND	ND	ND	ND	ND	14	ND	ND	78	ND	ND	ND	ND	0.126
Bromoform	ND	ND	ND	ND	ND	1	ND	ND	160	ND	8	ND	ND	2.33
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	440	ND	ND	19,100

* B wells are the shallow wells.

TABLE 4-15

SWMU 23 (NORTH POND), 29 (NORTH PLANT OIL COLLECTION), 31 (NORTH PLANT FUEL OIL), 25 (NORTH PLANT WASTE PIPES), 22 (NORTH PLANT NEUTRALIZATION SYSTEM) SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS 22-1 AND 22-2 AND MONITORING WELLS PZ-26A AND PZ-26B DURING THE PHASE II INVESTIGATION IN MAY 2001

Compound	Sample Results				MDEQ Tier 1 TRG Table µg/L (ppb)
	22-1-W	22-2-W	PZ-26A	PZ-26B	
Arsenic	ND	ND	6	8	50
Atrazine	ND	ND	ND	ND	3
Cyanazine	ND	ND	ND	ND	0.0797
Dinoseb	1.4	1.8	ND	ND	7
Toxaphene	ND	ND	ND	ND	3
Volatile Organics Component					
Choromethane	ND	ND	ND	ND	1.49
Bromomethane	ND	ND	ND	ND	8.52
Vinyl Chloride	ND	ND	ND	ND	2.0
Chloroethane	ND	ND	ND	ND	3.64
Methylene Chloride	ND	ND	ND	ND	5.0
Acetone	ND	ND	ND	ND	3,650
Carbon Disulfide	ND	ND	ND	ND	1,040
1,1-Dichloroethene	ND	ND	ND	ND	7.0
1,1-Dichloroethane	ND	ND	ND	ND	798
1,2-Dichloroethene (total)	ND	ND	ND	ND	70
Chloroform	6.78	D	ND	ND	0.152
2-Butanone	ND	ND	ND	ND	1,910
1,2-Dichloroethane	ND	ND	ND	ND	5.0
1,1,1-Trichloroethane	ND	ND	ND	ND	200
Carbon Tetrachloride	ND	ND	ND	ND	5.00
Bromodichloromethane	ND	ND	ND	ND	1.08
1,2-Dichloropropane	ND	ND	ND	ND	5.0
c-1,3-Dichloropropene	ND	ND	ND	ND	0.765
Trichloroethene	ND	ND	ND	ND	5.0
Benzene	1.08	ND	ND	ND	5.0
Dibromochloroemethane	ND	ND	ND	ND	5.0
t-1,3-Dichloropropene	ND	ND	ND	ND	0.0765
1,1,2-Trichloroethane	ND	ND	ND	ND	5.0
Bromoform	ND	ND	ND	ND	2.33
4-Methyl-2-pentanone	ND	ND	ND	ND	2,920
Tetrachlorethene	ND	ND	ND	ND	5.0
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	0.0527
2-Hexanone	ND	ND	ND	ND	1,460
Toluene	ND	ND	ND	ND	1,000
Chlorobenzene	ND	ND	ND	ND	100
Ethylbenzene	ND	ND	ND	ND	700
Styrene	ND	ND	ND	ND	100
Xylenes (total)	ND	ND	ND	ND	10,000

TABLE 4-16

SWMU 2 (LANDFILL AREA) SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS 2-18, 2-19, 2-20 AND 2-21 DURING THE INVESTIGATION IN SEPTEMBER 2001.

Compound	2-18	2-19	2-20	2-21	MDEQ Tier TRG Table µg/L (ppb)
Atrazine	ND	ND	ND	ND	3

From the existing groundwater data and the existing soil contamination data, the monitoring parameters for the site have been established to be arsenic, atrazine, cyanazine, dinoseb, toxaphene and Volatiles.

4.2 SOURCE OF GROUNDWATER CONTAMINATION

Over the course of the South Plant's long history, various construction activities have occurred at the site. Contamination sources, such as broken pipes, which can easily be repaired have been corrected. The contamination of soil and groundwater caused by the break would remain. Additionally, there may have been routine chemical spills at facilities that are now dismantled and demolished. Only the contaminated soil and groundwater remain; therefore, the original cause or source may be difficult to identify.

An example of a former source is the surface impoundments (SWMU 3), which have been retrofitted with double geosynthetic liners. Prior to the retrofit contaminated sludge was removed, solidified, stabilized and placed in an aboveground vault constructed to RCRA standards; SWMU 3 was the source of contamination.

The study of SWMUs 12, 11 and 15 resulted in discovery of an area of soils contaminated with arsenic and a groundwater plume of arsenic contamination. The main source of contamination presumably was waste handling activity at the former MSMA plant. During the September 2001 investigation, a pre-packed semi-permanent 1-inch diameter well was installed in the center of the arsenic plume to a depth of fifteen feet. The purpose of the well was to allow withdrawal of arsenic contaminated water to test compatibility with the brake fern (Pteris vittata). The brake fern is the first plant known to detoxify soils contaminated by arsenic. The fern absorbs large amounts of arsenic into its stems and fronds. Twenty gallons of groundwater was removed. Initially the groundwater was clear; however, after continued pumping it became yellow tinted. During previous investigations, the groundwater appeared clear and was only tested for arsenic. A sample of the twenty gallons was submitted for analysis and, as noted on Table 4-10 contains 1,387 ppb dinoseb, 4,770 ppb 4-nitrophenol, and 244,000 ppb arsenic. The arsenic concentration was as predicted. The dinoseb and 4-nitrophenol and yellow tint was not predicted. At one time, methyl parathion was produced at the SWMU 11, 12, 15 site and 4-nitrophenol was one of the raw materials. The presence of dinoseb must be due to spill of dinoseb stored on the site at some time. SWMU 9, the dinoseb drumming building is downgradient. Groundwater from location TP-1, which is between SWMU 11, 12, 15 and SWMU 9, showed no detection of either dinoseb or 4-nitrophenol.

SWMU 2 is an area of the plant site where there are known deposits of waste. SWMU 2 is a hill with a natural elevation approximately 30 feet above immediate surrounding areas. A landfill and four pits or ponds were constructed on the hill and utilized from 1972 to 1975. One pit was constructed to store dinoseb process wastewater. Three pits were used as disposal locations for pallets, empty fiber and steel drums. In 1977 many of the drums in the pits, but not the landfill, were removed and disposed off-site. In 1979 all the pits were drained, regraded so the hill was flattened and covered with a soil cap. Some of the soil was obtained off-site and placed on the landfill area. In 1983, there was additional grading and capping of the entire area consistent with an engineered plan approved by the MSDNR. A discovery of the RFI was that the cap did not extend sufficiently far on the southwest edge. An area that was obscured by trees and dense overgrowth had eroded and allowed transport of contamination to a valley between the hill and adjacent railroad tracks. The cap will be extended as part of corrective action. In 1988 the SWMU 3 wastewater ponds, which are adjacent to SWMU 2, were lined and a repository for pond sediments (SWACA) was constructed. The SWACA was constructed in the location of one of the ponds. The sediments from the SWMU 3 wastewater ponds and most of the sediment of the pond are within the SWACA. The pond lining and SWACA construction is consistent with RCRA guidelines. There is evidence from temporary wells that groundwater immediately beneath SWMU 2 has been impacted. SWMU 2 is monitored by monitoring well s MW-5, MW-6 and MW-7.

Groundwater has additionally been impacted at SWMU 23, the North Pond. The North Pond is no longer in use but there are volatiles in the groundwater. SWMU 23 is monitored by monitoring wells PZ-21A, PZ-22A, PZ-22B, PZ-23A, PZ-23B, PZ-24B, PZ-26A and PZ-26B.

SWMU 20 is the railroad area spanning the railroad line from the former atrazine production area to the present nitric acid plant. For the RFI and GWA investigation SWMU 4 (activated carbon wastewater treatment), SWMU 7 (dinoseb production), and SWMU 14 (toxaphene production) have all been incorporated into SWMU 20 because the boundary lines and potential impact area of the SWMUs are indistinguishable from one another. The SWMU 20 area was very active area of material handling when toxaphene and dinoseb were manufactured. The likelihood of material handling spills and process spills and leaks was high.

4.3 LIKELY CORRESPONDENCE BETWEEN PERMANENT WELLS AND SWMUS

This subsection is a summary that describes the sets of wells that monitor each SWMU and the contaminants detected in the groundwater from the wells. In addition, reference is made to appropriate tables of data pertinent to each SWMU from temporary wells. The data on water quality from the wells is summarized in the following:

- Appendix H – Groundwater Quality Data from Permanent Wells and Piezometers
- Tables 4-2 through 4-16 which contain groundwater quality data from various RFI investigations

The following Table 4-17 is a summary of the information:

TABLE 4-17

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	*Temporary Wells Location Number* and Reference for Groundwater Data	Comment	Permanent Wells
1 – Hazardous Waste Storage 16 – Atrazine Manufacturing and Warehousing 17 – Returned Product Storage	Locations A, D, 1, 2 Reference: Table 4-2 Locations 16-1 and 16-2 Reference: Table 4-3	Soil and concrete generally clean. Arsenic in groundwater at Location 2 (Reference: Figure 2-3 RFI Report) found to be clean.	**MW-2:** Arsenic (ND-2.6)/50 1,2-Dichloroethene (ND-7.36)/100 Trichloroethene (ND-2.0)/5.0 **MW-8:** Arsenic (ND-80)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5)/2.0
2 - Inactive Landfill	Locations LS1, LS2, LS3, LS4 and LS4 Reference: Table 4-5 Location 2-15 Reference: Table 4-6 Locations 2-18, 2-19, 2-20 and 2-21 Reference: Table 4-16	Atrazine was detected in groundwater at location 2-15, resulting in installation of surrounding temporary wells 2-18, 2-19, 2-20 and 2-21. Atrazine was not detected in any of the surrounding wells. See dinoseb plume, Figure 4-2 See VOA Plume, Figures 4-4 and 4-4K	**MW-5:** Arsenic (ND-70)/50 Dinoseb (ND-12.0)/7.0 Trichloroethene (ND-79)/5.0 Xylene (ND-10)/10,000 **MW-6:** *Arsenic (ND-15)/50* Dinoseb (ND-75.0)/7.0 Toxaphene (ND-25.0)/3.0 Trichloroethene (ND-9.03)/5.0 Vinyl Chloride (ND-4)/2.0 Xylene (ND-7)/10,000 **MW-7:** Arsenic (ND-30)/50 Dinoseb (ND-4.5)/7.0 Toxaphene (ND-2.8)/3.0
4 – Activated Carbon Unit	Location 2-18 *Reference: Table 4-13*	None	None
5 – South Plant Drainage System	None	MW-8, MW-12, MW-12C, MW-10, MW-10C, MW-16, and MW-9 effectively monitor the entire south plant drainage system.	**MW-8:** Arsenic (ND-80)/50 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5.0)/2.

TABLE 4-17 (Continued)

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	Temporary Wells Location Number and Reference for Groundwater Data	Comment	Permanent Wells
5 – South Plant Drainage System (Continued)			**MW-12:** Arsenic (ND-20)/50 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** Arsenic (9)/50 Dinoseb (277)/7.0 Vinyl Chloride (13)/2.0 1,1 Dichloroethene (7.4)/7.0 1,2 Dichloroethene (88)/70 Chloroform (3,879)/0.152 1,2-Dichloroethane (113)/5.0 Carbon Tetrachloride (23,350)/5.0 Trichloroethene (91)/5.0 Benzene (13.9)/5.0 1,1,2 Trichloroethane (84)/5.0 Tetrachloroethene (174)/5.0 **MW-10:** Arsenic (ND-15)50 Dinoseb (ND-0.836)/7.0 **MW-10C:** Dinoseb (717)/7.0 Chloroform (1,076)/0.152 Carbon Tetrachloride (1,486)/5.0 **MW-16:** Arsenic (ND-9)/50 Dinoseb (ND-0.391)/50 **MW-9:** Arsenic (ND-0.009)/50 Dinoseb (ND-11.4)/7.0

TABLE 4-17 (Continued)

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	Temporary Wells Location Number and Reference for Groundwater Data	Comment	Permanent Wells
7 – Dinoseb Manufacturing Area	Location 20-12, 20-19, 20-20, 20-21, 20-22 Reference: Table 4-13	Corrective action is indicated See dinoseb plume, Figure 4-2 See VOA plumes, Figures 4-4, 4-4A, 4-4B, 4-4C, 4-4D, 4-4E, 4-4F, 4-4G, 4-4H, 4-4I, 4-4J	**MW-12:** Arsenic (ND-20)/50 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** Arsenic (9)/50 Dinoseb (277)/7.0 Vinyl Chloride (13)/2.0 1,1 Dichloroethene (7.4)/7.0 1,2 Dichloroethene (88)/70 Chloroform (3,879)/0.152 1,2-Dichloroethane (113)/5.0 Carbon Tetrachloride (23,350)/5.0 Trichloroethene (91)/5.0 Benzene (13.9)/5.0 1,1,2 Trichloroethane (84)/5.0 Tetrachloroethene (174)/5.0 **MW-10:** Arsenic (ND-15)/50 Dinoseb (ND-0.836)/7.0
8 – Dinoseb Loading/Unloading Area	None	None	**MW-18A:** Arsenic (319)/50 **MW-18B:** Arsenic (194)/50 Dinoseb (132)/7.0
9 – Dinoseb Drumming Area	Location TP-1 Reference: Table 4-7 and Table 4-8	None	**MW-18A:** Arsenic (319)/50 **MW-18B:** Arsenic (194)/50 Dinoseb (132)/7.0

TABLE 4-17 (Continued)

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	Temporary Wells Location Number and Reference for Groundwater Data	Comment	Permanent Wells
11 – MSMA Salt Unloading 12 – MSMA Manufacturing Area 15 – Methyl Parathion Manufacturing Area	Locations G-W-G, D-W-G, I-W-G, K-W-G, 12-W-G, X-W-G, Z-W-G, DD-W-G, V-V-G, WW-W-G, YY-W-G, ZZ-W-G, 7-W-G Reference: Table 4-9 Location Semi-Permanent Well Reference: Table 4-10 Location MW-17A&B, MW-18A&B Reference: Table 4-11	The new wells are close to the source of arsenic. The monitor well network consisting of MW-8, MW-12, MW-12C, MW-10, MW-10C, MW-16, MW-16C and MW-9 are 400 to 800 feet away from the source but do cover the downgradient pathway. See arsenic plume, Figure 4-1 In addition there is dinoseb and 4-nitrophenol contamination present in the center of the arsenic plume.	**MW-17A:** Carbon tetrachloride (7.25)/5.0 **MW-17B:** Chloroform (1.43)/0.152 **MW-18A:** Arsenic (319)/50 **MW-18B:** Arsenic (194)/50 Dinoseb (132)/7.0 **MW-8:** Arsenic (ND-80)/50 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5.0)/2.0 **MW-12:** Arsenic (ND-20)/50 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** Arsenic (9)/50 Dinoseb (277)/7.0 Vinyl Chloride (13)/2.0 1,1 Dichloroethene (7.4)/7.0 1,2 Dichloroethene (88)/70 Chloroform (3,879)/0.152 1,2-Dichloroethane (113)/5.0 Carbon Tetrachloride (23,350)/5.0 Trichloroethene (91)/5.0 Benzene (13.9)/5.0 1,1,2 Trichloroethane (84)/5.0 Tetrachloroethene (174)/5.0

TABLE 4-16 (Continued)

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	Temporary Wells Location Number and Reference for Data	Comment	Permanent Wells
11 – MSMA Salt Unloading 12 – MSMA Manufacturing Area 15 – Methyl Parathion Manufacturing Area (Continued)			**MW-10:** Arsenic (ND-15)/50 Dinoseb (ND-0.836)/7.0 **MW-10C:** Dinoseb (717)/7.0 Chloroform (1,076)/0.152 Carbon Tetrachloride (1,486)/5.0 **MW-16:** Arsenic (ND-9)/50 Dinoseb (ND-0.391)/50 **MW-9:** Arsenic (ND-9)/50 Dinoseb (ND-11.4)/7.0
13 – South Plant Drainage Ditch	Location 13-10 Reference: Table 4-12	Clean	None
14 – Toxaphene Manufacturing Area	Locations 20-18, 20-19, 20-20, 20-21, 20-22 Reference: Table 4-13	The new wells, MW-12C and MW-10C in combination with MW-12 and MW-10 effectively monitor SWMU 14. There is not toxaphene plume. There is a VOA plume, see Figures 4-4, 4-4A, 4-4B, 4-4C, 4-4D, 4-4E, 4-4F, 4-4G, 4-4H, 4-4I, 4-4J	**MW-12:** Arsenic (ND-20)/50 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (5.0)/10,000 **MW-12C:** Arsenic (9)/50 Dinoseb (277)/7.0 Vinyl Chloride (13)/2.0 1,1 Dichloroethene (7.4)/7.0 1,2 Dichloroethene (88)/70 Chloroform (3,879)/0.152 1,2-Dichloroethane (113)/5.0 Carbon Tetrachloride (23,350)/5.0 Trichloroethene (91)/5.0 Benzene (13.9)/5.0 1,1,2 Trichloroethane (84)/5.0 Tetrachloroethene (174)/5.0

TABLE 4-17 (Continued)

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	Temporary Wells Location Number and Reference for Groundwater Data	Comment	Permanent Wells
14 – Toxaphene Manufacturing Area (Continued)			**MW-10:** Arsenic (ND-15)/50 Dinoseb (ND-0.836)/7.0 **MW-10C:** Dinoseb (717)/7.0 Chloroform (1,076)/0.152 Carbon Tetrachloride (1,486)/5.0
18 – Blue Tank Area	None	Monitored by MW-9.	**MW-9:** Arsenic (ND-9)/50 Dinoseb (ND-11.4)/7.0
20 – Railroad Area	Locations: 20-18, 20-19, 20-20, 20-21, 20-22, 20-23, 20-24 Reference: Table 4-13	The new wells, MW-12C and MW-10C in combination with MW-2, MW-8, MW-12, MW-10, MW-16, MW-1A and MW-14 effectively monitor SWMU 20. There is a dinoseb plume, see Figure 4-2. There is a VOA plume, see Figures 4-4, 4-4A, 4-4B, 4-4C, 4-4D, 4-4E, 4-4F, 4-4G, 4-4H, 4-4I, 4-4J	**MW-2:** Arsenic (ND-26)/10 1,2-Dichloroethene (ND-7.36)/100 Trichloroethene (ND-2.0)/5.0 **MW-8:** Arsenic (ND-80)/10 *Dinoseb (ND-0.686)/7.0* Vinyl Chloride (ND-5.0)/2.0 **MW-12:** Arsenic (ND-20)/50 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000

TABLE 4-17 (Continued)

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	Temporary Wells Location Number and Reference for Groundwater Data	Comment	Permanent Wells
20 – Railroad Area (Continued)			**MW-12C:** Arsenic (9)/50 Dinoseb (277)/7.0 Vinyl Chloride (13)/2.0 1,1 Dichloroethene (7.4)/7.0 1,2 Dichloroethene (88)/70 Chloroform (3,879)/0.152 1,2-Dichloroethane (113)/5.0 Carbon Tetrachloride (23,350)/5.0 Trichloroethene (91)/5.0 Benzene (13.9)/5.0 1,1,2 Trichloroethane (84)/5.0 Tetrachloroethene (174)/5.0 **MW-10:** Arsenic (ND-15)50 Dinoseb (ND-0.836)/7.0 **MW-10C:** Dinoseb (717)/7.0 Chloroform (1,076)/0.152 Carbon Tetrachloride (1,486)/5.0 **MW-16:** Arsenic (ND-9)/50 Dinoseb (ND-0.391)/50 **MW-1A:** Arsenic (ND-54)/50 Dinoseb (2.34-5,500)/50 Chloroform (ND-4.0)/0.152 Dichlorobenzene (ND-2.75)/75 Trichloroethene (ND-13)/5.0 *Xylene (ND-5)/10,000* **MW-14:** Arsenic (ND-7)/50 Dinoseb (ND-0.746)/50

TABLE 4-17 (Continued)

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	Temporary Wells Location Number and Reference for Groundwater Data	Comment	Permanent Wells
23 – North Pond	Location 22-1, 22-2 Reference: Table 4-15	The new wells, in combination with PZ-24B, PZ-20A, PZ-20B, PZ-23A, PZ-23B, PZ-22A, PZ-22B, and PZ-21A will effectively monitor the groundwater associated with SWMU 23. There is a VOA plume, see Figure 4-4.	**PZ-24B:** ND **PZ-20A:** ND **PZ-20B:** Bromodichloromethane (36)/1.08 Bromoform (18)/2.33 Carbon Tetrachloride (4)/5.0 Chloroform (1,700)/0.152 Chlorodibromomethane (18)/0.126 Trichloroethene (1.0)/5.0 **PZ-23A:** ND **PZ-23B:** *Bromoform (8)/2.33***PZ-22A:** ND **PZ-22B:** Bromodichloromethene (66)/1.08 Bromoform (160)/2.33 Chloroform (1,600)/0.152 Chlorobromomethane (78)/0.126 **PZ-21A:** ND **PZ-26A:** ND **PZ-26B:** ND
30 – North Plant Waste Oil Accumulation Area	None	Soil discoloration muds need to be cleaned up.	None
34 – Surplus Equipment Storage	13-10	Clean	None

TABLE 4-17 (Continued)

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUs

SWMU Number	Temporary Wells Location Number and Reference for Groundwater Data	Comment	Permanent Wells
29 – North Plant Oil Collection System 31 – North Plant No. 6 Fuel Oil Area 25 – North Plant Waste Water Pipes 22 – North Plant Neutralization System	22-1, 22-2	Clean	**PZ-26A:** ND **PZ-26B:** ND

4.4 CONTAMINATION PLUME

Data from sampling and analysis of the permanent and temporary wells have been used to construct maps of contamination plumes in the uppermost aquifer. Any detected hazardous waste or hazardous waste constituents in the uppermost aquifer were mapped to show the extent of the contamination plume. Based on the location and concentration of the hazardous waste or hazardous waste constituent and the direction of groundwater flow, the migration direction (flowpath) has been identified to be south-southeast toward Hennessey's Bayou.

Separate site wide maps have been constructed to show concentrations of each of the following:

- Arsenic – see Figure 4-1
- Dinoseb – see Figure 4-2
- Toxaphene – see Figure 4-3
- Volatiles (summary of VOAs) – see Figure 4-4 and Figures 4-4A, 4-4B, 4-4C, 4-4D, 4-4E, 4-4F, 4-4G, 4-4H, 4-4I, 4-4J and 4-4K
- Atrazine/Cyanazine – see Figure 4-5

Each of the contaminants and maps is discussed below:

ARSENIC

There is an arsenic plume in the middle of the South Plant. A discussion of the plume must involve SWMU 11, 12, 15 as the source of arsenic, and also background concentrations of arsenic in soil.

SWMU 11, 12 and 15 is the former manufacturing site of arsenical pesticides. The process has been shut down, equipment removed from the area, and the concrete foundations cleaned with high-pressure water equipment.

A characterization of the soil and groundwater at SWMU 11, 12 and 15 has been made and summarized in "RCRA Facility Investigation Report". An area of residual contamination of soil by arsenic has been reported. Likewise a groundwater plume of arsenic has been reported and is noted on Figure 4-1.

SWMU 11, 12 and 15 and the soil and groundwater contamination is at least 800 feet from Hennessey's Bayou, the nearest pathway to off-site. Theoretically, soil contaminated with arsenic could be, in time, transported to the bayou. Theoretically, groundwater contaminated with arsenic could be, in time, transported to the bayou. A substantial number of soil and groundwater samples have been obtained in the area between SWMU 11, 12 and 15. These paragraphs summarize the analytical data on arsenic and information on the background concentration of arsenic in soil and groundwater in order to determine if there is imminent danger of off-site transport of arsenic, and therefore potential for exposure, evident in the pattern of data established since the shut down of the arsenical pesticides process approximately 14 years ago.

Background Concentration – Arsenic in Soil and Groundwater

The following data on arsenic concentration (not including data for SWMU 11, 12 and 15) in soil is obtained from "RCRA Facility Investigation Report".

TABLE 4-18

ARSENIC CONCENTRATIONS IN SOIL

SWMU Number	Number of Samples Analyzed	Range of Concentrations Reported µg/kg (ppb)	Average Concentration µg/kg (ppb)
1, 16, 17	90	1,570 – 27,000	7,400
1, 16, 17	10	7,470 – 11,800	9,372
2 (Hill)	17	<500 – 4,460	2,024
2 (Valley)	14	2,200 – 5,200	3,393
4	6	5,100 – 15,700	8,433
5	16	<500 – 174,000	19,694
5[(1)]	15[(1)]	<500 – 39,200	9,407
7	9	<500 – <500	<500
8	4	<500 – 9,800	3,900
9	16	3,800 – 61,000	19,744
9[(2)]	13[(2)]	3,800 – 30,600	10,531
9	3	7,320 – 9,570	8,650
13	9	2,700 – 8,800	4,356
14	17	<500 – 1,900	665
18	5	<500 – 17,500	7,540
20	32	<500 – 10,900	1,763
23	13	340 – 4,900	1,656

NOTES:

(1) The 174,000 ppb location (removed in this row) is within the SWMU 11, 12, 15 boundary.

(2) One location (3 sample points) is probably contaminated soil excavated elsewhere and used as fill.

Three soil background samples were obtained adjacent to the parking lot to the north of the north plant administration building. An additional three samples were obtained in Vicksburg Chemical employee park located between the north plant administration building and the Mississippi River. The samples were first reported on Page 27 of the "Expedited RCRA Facility Investigation Report SWMUs 16, 1, 17 dated June 1997."

TABLE 4-19

BACKGROUND CONCENTRATION OF ARSENIC IN SOIL OF NON-MANUFACTURING AREAS

Sample Number	Data Obtained During Investigation of SWMU	Concentration of Arsenic µg/l (ppb)
B1-0, 2-A	16, 1, 17	9,380
B2-0, 2-A	16, 1, 17	7,470
B3-0, 2-A	16, 1, 17	7,270
B4-0, 2-A	16, 1, 17	10,800
B5-0, 2-A	16, 1, 17	11,700
B5-0, 2-A	16, 1, 17	11,800

The average concentration is 9,700 ppb.

The predominant data on arsenic concentrations in groundwater is from analyses of the monitor wells. The monitor well data is included within this report. The range on concentrations, average concentration and June 2001 concentration for each well are mapped on Figure 4-1. There have been 45 to 50 samples analyzed per well beginning as early as December 1981. The data for monitor wells (not including data for MW-17A, MW-17B, MW-18A, and MW-18B) can be summarized as follows:

TABLE 4-20

GROUNDWATER CONCENTRATION OF ARSENIC FROM PERMANENT MONITOR WELLS AND PIEZOMETERS

Monitor Well Number	Range of Arsenic Concentration µg/l (ppb)	Average Arsenic Concentration µg/l (ppb)
MW-1A	<5 – 54.0	6
MW-2	<5 – 8.0	5
MW-4	<5 – 8.9	5
MW-5	<5 – 70.0	8
MW-6	<5 – 19.0	6
MW-7	<5 – 113.0	14.5
MW-8	<5 – 80.0	32.7

TABLE 4-20 (Continued)

GROUNDWATER CONCENTRATION OF ARSENIC FROM PERMANENT MONITOR WELLS AND PIEZOMETERS

Monitor Well Number	Range of Arsenic Concentration µg/l (ppb)	Average Arsenic Concentration µg/l (ppb)
MW-9	<5 – 9.0	6
MW-10	<5 – 15.0	6
MW-11	<5 – 12.0	5.3
MW-12	<5 – 20.0	7.4
MW-13	<5 – 32.0	14.9
MW-14	<5 – 7.0	5.8
MW-16	<5 – 21.0	5.7
MW-1C	ND	ND
MW-10C	ND	ND
MW-12C	9	9
MW-17A	ND	ND
MW-17B	8	8
MW-18A	319*	319
MW-18B	194*	194
PZ-26A	6	6
PZ-26B	8	8
PZ-12B	0.9	0.9
PZ-12A	1.8	1.8
PZ-20B	1.4	1.4
PZ-20A	0.8	0.8
PZ-21A	1.4	1.4
PZ-22B	2.0	2.0
PZ-22A	1.8	1.8
PZ-23B	0.4	0.4
PZ-23A	0.4	0.4
PZ-24B	0.4	0.4
PZ-25B	0.4	0.4
PZ-21A-FB	0.4	0.4

* Influenced by arsenic plume

Data from temporary wells has been obtained on a one-time basis. The following is a table of that data (not including data obtained during investigation of SWMU 11, 12, 15):

TABLE 4-21

GROUNDWATER CONCENTRATION OF ARSENIC FROM TEMPORARY WELLS

Temporary Well or *Piezometer Number*	Data Obtained During Investigation of SWMU	Concentration of Arsenic µg/l (ppb)
2-W-TA	1, 16, 17	538
LS1-W	2	<10
LS2-W	2	<10
LS3-W	2	<10
LS4-W	2	<10
LS4-W Dup	2	<10
LS5-W	2	<10
TP-1	9	378
20-18-W	20	7
20-19-W	20	ND
20-20-W	20	ND
20-21-W	20	ND
20-22-W	20	19
20-23-2	20	ND
20-24-W	20	ND

The concentration of arsenic in the soil at the Vicksburg site presents an interesting challenge. There is obvious arsenic contamination in the SWMU 11, 12 and 15 area caused during the manufacture of MSMA. It is not obvious, however, what is background arsenic and what may be caused by contaminant transport from SWMU 11, 12 and 15. The background level of arsenic on the site is variable, but does exceed the values presented in the MSDEQ Tier 1 TRG Table. Examination of the average concentration values presented in Table 4-18 and Table 4-21 lead to the following generalizations:

- The south plant manufacturing areas can be characterized as an area where the background concentration of arsenic is about 10,000 ppb. The evidence is the concentration of arsenic in soil at SWMUs 1, 16, 17, 5, 8, 9 and 18.
- The "background" concentrations of arsenic were obtained in areas geologically similar to the south plant manufacturing areas. That concentration is likewise about 10,000 ppb.
- The railroad area (SWMUs 20, 7, 14 and 4), hill upon which SWMU 23 was constructed, hill upon which SWMU 2 was constructed and the southwest

drainage ditch (SWMU 13) can be characterized by an arsenic concentration of less than 5,000 ppb. These are the areas nearest to Hennessey's Bayou.

From the data it can be concluded that there has been no erosional mechanism that has transported arsenic from the source at SWMU 11, 12, 15. The background concentration of arsenic in soils in areas where there is no potential for transport by erosion is high. In fact, some of the areas are underneath concrete in buildings where there has never been manufacture or storage of arsenic compounds.

Examination of external sources of information lends support to the thesis that there is a variation in the concentration of arsenic in natural soils and that concentration can exceed remediation goals. The EPA Region 9 has published remediation goals in a program that is in concept similar to the MDEQ Brownfields Program. In the "Region 9 Preliminary Remediation Goals (PRGs) for 1998", background concentrations are addressed as follows:

"Before embarking on an extensive sampling and analysis program to determine local background concentrations in the area, one should first compile existing data on the subject. Far too often, there is pertinent information in the literature that gets ignored, resulting in needless expenditures of time and money. An illustrative example of this is naturally occurring arsenic in soils which frequently is higher than the risk-based PRG set at one-in-one-million cancer risk (PRG for residential soils is 0.38 mg/kg):

TABLE 4-22

BACKGROUND CONCENTRATIONS OF SELECTED ELEMENTS IN SOILS

Trace Element	U.S. Study Data[1]			California Data[2]		
	Range	GeoMean	ArMean	Range	GeoMean	ArMean
Arsenic	<.1-97	5.2 mg/kg	7.2 mg/kg	0.59-11	2.75 mg/kg	3.54 mg/kg
Beryllium	<1-15	0.63 mg/kg	0.92 mg/kg	0.10-2.7	1.14 mg/kg	1.28 mg/kg
Cadmium	<1-10	–	<1	0.05-1.7	0.26 mg/kg	0.36 mg/kg
Chromium	1-2000	37	54	23-1579	76.25 mg/kg	122.08 mg/kg
Nickel	<5-700	13	19	9.0-509	35.75 mg/kg	56.60 mg/kg

NOTES:

1 Shackle and Hansford, "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States", USGS Professional Paper 1270, 1984.

2 Bradford et al, "Background Concentrations of Trace and Major Elements in California Soils", Kearney Foundation Special Report, UC-Riverside and CAL-EPA DTSC, March 1996.

Where anthropogenic "background" levels exceed PRGs and EPA has determined that a response is necessary and feasible, EPA's goals will be to develop a comprehensive response to the widespread contamination. This will often require coordination with different authorities that have jurisdiction over the sources of contamination in the area.

After considering background concentrations in a local area, EPA Region 9 has at times used the non-cancer PRG for arsenic (22 mg/kg) to evaluate sites recognizing that this value tends to be above background levels yet still falls within the range of soil concentrations (0.38-38 mg/kg) that equate the EPA's "permissible" cancer risk (10E-6 to 10E-4)."

Table 4-22, which presents the background concentrations of selected elements in soils, references "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States", Shackle and Hansford, USGS Professional Paper 1270, 1984. On page 14 of that reference, a map depicts the location of the arsenic data points. The four points that are nearest the Vicksburg site range from 4.1 to 97 ppm arsenic. The 97 ppm is the highest value reported in the USGS study.

Aside from the examination of data that indicates no erosional transport of arsenic, the physical layout of the arsenic contamination source area at SWMU 11, 12, 15 also supports the thesis that there is no erosional transport. The area is overlayed with hard packed soil, asphalt and concrete. No erosional areas are evident.

The plume of arsenic contamination reported at SWMU 11, 12, 15 is depicted on Figure 4-1. The question at hand is whether that plume can migrate to Hennessey's Bayou and offsite in the near term.

Examination of the data presented in Tables 4-18 and 4-19 can lead to some general conclusions:

- The groundwater is an area where the natural soil is low in arsenic is likewise low in arsenic. The concentration of arsenic in groundwater at SWMU 23 is less than 2 ppb.

- The groundwater in an area where the natural soil is relatively high in arsenic is likewise relatively high in arsenic. MW-4 is the "official" background well. It is located in the north plant away from manufacturing areas but nearby the area where background concentration of arsenic in soil is 9,700 ppb. The concentration of arsenic in MW-4 has been analyzed as high as 8.9 ppb and averages 5 ppb.

- The detection of an average of 5 to 6 ppb arsenic in groundwater noted in the monitor well network (MW-1A, MW-2, MW-4, MW-5, MW-6, MW-9, MW-10, MW-10C, MW-11, MW-12, MW-12C, MW-14 and MW-16) is not indicative that the plume has reached anywhere near Hennessey's Bayou.

It can be concluded that there is no danger of imminent impact of the arsenic plume on Hennessey's Bayou and therefore offsite. There is confirmation, however, that additional monitoring should continue.

MODELING ARSENIC PLUME

Methodology:

A calculation of arsenic concentration in groundwater that is protective of surface water classified as a non-drinking water supply can be calculated and then compared to concentrations that exist in the zone of contamination utilizing the following steps:

- Identify the nearest downgradient surface water body that may receive discharge from the impacted zone;
- Determine if the downgradient surface water body (segment or subsegment) is classified as a drinking water or non-drinking water supply;
- Identify the appropriate human health protection criterion based on the use classification (drinking water supply or non-drinking water supply); and
- Calculate a site-specific longitudinal dilution and attenuation factor (DAF) to be applied to groundwater concentrations at the point of exposure (POE) using the Domenico model and site-specific data and/or default parameters as presented below. The site-specific DAF is representative of dilution and

attenuation associated with the migration of arsenic from the zone of contamination to the nearest downgradient surface water body (POE).

GW Formula

The appropriate formula is:

$$GW_{3NDW}\,(mg/L) = \frac{TR \times BW_a}{SF_o[IRW_{NDW} + (BCF \times IRF)]}$$

Where:

Parameter:	Definition (units):	Input Value:
GW_{3NDW}	Risk-based constituent concentration in water (mg/l)	--[a]
TR	Target excess individual lifetime cancer risk (unitless)	10^{-6}
BW_a	Average adult body weight (kg)	70 kg
IRF	Fish/shellfish ingestion rate (kg/day)	0.02 kg/day[b]
SF_o	Oral cancer slope factor ((mg/kg-day)$^{-1}$)	Chemical-specific[c]
IRW_{NDW}	Incidental water ingestion rate (L/day)	0.089 L/day[d]
BCF	Bioconcentration factor (L/kg)	Chemical-specific[e]

[c]The SF used in the calculation is obtained from the following hierarchy of sources: (1) EPA's *Integrated Risk Information System*; (2) EPA's *Health Effects Assessment Summary Tables*; (3) EPA Region VI *Human Health Medium Specific Screening Levels*, EPA Region III *Risk-Based Concentration Tables* or Region IX *Preliminary Remediation Goals*; or (4) other EPA or EPA-recommended reference.

[d]An incidental ingestion rate of 0.089 L/day shall be used for water bodies designated for primary contact recreation. This rate is based on the following assumptions: 250 mL/hr possible ingestion x 5 hrs/week swimming duration x 6 months/12 months swimming season x 1 week/7 days = 0.089 L/day incidental ingestion. The chemical specific parameters used in the calculation shall be obtained from a hierarchy of sources established by the Submitter. If there is potential for a COC to be bioconcentrated by fish and a BCF value is not available for the COC, then a BCF may be estimated using the K_{ow} and the algorithm presented below.

$$\text{Log BCF} = 0.76 \log K_{ow} - 0.23$$

Where:

Parameter:	Definition (units):	Input Value:
BCF	Bioconcentration factor	Chemical-specific
K_{ow}	Octanol-water partition coefficient	chemical-specific

(Fundamentals of Aquatic Toxicology. 1985. Ed. Rand and S. Petrocelli, Washington: Hemisphere Publishing Corp., Chapter 17, Bioaccumulation, A. Ipacie and J.L. Hamelink). If a K_{ow} is not available in the literature, a K_{ow} value may be estimated from the K_{oc} using the algorithm presented below (or other appropriate model):

$$\text{Log } K_{oc} = 0.0784 + (0.7919 \text{ x log } K_{ow})$$

(Soil Screening Guidance: Technical background Document, EPA, 1996).

GW Calculation

For arsenic SF_o = 1.5. No data is found for K_{oc}, K_{ow} or BCF; therefore, a BCF = 1.0 is used.

By calculation GW_{3NDW} = 4.28 (10^{-4}) ppm or 0.428 ppb. Groundwater entering Hennessey's Bayou should not exceed 0.428 ppb or the established MCL. The MCL for arsenic is 50 ppb.

DAF Formula

The site-specific DAF is calculated using the following:

$$DAF = \frac{Csi}{C_{(x)_i}} = 1/\left(\exp\left(\frac{x}{2\alpha_x}\left[1 - \sqrt{1 + \frac{4\lambda_i \alpha_x R_i}{v}}\right]\right)\left(erf\left[\frac{S_w}{4\sqrt{\alpha_y x}}\right]\right)\left(erf\left[\frac{S_d}{2\sqrt{\alpha_z x}}\right]\right)\right)$$

Where:

Parameter:	Definition (units):	Input Value:
$C_{(x)i}$	Concentration of constituent i in groundwater at distance x downstream of source (mg/L) or (mg/m^3)	--

Parameter:	Definition (units):	Input Value:
C_{si}	Concentration of constituent i in source zone (mg/L) or mg/m^3)	--
S_w	Source width perpendicular to groundwater flow (ft)	Site-specific
D_v	Groundwater Darcy velocity (K x i) (ft/yr)	Site-specific (30)[b]
n	Soil porosity (dimensionless)	Site-specific (0.36)[b]
λ_i	First-order degradation rate for constituent i	Site-specific[c]
R_i	Constituent retardation factor (dimensionless)	Site-specific[c]
i	Hydraulic gradient (ft/ft)	Site-specific
v	Groundwater seepage velocity	(K x i)/n
x	Distance downgradient from source (ft)	Site-specific
S_d	Source thickness (e.g., the thickness of the impacted groundwater within the permeable zone) (ft)	Site-specific
K	Hydraulic conductivity (ft/yr)	Site-specific
α_x	Longitudinal groundwater dispersivity (ft)	(x * 0.1)
α_y	Transverse groundwater dispersivity (ft)	(α_x / 3)
α_z	Vertical groundwater dispersivity (ft)	(α_x / 20)
erf	Error function; $\text{erf}\chi = \frac{2}{\sqrt{\pi}} \int_o^x e^{-1^2} dt$	--[d]

[a]Domenico, P.A. and F.W. Schwartz, 1990. *Physical and Chemical Hydrogeology*, John Wiley and Sons, New York, N.Y.

[b]LDEQ

[c]Degradation and/or retardation shall only be included in the model when site-specific quantitative data document occurrence. Derivation of constants for these process shall be included with the model input data. Degradation and retardation data are by definition monitored natural attenuation processes. Therefore, literature values for retardation and degradation are not acceptable.

[d]The solution to the error function is presented below:

Solution to the Error Function

χ	erf χ
0.00	0.000 000
0.05	0.056 372
0.10	0.112 463
0.15	0.167 996
0.20	0.222 703
0.25	0.276 326
0.30	0.328 627
0.35	0.379 382
0.40	0.428 392
0.45	0.475 482
0.50	0.520 500
0.55	0.563 323
0.60	0.603 856
0.65	0.642 029

χ	erf χ
0.70	0.677 801
0.75	0.711 156
0.80	0.742 101
0.85	0.770 668
0.90	0.796 908
0.95	0.820 891
1.00	0.842 701
1.1	0.880 205
1.2	0.910 314
1.3	0.934 008
1.4	0.952 285
1.5	0.966 105
1.6	0.976 348
1.7	0.983 790

χ	erf χ
1.8	0.989 091
1.9	0.992 790
2.0	0.995 322
2.2	0.998 137
2.4	0.999 311
2.6	0.999 764
2.8	0.999 925
3.0	0.999 978
3.2	0.999 994
3.4	0.999 998
3.6	1.000 000
3.8	1.000 000
≥ 4.0	1.000 000

Estimation of S_d:

The S_d is defined as the thickness of the contaminated groundwater within the permeable zone.

For the purpose of developing a DAF for GW_3, LDEQ requires that the S_d be estimated using Method 1 (below). If the estimated S_d value exceeds the aquifer thickness, S_d should be set to the thickness of the aquifer.

Method 1: Sum of advective and dispersive depths

$$S_d = h_{adv} + h_{disp}$$

$$H_{adv} = B[1-\exp((-I \times L)/(B \times D_v))]$$

Where:

Parameter:	Definition (units):	Input Value:
h_{adv}	Advective component of the plume depth (ft)	Site-specific
I	Infiltration rate (ft/yr)	Site-specific (0.33)[a]
D_v	Darcy horizontal velocity (ft/yr)	Site-specific
B	Thickness of the shallow water bearing zone (ft)	Site-specific
L	Length of the source parallel to the groundwater flow at the water table	Site-specific

[a]LDEQ

$h_{disp} = (2 \times \alpha_z \times L)^{1/2}$

Where:

Parameter:	Definition (units):	Input Value:
H_{disp}	Dispersive component of the plume depth (ft)	Site-specific
α_z	Vertical dispersivity (ft)	Site-specific (*L/200*)
L	Length of the source parallel to the groundwater flow at the water table (ft)	Site-specific

Method 2: Thickness of the aquifer

The thickness of the impacted permeable zone shall be used as the S_d if the thickness of the groundwater plume is not known.

Calculate DAF

Estimated S_d:

B = 30 ft.
L = 450 ft. (edge of 300 ppb plume)
D_v = 4.3 ft/yr (see Section 3 Table 3-5)

Therefore:

$h_{adv} = 20.5$
$h_{disp} = 45$
$S_d = 65.5$ ft which is larger than aquifer thickness; therefore, use $S_d = 30$ ft.
x = 600 feet (Figure 4-1 distance from 300 ppb isopleth to Hennessey's Bayou)
$\lambda_i = 0$ for inorganics
$R_i = 0$ for inorganics
$v = 4.3$ ft/year (Table 3-5)
$S_w = 20$ ft (source depth at 300 ppb isopleth) is 20
$S_d = 300$ ft (source thickness from 300 ppb isopleth to center of highest arsenic concentration)

$$DAF = \frac{1}{\exp.(0)erf\left(\frac{300}{\sqrt[4]{\frac{60}{3}(600)}}\right)ert\left(\frac{20}{\sqrt[2]{\frac{60}{20}(600)}}\right)}$$

DAF = 6.3

CONCLUSION:

The zone of contamination should be kept below (DAF)(MCL) = 6.3 (50) = 315 ppb in order that the arsenic concentration at the point of exposure is below 50 ppb. (There are studies in the regulatory agencies that suggest the MCL for arsenic will be lowered to a value between 5 and 20 ppb.)

DINOSEB

Localized Dinoseb Contamination

There is evidence of localized contamination at MW-1A and MW-11. There are two possible explanations for the localized contamination:

- A break in the line carrying wastewater to the ponds. The break has been repaired.

- The ponds themselves prior to being cleaned out and double lined. MW-1A and MW-11 are upgradient of the ponds now; however, the ponds used to be earthen lined and it is likely that water was mounded underneath the ponds.

The concentration of dinoseb in MW-1A varies from non-detect to 5,500 ppb. The concentration averages 531 ppb dinoseb. The concentration since 1993 averages 148 ppb. The concentration since 1997 averages 121 ppb. The most recent (June 2001) concentration is 139.6 ppb. A well, MW-1C, was installed approximately five feet from MW-1A in May 2001. The construction of MW-1A and MW-1C are similar, both monitor the shallow zone approximately 10-20 feet below ground surface. Dinoseb is undetected in MW-1C.

The concentration of dinoseb in MW-11 varies from non-detect to 29 ppb. The concentration averages 3 ppb. Dinoseb was first detected in 1993; since 1993, the dinoseb concentration averages 5.0 ppb. The concentration in June 2001 was non detect. The concentration since 1997 averages 8 ppb. MW-11 is 150 feet directly downgradient from MW-1A.

It can be inferred that there was localized contamination near MW-1A. The concentration at MW-1A is small in areal extent and in a decreasing trend so it can be further inferred that the original source of the contamination is absent, that is, dinoseb is no longer entering the groundwater at MW-1A.

SWMU 2 Dinoseb Contamination

There is evidence of a plume of dinoseb underneath the SWMU 2 "hill area" landfill. Temporary wells were constructed to groundwater. The groundwater in well LS-5 was 797 ppb dinoseb; the groundwater in well LS-4 was 597 ppb dinoseb; the groundwater in well LS-2 was 8,714 ppb dinoseb. Groundwater in wells LS-1 and LS-3 contained no dinoseb.

The groundwater surrounding the landfill has been monitored by wells MW-5, MW-6 and MW-7 since 1983. The groundwater at MW-5 varies from non-detect to 12.0 ppb dinoseb and averages 0.3 ppb dinoseb. The groundwater at MW-6 varies from non-detect to 75 ppb dinoseb and averages 1.3 ppb dinoseb. The groundwater at MW-7 varies from non-detect to 4.5 ppb dinoseb and averages 0.1 ppb dinoseb.

Groundwater in this area is estimated (see Table 3-2) to move at 5.8 feet per year. Groundwater is not found, however, at the elevation at which wastes were placed in the

landfill. The wastes were placed approximately 30 feet above groundwater. Dinoseb would have to be leached by percolating rainwater downward to the groundwater. That route has been inhibited by soil caps placed in 1979 and 1983. The most likely or most significant source would be a dinoseb process wastewater pond operated from 1972 through 1975. The dinoseb would have begun to enter the groundwater stream prior to the initial cap installation in 1979.

Despite the relatively high dinoseb concentrations found localized in groundwater directly beneath the hill, there is no direct evidence of likely dinoseb impact on Hennessey's Bayou in concentrations in excess of MDEQ Tier 1 TRG Table values. The area is effectively monitored by wells MW-5, MW-6 and MW-7. Despite the scatter of data from dinoseb concentrations in the groundwater at these wells, the overall average is less than one ppb.

Vicksburg Chemical has established in soil treatment units that dinoseb in soil, including moist soil, can be biodegraded aerobically and anaerobically. Neither rates of degradation nor the quantity of dinoseb in the landfill has been established. It can, however, be conjectured, because monitor wells MW-5, MW-6 and MW-7 have not been significantly impacted, that the rate of movement of dinoseb is sufficiently slow and the rate of dinoseb degradation sufficiently fast such that Hennessey's Bayou may not be adversely impacted.

SWMU 20 Dinoseb Contamination

Results of the May 2001 investigation of groundwater indicate a plume of dinoseb in the vicinity of the Former Dinoseb Manufacturing Area. Concentrations of dinoseb as high as 18,821 ppb were found. Two monitor wells, MW-12C and MW-10C were installed on the boundary of the plume to monitor the shallow zone (10-20 feet below ground surface) of the aquifer. Existing wells MW-12 and MW-10 monitor the deep (20-30 feet below ground surface) of the aquifer. Dinoseb is undetected in MW-12 but present in MW-12C at 277 ppb. Dinoseb is undetected in MW-10 but present in MW-10C at 717 ppb. The plume exists in the shallow zone but not the deep zone. In subsequent sampling and analysis of groundwater from MW-10C and MW-12C by VCC in October 2001, the concentrations of dinoseb are higher than the concentrations obtained in May 2001. The dinoseb concentration reported for MW-10C is 7,000 ppb and the dinoseb concentration for MW-12C is 13,000 ppb. The dinoseb plume on Figure 4.2 reflects the latest concentrations.

It is another observation of conditions in the area of the plume that the top layer of soil (0-1 ft below ground surface) is contaminated with dinoseb, however, deeper soil (1-8 ft below ground surface) is not contaminated. The RFI Final Report, August 2001, provides a record of the soil contamination. A generalized depiction of soil contamination is presented as Figure 4-6.

The corrective action for this plume will be considered during the Corrective Measures Study. There is, however, an important feature of the construction of the lining of the Surface Impoundments that significantly impacts the transport of the dinoseb plume. A "blanket drain" was constructed along the western edge of the impoundment from the intake structure of the impoundment to the pump outlet structure. The blanket drain is a permeable layer that is connected to the impoundment subsurface sumps. The blanket drain is depicted on Figure 4-7. The blanket drain and compacted soil placed atop the drain were installed to dewater the general area and provide support for the surface impoundment double liner system. The blanket drain now functions as an intercept trench between the dinoseb plume and Hennessey's Bayou.

Dinoseb Contamination – SWMU 11, 12, 15

During the September 2001 investigation, a pre-packed semi-permanent 1-inch diameter well was installed in the center of the arsenic plume to a depth of fifteen feet. The purpose of the well was to allow withdrawal of arsenic contaminated water to test compatibility with the brake fern (Pteris vittata). The brake fern is the first plant known to detoxify soils contaminated by arsenic. The fern absorbs large amounts of arsenic into its stems and fronds. Twenty gallons of groundwater was removed. Initially the groundwater was clear; however, after continued pumping it became yellow tinted. During previous investigations, the groundwater appeared clear and was only tested for arsenic. A sample of the twenty gallons was submitted for analysis and, as noted on Table 4-10 contains 1,387 ppb dinoseb, 4,770 ppb 4-nitrophenol, and 244,000 ppb arsenic. The arsenic concentration was as predicted. The dinoseb and 4-nitrophenol and yellow tint was not predicted. At one time, methyl parathion was produced at the SWMU 11, 12, 15 site and 4-nitrophenol was one of the raw materials. The presence of dinoseb must be due to spill of dinoseb stored on the site at some time. SWMU 9, the dinoseb drumming building is downgradient. Groundwater from location TP-1, which is between SWMU 11, 12, 15 and SWMU 9, showed no detection of either dinoseb or 4-nitrophenol.

TOXAPHENE

Toxaphene is not a contaminant that is mobile in groundwater. It has mainly been detected at the Vicksburg Chemical site in soils at or near the surface. The generalized soil contamination is noted on Figure 4-6. The mechanism of contaminant transport is that toxaphene moves as soil is eroded.

Nevertheless, toxaphene has been detected in the groundwater at monitor wells MW-6 and MW-7. The concentration of toxaphene in MW-6 varies but the average concentrations is 2.1 ppb. The average concentration of toxaphene in MW-7 is 0.05 ppb..

There was no toxaphene detected in the groundwater at temporary wells LS-1, LS-2, LS-3, LS-4 or LS-5 or permanent well MW-5. The one time hit at MW-7 may be an analytical anomaly. The concentrations detected at MW-6 appear to be declining. The average concentration is less than the value in the MDEQ Tier 1 TRG Table. It is likely that the presence of toxaphene is a small localized contamination downgradient of LS-1.

VOAs

The summation of concentrations of various VOAs detected in the groundwater has been made and recorded for each well depicted on Figure 4-4. For the most part, values recorded on Figure 4-4 represent localized situations caused by small spills during the many years of operating life at the facility. There are three areas where there are VOA plumes, one is associated with the north pond (SWMU 23), another is associated with the landfill (SWMU 2), and the third is associated with former manufacturing areas in the railroad area (SWMU 20).

SWMU 23 VOA Contamination

There is a zone of perched water associated with former operation of the north pond. The north pond is no longer in operation but at one time served as a neutralization/equalization basin for wastewater effluent from the potassium nitrate plant. The perched zone contains VOAs, mostly as halomethanes.

SWMU 2 VOA Contamination

The groundwater underneath the landfill (SWMU 2) does contain various VOAs that are present in concentrations in excess of MDEQ Tier 1 TRG Table values. The contaminants are chloroform, carbon tetrachloride, acetaphenone, 4-nitrophenol, and bis-(2-ethyl)hexyl phthalate.

The concentrations detected are tabulated in Table 4-5 and are listed on Figure 4-4K. There are no patterns that indicate interconnection of the VOA plumes within the landfill. The borings and temporary wells were advanced through the boundaries of former ponds or burial areas. The VOAs are indicative of what was buried or dumped into a particular pond or burial area.

The landfill area (SWMU 2) is monitored by permanent monitoring wells MW-5, MW-6 and MW-7. None of the compounds noted above have been detected in these monitor wells. Trichloroethene was detected in MW-5 and MW-6 in March 1996; laboratory or sampling error is suspected since it has been detected at no other time in both wells.

SWMU 20 VOA Contamination

Solvents were used in the manufacturing processes for toxaphene. There is ample evidence of subsurface contamination of groundwater by these solvents. The concentration of VOAs in groundwater at temporary well location 20-2 is 401,112 ppb. Monitor wells MW-10C and MW-12C were installed at the boundaries of the VOA plumes. The concentration of VOAs in MW-12C is 27,837 ppb. The concentration of VOAs in Mw-10C is 2,568 ppb. VOAs are virtually non-detected in MW-12 and MW-10; therefore, the plume exists in the shallow zone of the aquifer.

The toxaphene manufacturing area was south of and adjacent to the dinoseb manufacturing area. Not suprisingly, the VOA plume is south of and adjacent to the dinoseb plume.

Various of the VOA components are presented in the groundwater in concentrations in excess of MDEQ Tier 1 TRG Table values. The contaminants are chloromethane, methylene chloride, 1,1-dichloroethene, 1,2, dichloroethene (total), chloroform, carbon tetrachloride, trichloroethene, benzene, 1,1,2-trichloroethane, and tetrachloroethene. Individual plumes of the contaminants are mapped on Figures 4-4A through 4-4J.

The corrective action for this plume will be considered during the Corrective Measures Study. There is, however, an important feature of the construction of the lining of the Surface Impoundments that may impact the transport of the VOA plume. A "blanket drain" was constructed along the western edge of the impoundment from the intake structure of the impoundment to the pump outlet structures. The blanket drain is a permeable layer that is connected to the impoundment subsurface sumps. The blanket drain is depicted on Figure 4-7. The blanket drain and compacted soil placed atop the drain were installed to dewater the general area and provide support for the surface impoundment double liner system. The blanket drain now functions as an intercept trench between the dinoseb plume and Hennessey's Bayou and does influence the VOA plume.

ATRAZINE/CYANAZINE

Neither atrazine nor cyanazine have been frequently detected in samples of soil or groundwater.

There were some hits (below MDEQ Tier 1 TRG Table Values) in the landfill (SWMU 2) soil. Atrazine was also detected in the groundwater from temporary wells LS-2 and 2-15.

Atrazine was detected in trace concentrations in groundwater at MW-1A, MW-7, MW-8 and MW-9. Cyanazine was detected in trace concentrations in groundwater at MW-1A. There is no apparent source of contamination that would lead to the prediction that Hennessey's Bayou will be impacted.

Atrazine was detected in groundwater at location 2-15 above MDEQ Tier 1 TRG Table Values. As a result from temporary wells were installed in September 2001 at locations 2-18, 2-19, 2-20 and 2-21. The temporary wells surround location 2-15. No atrazine was detected in the groundwater from the four surrounding wells.

The investigation of SWMUs has been completed. The likely correspondence between monitoring wells and SWMUs was presented in Section 4.3 and Table 4-15. The various plumes of contamination have been discussed and are drawn on Figures 4-1 through 4-5.

It is proposed that groundwater monitoring in the future emphasize monitoring of the plumes rather than SWMUs. Monitoring of each of the plumes is discussed below:

ARSENIC PLUME (Refer to Figure 4-1)

The arsenic plume is bounded by nested wells MW-17A, MW-17B and MW-18A, MW-18B and by MW-9. Although nested monitor wells MW-10, MW-10C, and MW-12, MW-12C are not impacted they serve as a long term red flag for potential impact of Hennessey's Bayou.

DINOSEB PLUME (Refer to Figure 4-2)

The dinoseb plumes in SWMU 2 are monitored by wells MW-7, MW-6 and MW-5. The dinoseb plume in the railroad track area is bounded by nested wells MW-10, MW-10C and MW-12, MW-12C. MW-11 additionally offers value as a long term red flag for potential impact of Hennessey's Bayou.

TOXAPHENE PLUME (Refer to Figure 4-3)

There are not toxaphene plumes. Nevertheless, it is proposed to continue analyzing wells MW-5, MW-6 and MW-7 for toxaphene.

VOA PLUMES (Refer to Figure 4-4)

The wells MW-7, MW-6, and MW-5 will monitor the VOA plumes in SWMU 2.

Nested wells PZ-22A and PZ-22B will monitor the VOA plume at SWMU 23.

Nested wells MW-12c, MW-12, and MW-10C, MW-10 will monitor the VOA plume in the railroad area. MW-11 will be monitored for VOAs as a long term red flag for potential impact of Hennessey's Bayou.

ATRAZINE/CYANAZINE PLUME (Refer to Figure 4-5)

There are no atrazine/cyanazine plumes that require monitoring.

SUMMARY

The following is proposed to be the long term analyses matrix for monitoring groundwater:

TABLE 5-1

GROUNDWATER MONITORING MATRIX

Analytical Parameter	MW-5	MW-6	MW-7	MW-9	MW-10	MW-10C	MW-11	MW-12	MW-12C	MW-17A	MW-17B	MW-18A	MW-18B	PZ-22A	PZ-22B
Arsenic				X	X	X		X	X	X	X	X	X		
Dinoseb	X	X	X		X	X	X	X	X						
Toxaphene	X	X	X												
VOAs	X	X	X		X	X	X	X	X					X	X
Atrazine/Cyanazine															

Since the flow rate of groundwater is such that quarter to quarter variation of results are insignificant, it is suggested that monitoring and analyses be conducted on a semi-annual basis.

The following is a list of the information that has been provided in this GWA:

- The location of wells is found on Figure 1-1. Potentiometric contours are also shown on the Figures 3-1 and 4-1 through 4-5. No new wells are proposed.
- Construction logs for each permanent monitoring well and piezometer is found in Appendix D.
- The monitoring parameters have been established for the Vicksburg site to be: arsenic, dinoseb, toxaphene and volatiles.
- Geologic cross-sections are found in the Figures section as Figures 3-2 through 3-7.
- The monitoring zone is identified.
- The flow direction is identified.
- The flow velocity is measured and calculated.
- Sampling and analytical methods are found in Appendix E and Appendix F. The first pages in Appendix E are an addendum describing bailer purging of wells. The addendum is from page 17-1 of "Response to July 3, 2000 comments by the U.S. EPA on the 'Amended and Supplemental Groundwater Assessment Workplan', December 1999".
- Previously-gathered groundwater quality information through June 2001 and piezometric elevation information from permanent wells and piezometers is included in Appendix H. The sampling program at VCC has consisted of quarterly sampling and analysis for arsenic, dinoseb, toxaphene and volatiles.
- Previously-gathered groundwater quality information from temporary and new wells is included in Tables 4-2 through 4-16.

- The previously-gathered groundwater quality information is evaluated by comparing it to values presented in the MDEQ Tier 1 TRG Table and by examining the likely correspondence between wells and SWMUs as presented in Table 4-15.

- An overview of site wide soil contamination sources is presented on Figure 4-6. The specific areas where there are concentrations of contaminants in soil that exceed MDEQ Tier 1 TRG Table values for restricted use are also shown on Figure 4-6.

- An overview of site wide groundwater contamination of arsenic, dinoseb, toxaphene, volatiles, atrazine and cyanazine is presented on Figures 4-1, 4-2, 4-3, 4-4, and 4-5.

The GWA is the first annual report and will be updated annually with the results of groundwater sampling and analysis obtained during the previous year. The remaining work is to continue the groundwater sampling and analysis program as modified in Section Five.

Corrective action is to be considered for arsenic, dinoseb and VOA plumes. Details will be developed in a Corrective Measures Study.

7.1 GROUNDWATER ASSESSMENT PROJECT SCHEDULE

The finalization of the GWA Report is a function of U.S. EPA schedule of review. VCC anticipates issuing a Final GWA report in December 2001.

7.2 REPORTING REQUIREMENTS

Several reports are mandated by the Consent Decree. Due dates for these reports are also mandated in the Consent Decree.

7.2.1 Progress Reports

Monthly progress reports dated the 10th of the month have been and will continue to be provided to EPA and MSDEQ containing:

- Description and estimate of the percentage of the RFI completed
- Summaries of all findings
- Summaries of all changes made in the RFI during the reporting
- Summaries of all contacts with representatives of the local community, public interest groups, or State government during the reporting period
- Actions being taken to rectify problems
- Changes in personnel during the reporting period
- Projected work for the next reporting period
- Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

7.2.2 Annual Groundwater Assessment Reports

VCC will begin submission of annual Groundwater Assessment Reports to EPA and MSDEQ on or before March 1 of 2002 and each subsequent calendar year. This annual report will include the following information:

- Groundwater elevations measured on a yearly basis.

- Concentrations or values of the monitoring parameters obtained from semi-annual analysis at each groundwater monitoring well as noted in Section Five.
- Evaluation of the monitoring parameter.
- Plots showing concentrations of arsenic, dinoseb, toxaphene, and volatiles on maps of the site.
- Recalculations, as necessary
  - Hydraulic conductivity.
  - Determination of the rate of groundwater flow and direction in the uppermost aquifer.
- Summary and conclusions of results.

The Project Management Plan consists of the following elements:

- Project task definition
- Specific personnel positions within the project organizational structure

8.1 PROJECT TASK DEFINITION

VCC has retained the services of URS to develop the RFI and GWA Work Plans to the satisfaction of the EPA and MSDEQ and assist VCC in implementing the work plans.

8.2 PROJECT PERSONNEL

Duties of key personnel are described below.

8.2.1 U.S. EPA and MSDEQ Project Coordinator

The U.S. EPA and MSDEQ project coordinators or designated agents will observe work plan activities to any extent deemed necessary to confirm that the requirements of the Consent Decree, and the RFI Work Plan are met.

8.2.2 Project Director

The Project Director is Mr. Steve Boswell. He is an employee of and is the official representative for VCC. He is in charge of administration of the work and the completion of the project.

8.2.3 URS Project Manager

The URS Project Manager develops the plans required by the Consent Decree and oversees work implementing the Work Plan on behalf of VCC, and is the primary contact with VCC. The URS Project Manager is Richard D. Karkkainen. Mr. Karkkainen is a Principal Environmental Engineer in URS.

8.2.4 URS Field Investigation Site Coordinator

The URS Field Investigation Site Coordinator will handle day to day activities and coordinate them with other RFI and GWA activities. He will coordinate efforts and oversee their implementation. The Project Manager is expected to fulfill this role. He will be assisted by Dean Lowe, a geologist with 40 years of experience. Mr. Lowe is a Principal Geologist associated with Petra Environmental the geo-probe subcontractor.

8.2.5 Health and Safety Officer

A Health and Safety (H & S) officer will be responsible for the administration and implementation of the site Health and Safety for Groundwater Assessment activities. The H & S Officer will coordinate efforts through a Site Safety Officer. The Site Safety Officer will coordinate effort with the VCC safety personnel. The Project Manager may fulfill this role. A Health and Safety Plan is found in Appendix C of the Amended and Supplemental RFI Work Plan, December 1999. The H & S officer will have the overall responsibility for safety and health and will:

- Ensure that and employee medial surveillance program which meets the requirements of 29 CFR 1910.120 is instituted and maintained.

- Be responsible for the initial pre-construction indoctrination of all on-site personnel with regard to the H & S Plan and other safety requirements to be observed during the construction, including but not limited to:

  - potential hazards
  - personal hygiene principles
  - personnel protective equipment
  - respiratory protection equipment usage and fit testing, and
  - emergency response including site evacuation, dealing with fire and medical situations

- Be responsible for the maintenance of separate exclusion, contamination reduction, and support zones if needed as described in the Contractor's H & S Plan and on the drawings.

- Ensure that personnel exposure air monitoring, if needed, is properly conducted and recorded.

- During on-site activity, maintain a recordkeeping system which will include daily records of all site activity, waste quantities produced, waste transportation activity information, laboratory results, and other information.

8.2.6 QA/QC Manager

The QA/QC Manager will be responsible for coordination with the analytical laboratory and for the validation of data. Mr. Rodney Culpeper, analytical chemist and manager of Magnolia Scientific Laboratory, is QA/QC Manager.

APPENDIX H

GROUNDWATER MONITORING DATA

Contents of Appendix H:

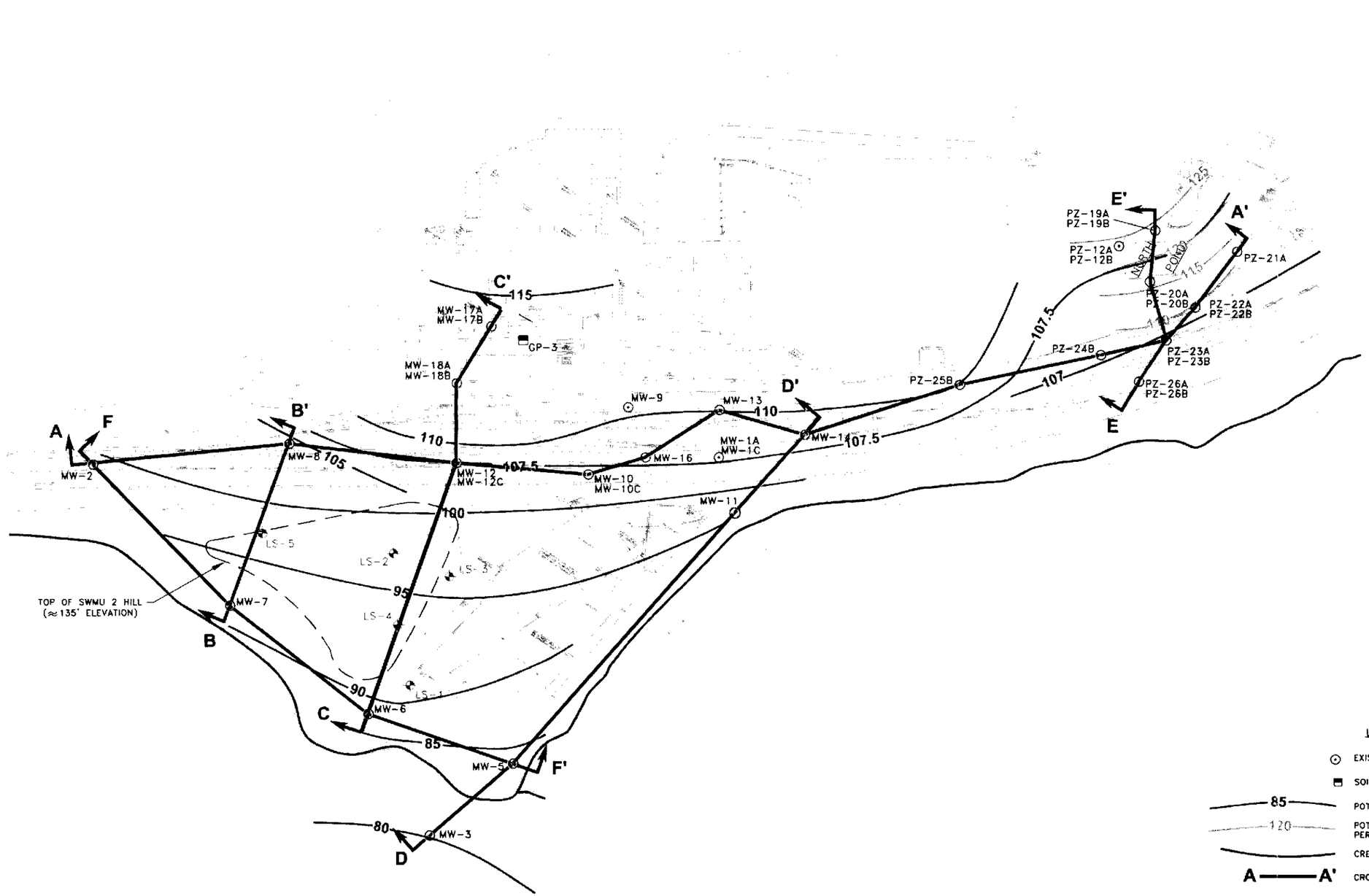
- **Table H-1 Data Locator and Impact Summary**
- **Table H-2 Constituents of Concern**
- **Table H-3 Cross Reference to TCL Compounds**
- **Table H-4 Groundwater Data Level Measurements**
- **Table H-5 The Data**

(Note that the compounds are not organized in alphabetical order. Refer to the Data Locator to find the appropriate "H" page.)

Note: The data in Appendix H is data from wells MW-1A, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14 and MW-15. It does not include data from RFI investigations or the new wells MW-1C, MW-10C, MW-12C, MW-17A, MW-17B, MW-18A and MW-18B, since the data from those temporary and permanent wells is included in the body of the GWA Report.

APPENDIX H – TABLE H-5

THE DATA



SCALE: 1 INCH=300 FEET

300' 0 300'

LEGEND:

- EXISTING MONITOR WELL OR PIEZOMETER LOCATION
- SOIL BORING LOCATION
- 85 — POTENTIOMETRIC CONTOUR (UPPERMOST AQUIFER)
- 120 — POTENTIOMETRIC CONTOUR PERCHED WATER TABLE IN NORTH POND AREA
- CREEK
- A——A' CROSS-SECTION LOCATION LINE

K:\CEDAR\03013\03013--92B007CB.DWG

REV	DESCRIPTION OF REVISION	BY	DATE
2	AS OF MAY 2001	PCG	8/19/01
1	ADD SWMU 2 BORINGS	PCG	8/17/00

VICKSBURG CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

URS
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

REFERENCE DRAWINGS

SCALE: 1"=300'
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 8/17/01

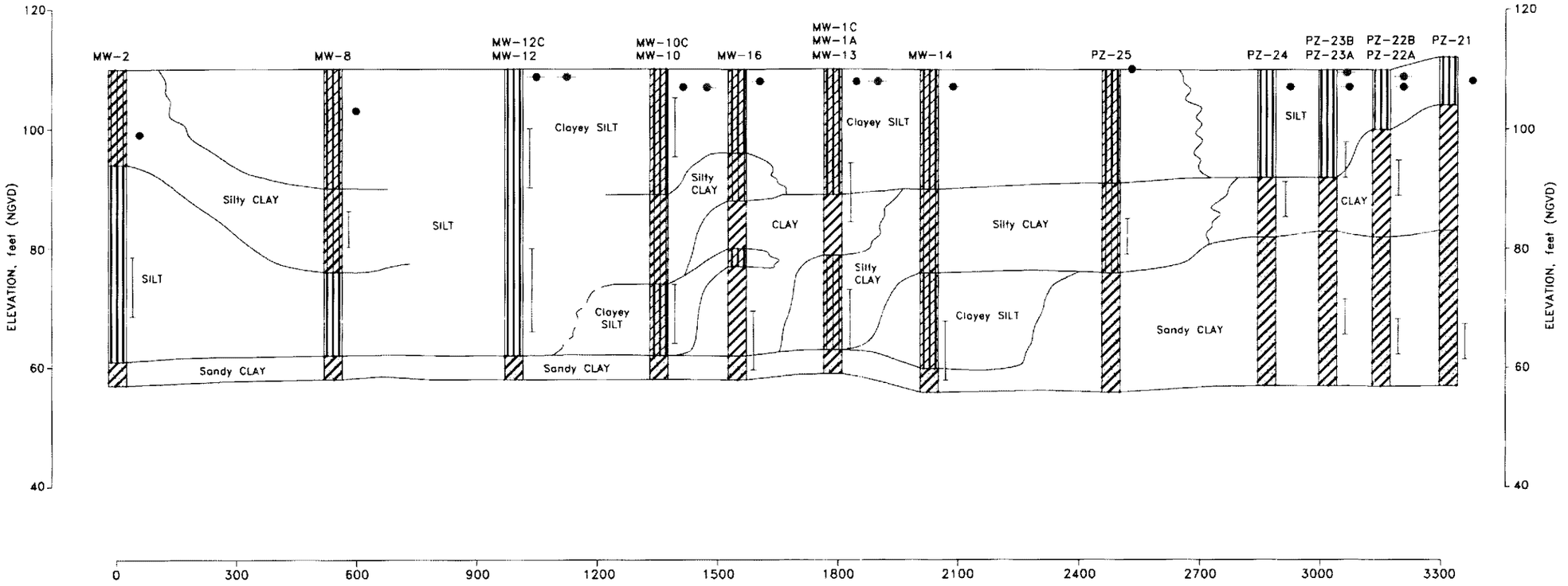
GROUNDWATER ASSESSMENT

POTENTIOMETRIC CONTOURS
WITH CROSS SECTION LOCATIONS

REVISION: 2
PROJECT: 35092B007C
FIGURE: 3-1

A
WEST

A'
EAST



LEGEND

- CLAY
- Silty CLAY
- SILT
- Sandy CLAY
- Clayey SILT
- PIEZOMETER ELEVATIONS
- PIEZOMETER ELEVATIONS
- EXISTING SCREEN ELEVATION
- EXISTING SCREEN ELEVATION

K:\CEDAR\03013\03013-92B007C9.DWG

REV	DESCRIPTION OF REVISION	BY	DATE
2	"AS IS" PER MAY 2001 RFI PHASE II	PCG	7/19/01
1	ADD WELL SCREEN AND PIEZOMETER ELEVATIONS	PCG	11/3/00

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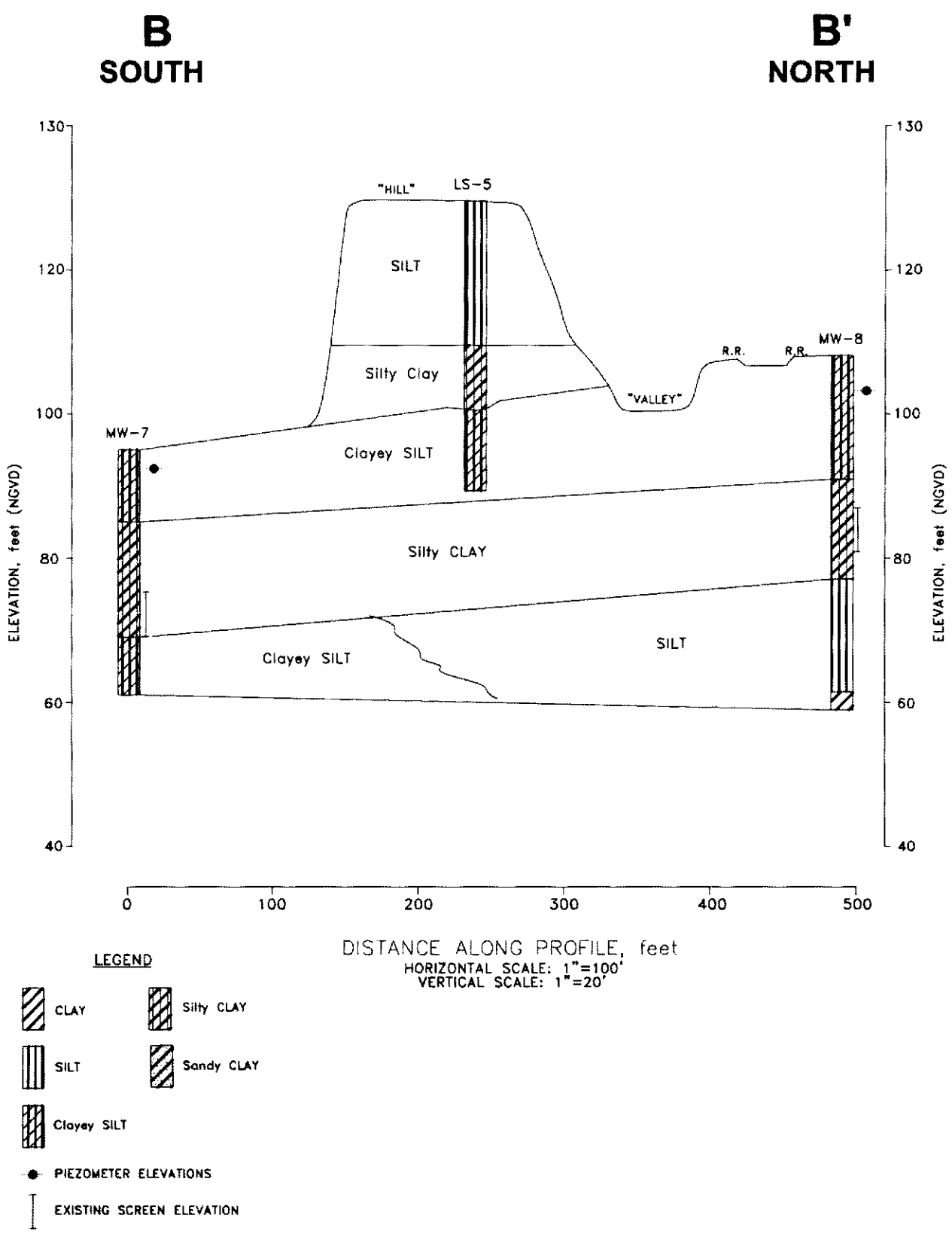
REFERENCE DRAWINGS

SCALE: AS SHOWN
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/19/01

GROUNDWATER ASSESSMENT

CROSS-SECTION A-A'

REVISION: 2
PROJECT: 3596B007C
FIGURE: 3-2



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SCALE:	DRAWN BY: PCG	DATE: 7/19/01
AS SHOWN	CHKD. BY:	DATE:

GROUNDWATER ASSESSMENT

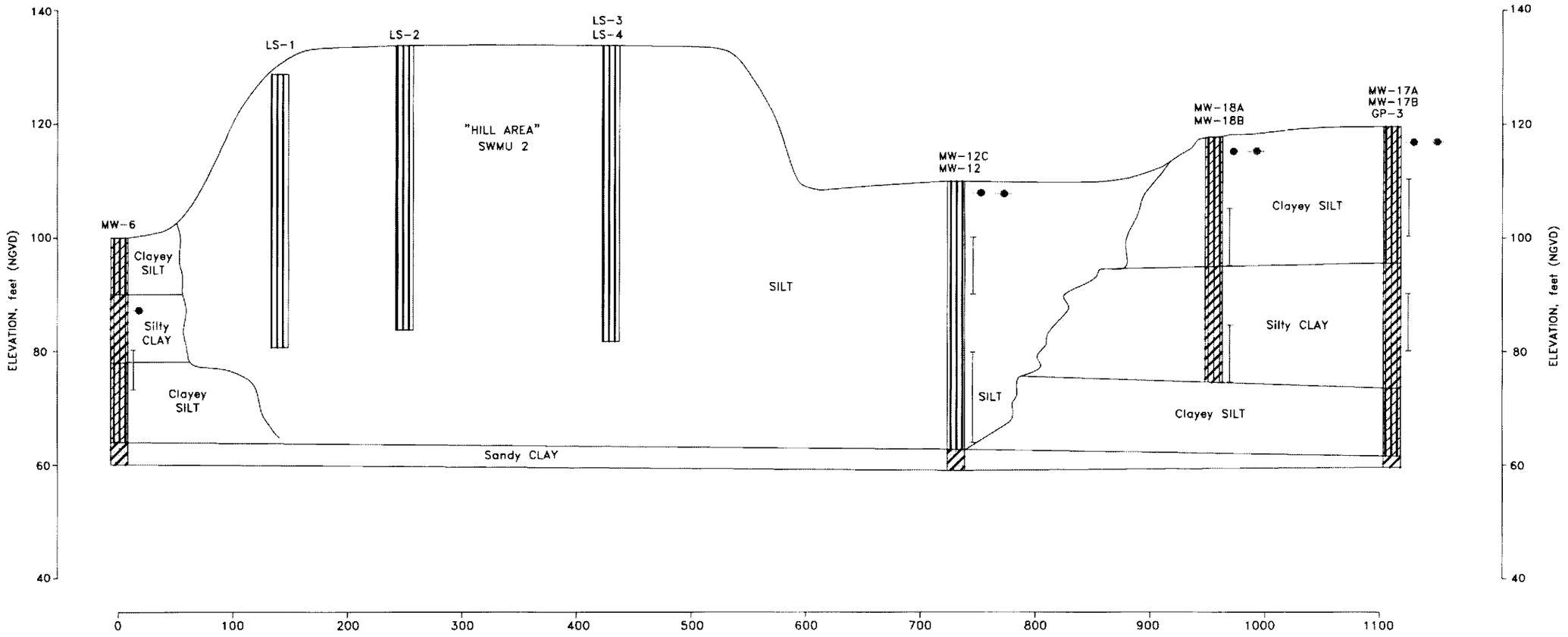
CROSS-SECTION B-B'

PROJ. NO. 35092B007C

FIGURE 3-3

C
SOUTH

C'
NORTH



LEGEND

- CLAY
- SILT
- Clayey SILT
- Silty CLAY
- Sandy CLAY
- PIEZOMETER ELEVATIONS
- PIEZOMETER ELEVATIONS
- EXISTING SCREEN ELEVATION
- EXISTING SCREEN ELEVATION

K:\CEDAR\03013\03013-92B007C11.DWG

REV	DESCRIPTION OF REVISION	BY	DATE
2	"AS IS" PER MAY 2001 RFI PHASE II	PCG	7/19/01
1	ADD WELL SCREEN & PIEZOMETER ELEVATIONS	PCG	11/3/00

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REFERENCE DRAWINGS

SCALE: AS SHOWN
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/19/01

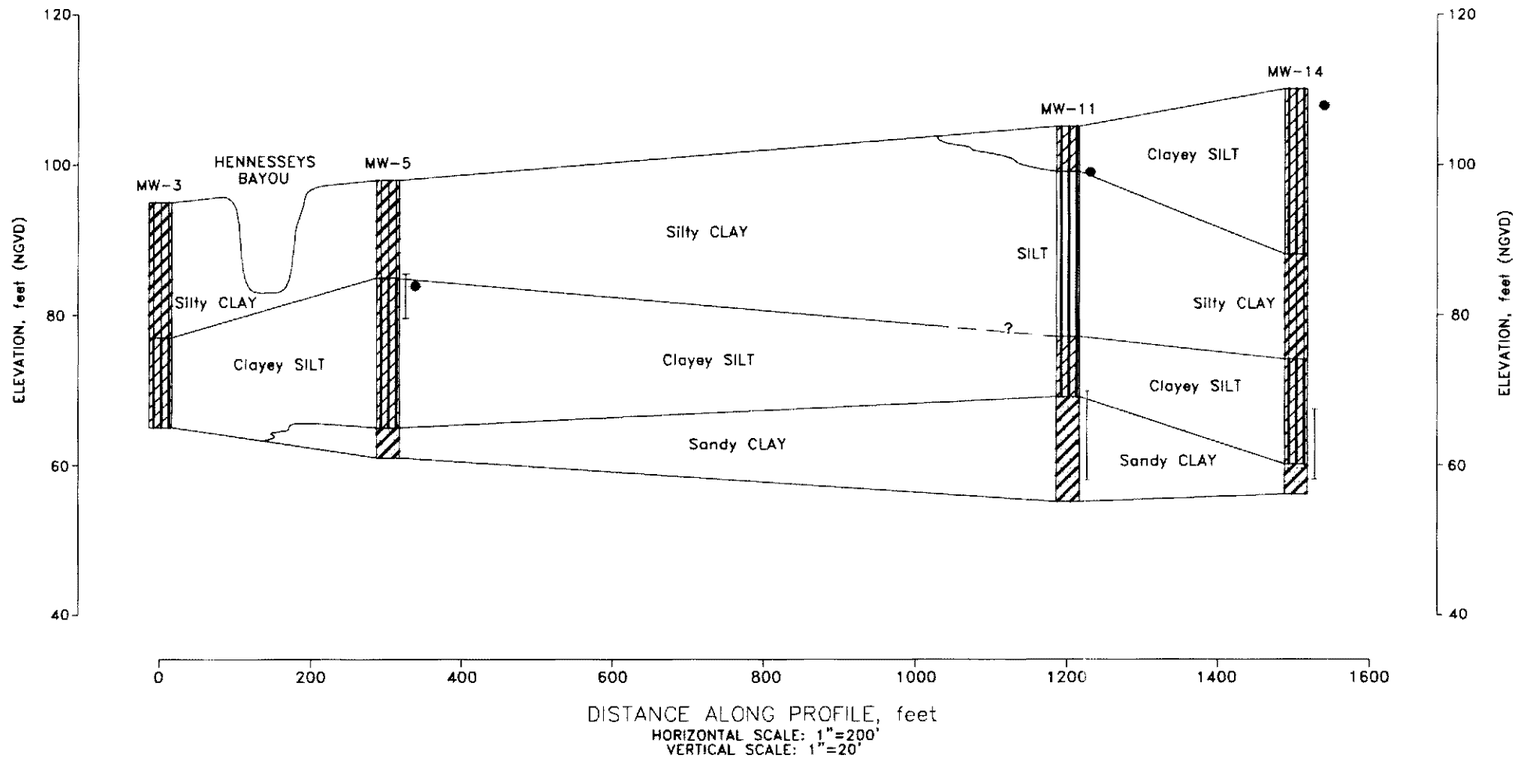
GROUNDWATER ASSESSMENT

CROSS-SECTION C-C'

REVISION: 2
PROJECT: 35096B007C
FIGURE: 3-4

D
SOUTH

D'
NORTH



LEGEND

- CLAY
- Silty CLAY
- SILT
- Sandy CLAY
- Clayey SILT
- PIEZOMETER ELEVATIONS
- EXISTING SCREEN ELEVATION

K:\CEDAR\03013\03013-92B007C12.DWG

REV	DESCRIPTION OF REVISION	BY	DATE
1	ADD WELL SCREEN AND PIEZOMETER ELEVATIONS	PCG	11/3/00

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REFERENCE DRAWINGS

SCALE: AS SHOWN
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/19/01

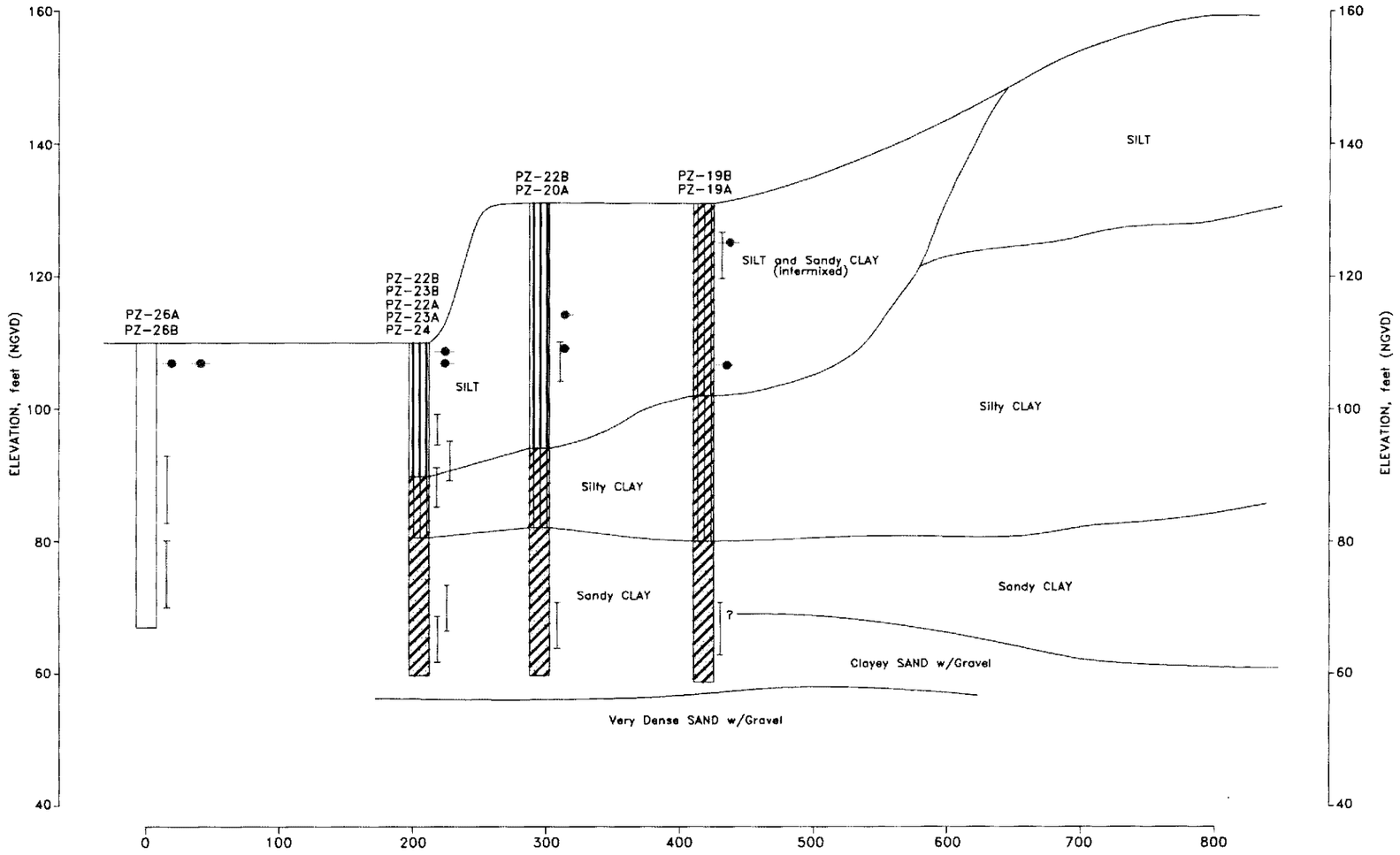
GROUNDWATER ASSESSMENT

CROSSS-SECTION D-D'

REVISION: 1
PROJECT: 35092B007C
FIGURE: 3-5

E
SOUTH

E'
NORTH



DISTANCE ALONG PROFILE, feet
HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=20'

LEGEND

- CLAY
- Silty CLAY
- SILT
- Sandy CLAY
- Clayey SILT
- PIEZOMETER ELEVATIONS
- PIEZOMETER ELEVATIONS
- EXISTING SCREEN ELEVATION
- EXISTING SCREEN ELEVATION
- EXISTING SCREEN ELEVATION

C:\CEDAR\03013\03013-92B007C13.DWG

REV	DESCRIPTION OF REVISION	BY	DATE
4	"AS IS" PER MAY 2001 RFI PHASE II	PCG	7/19/01
3	ADD WELL SCREEN & PIEZOMETER ELEVATIONS	PCG	11/3/00
2	ADD PROPOSED PZ-26	PCG	11/3/00
1			
0			

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REFERENCE DRAWINGS

SCALE: AS SHOWN
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/19/01

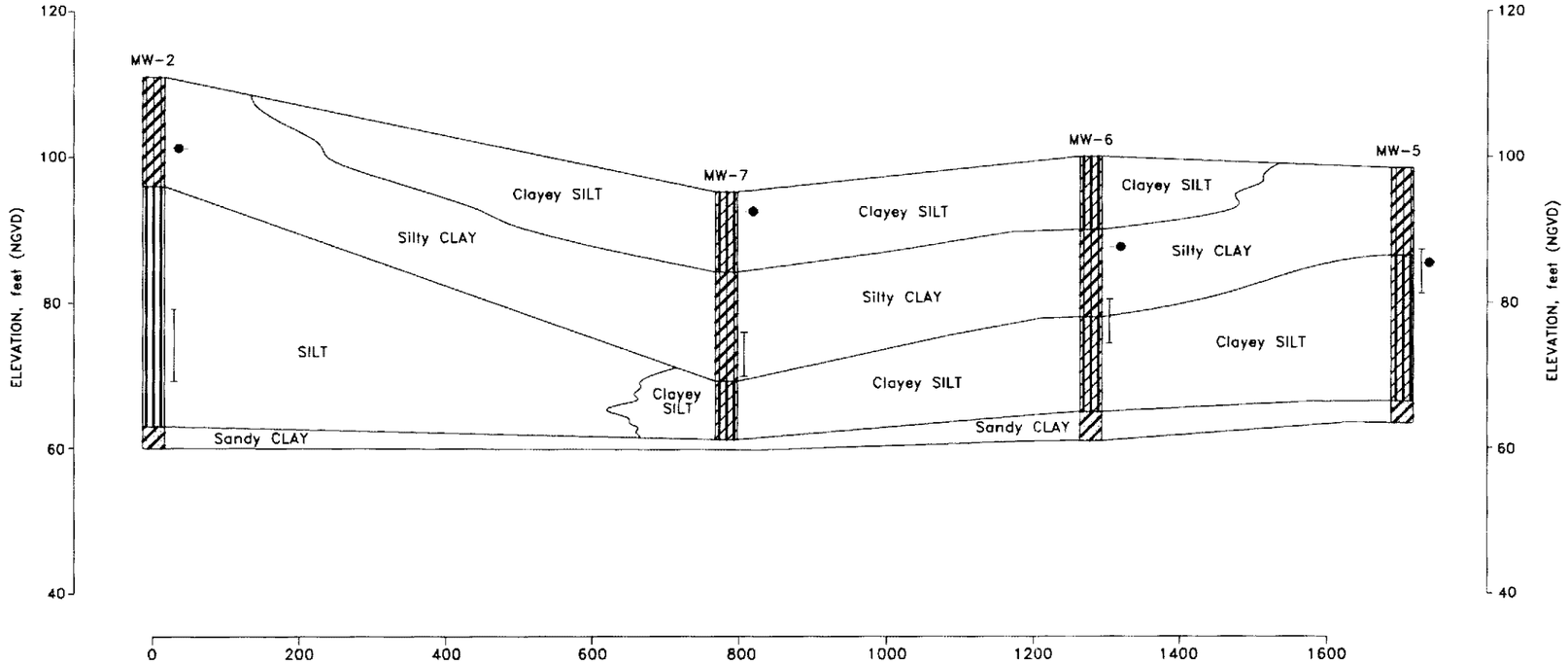
GROUNDWATER ASSESSMENT

CROSS-SECTION E-E'

REVISION: 2
PROJECT: 35092B1007C
FIGURE: 3-6

F
WEST

F'
EAST



LEGEND

- CLAY
- Silty CLAY
- SILT
- Sandy CLAY
- Clayey SILT
- PIEZOMETER ELEVATIONS
- EXISTING SCREEN ELEVATION

K:\CEDAR\03013\03013-92B007C14.DWG

REV	DESCRIPTION OF REVISION	BY	DATE
1	ADD WELL SCREEN AND PIEZOMETER ELEVATIONS	PCG	11/2/00

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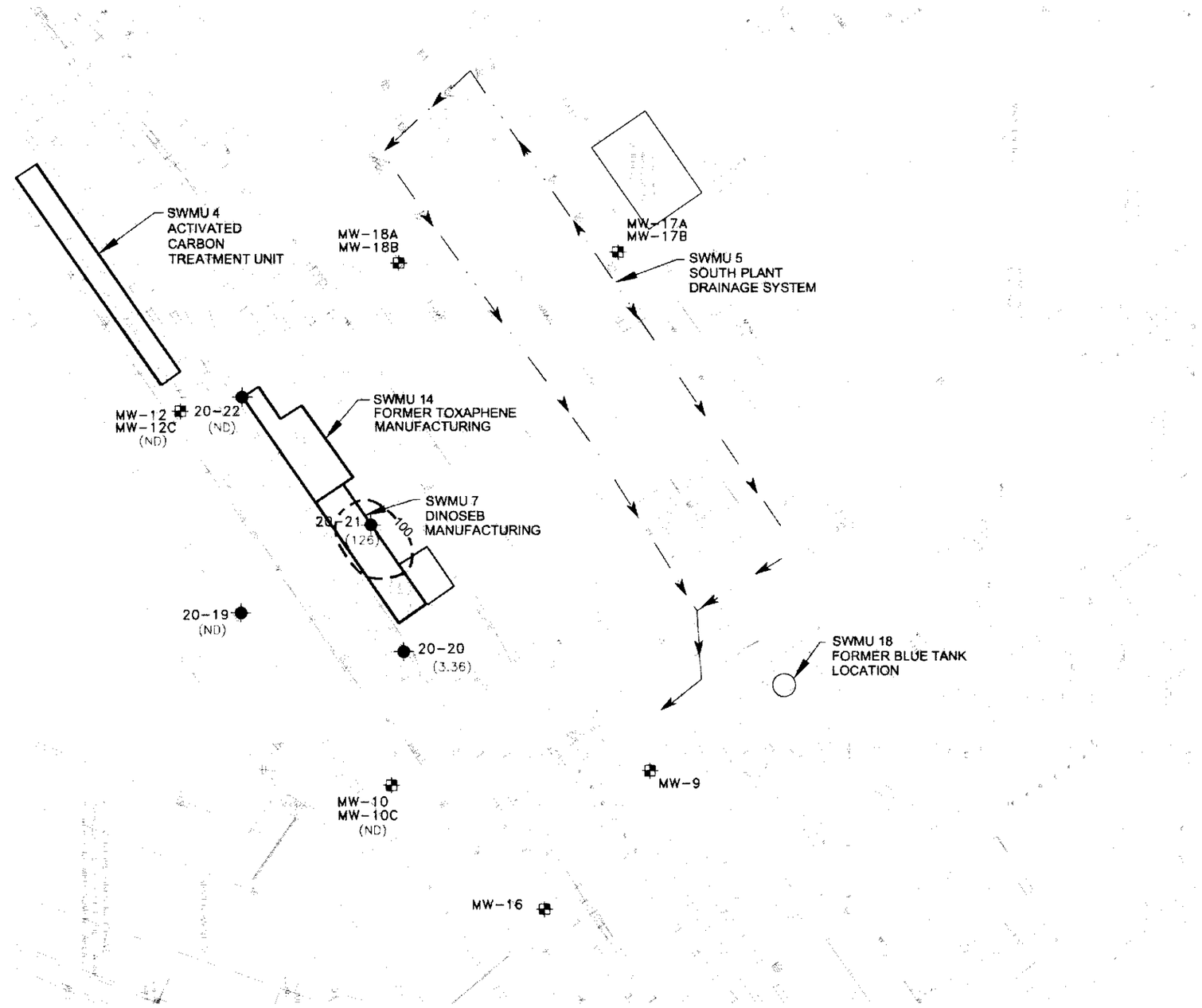
REFERENCE DRAWINGS

SCALE: AS SHOWN
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/19/01

GROUNDWATER ASSESSMENT

CROSS-SECTION F-F'

REVISION: 1
PROJECT: 35092B007C
FIGURE: 3-7



SCALE: 1 INCH=100 FEET

100' 0 100'

LEGEND

BORINGS FOR SOIL SAMPLES AND CHEMICAL ANALYSIS

EXISITNG MONITOR WELLS

PHASE II BORINGS TO GROUNDWATER (3 SOIL SAMPLES & 1 GROUNDWATER SAMPLE PER BORING)

DRAINAGE SYSTEM

( ) CONCENTRATION OF CHLOROMETHANE IN ppg

--100-- CHLOROMETHANE CONCENTRATION IN GROUNDWATER ISOPLETH

K:\CEDAR\0301\3\0301.3-92B007C16.DWG (CHLOROMETHANE)

REV	DESCRIPTION OF REVISION	BY	DATE
1			
2			
3			
4	CONFY RFI PHASE II "AS IS"	PCG	7/18/01
5	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
6	ADD PHASE II BORINGS	PCG	12/8

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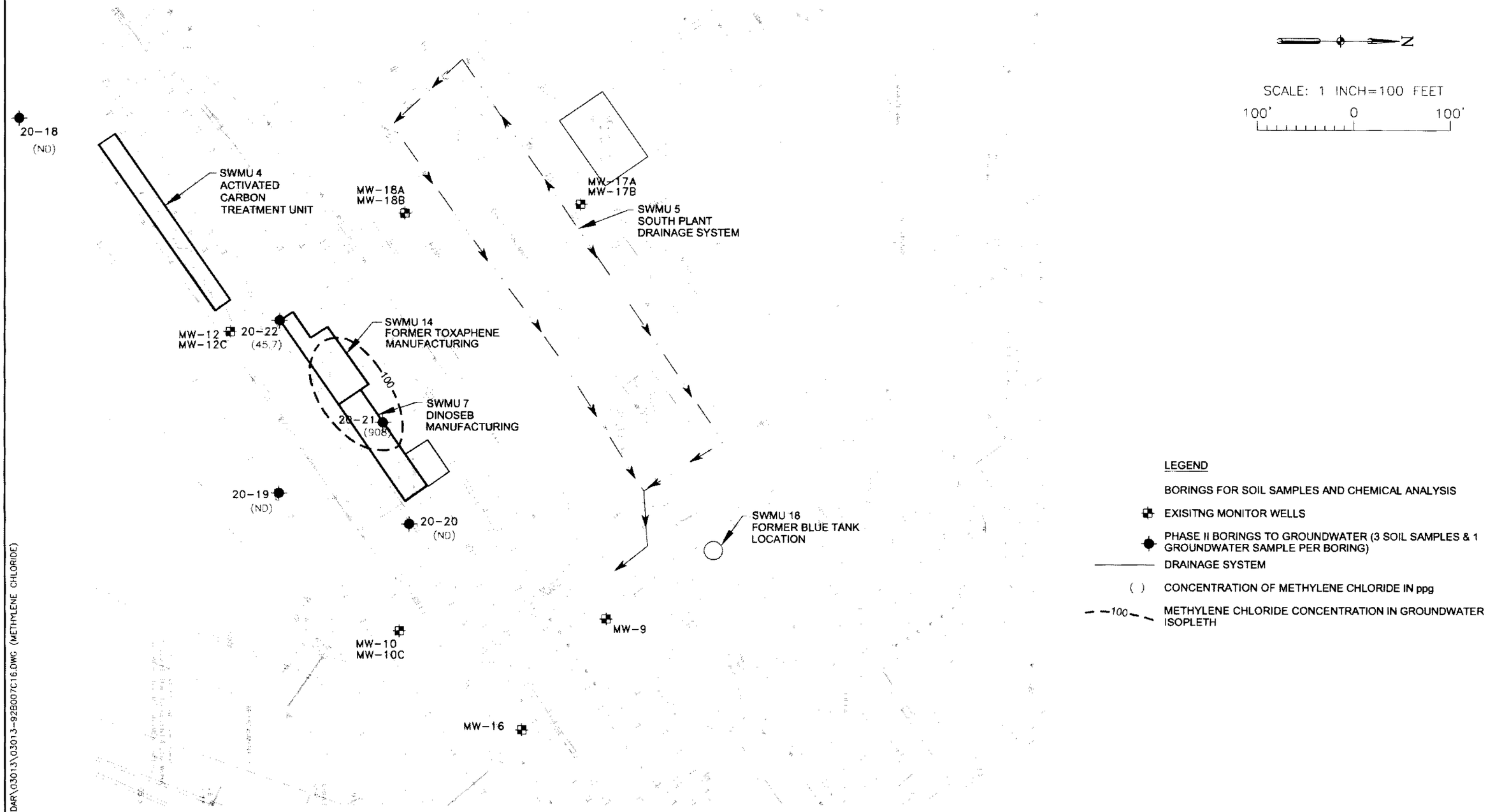
REFERENCE DRAWINGS

SCALE: 1"=100'
DESIGNED:
DRAWN: GAT
CHECKED:
PEER REVIEWED:
DATE: 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE CHLOROMETHANE COMPONENT

REVISION: 3
PROJECT: 35092B007C
FIGURE: 4-4A



K:\CEDAR\03013\03013-92B007C16.DWG (METHYLENE CHLORIDE)

REV	DESCRIPTION OF REVISION	BY	DATE
3	MODIFY RFI PHASE II "AS IS"	PCG	7/18/01
2	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
1	ADD PHASE II BORINGS	PCG	12/8

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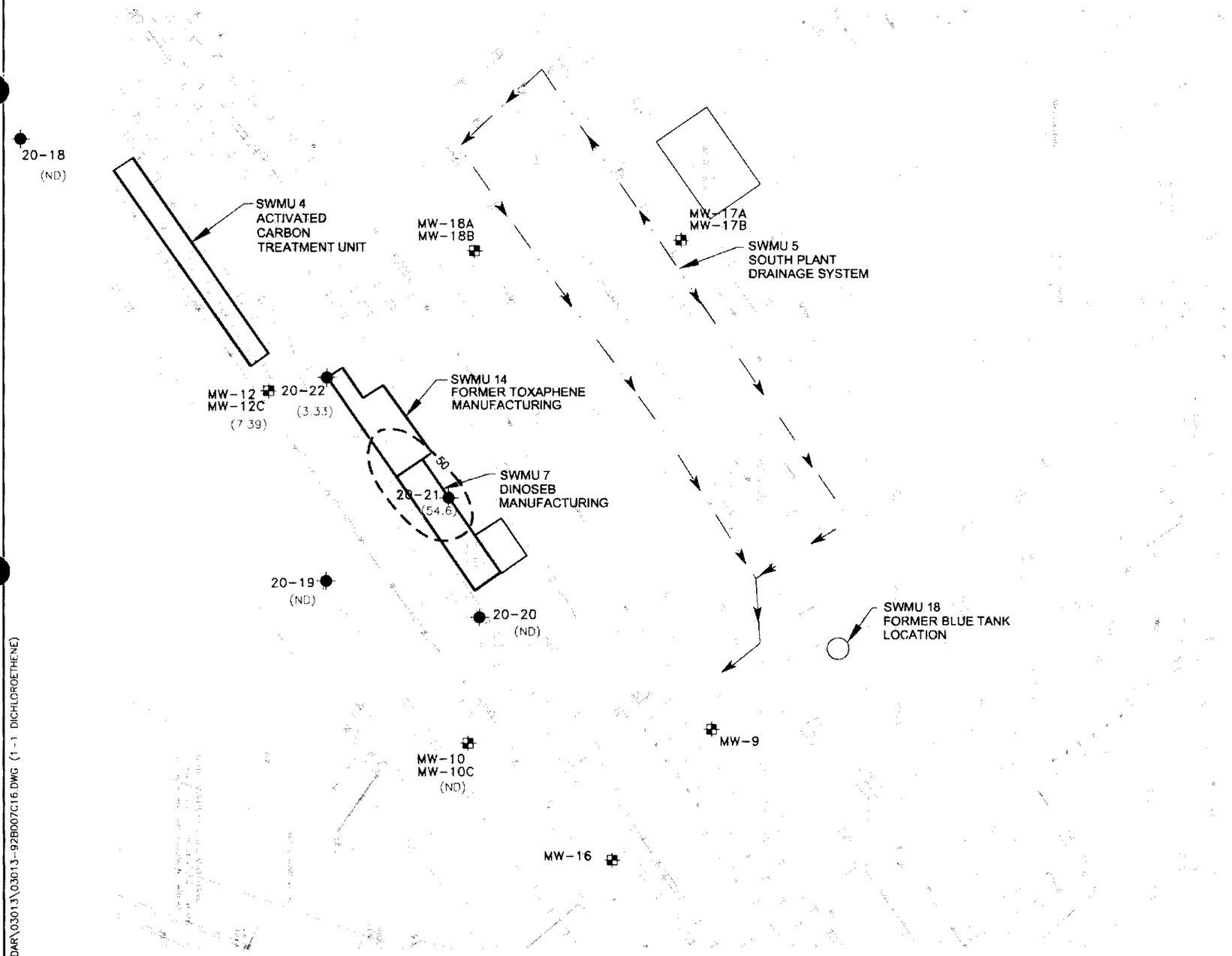
REFERENCE DRAWINGS

SCALE 1"=100'
DESIGNED
DRAWN CAT
CHECKED
PEER REVIEWED
DATE 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE METHYLENE CHLORIDE COMPONENT

REVISION 3
PROJECT 35092B007C
FIGURE 4-4B



N

SCALE: 1 INCH=100 FEET

100' 0 100'

LEGEND

BORINGS FOR SOIL SAMPLES AND CHEMICAL ANALYSIS

EXISITNG MONITOR WELLS

PHASE II BORINGS TO GROUNDWATER (3 SOIL SAMPLES & 1 GROUNDWATER SAMPLE PER BORING)

DRAINAGE SYSTEM

( ) CONCENTRATION OF 1,1-DICHLOROETHENE IN ppg

50 1,1-DICHLOROETHENE CONCENTRATION IN GROUNDWATER ISOPLETH

K:\CEDAR\03013\03013-92B007C16.DWG (1-1 DICHLOROETHENE)

REV	DESCRIPTION OF REVISION	BY	DATE
3	MODIFY RFI PHASE II "AS IS"	PCG	7/18/01
2	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
1	ADD PHASE II BORINGS	PCG	12/6

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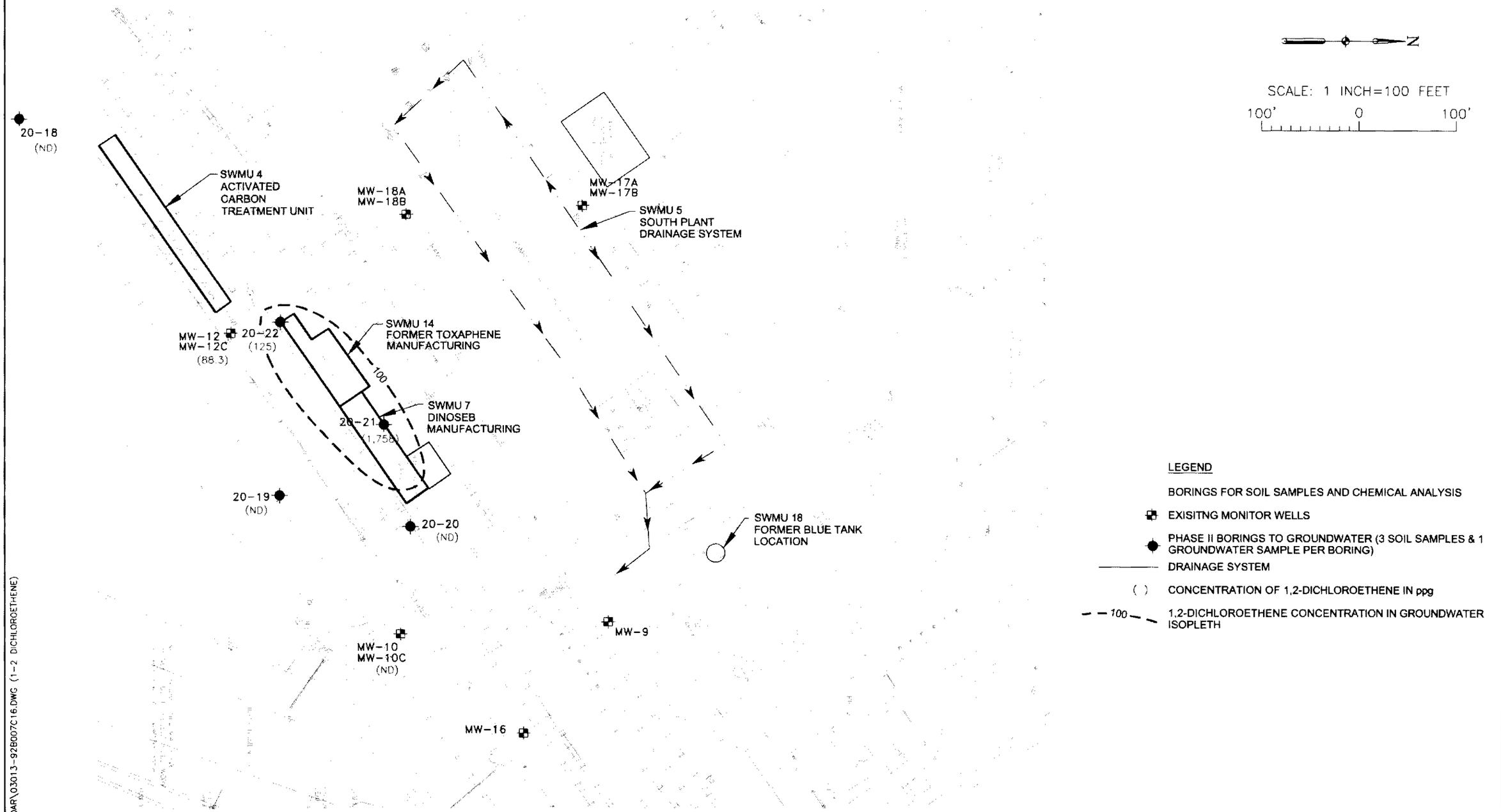
REFERENCE DRAWINGS

SCALE 1"=100'
DESIGNED
DRAWN GAT
CHECKED
PEER REVIEWED
DATE 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE 1,1-DICHLOROETHENE COMPONENT

REVISION 3
PROJECT 35092B007C
FIGURE 4-4C



K:\CEDAR\03013-92B007C16.DWG (1-2 DICHLOROETHENE)

REV	DESCRIPTION OF REVISION	BY	DATE
4			
3			
2			
1	MODIFY RFI PHASE II "AS IS"	PCG	7/18/01
0	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
	ADD PHASE II BORINGS	PCG	12/6

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Baton Rouge, Louisiana 70816
225/751-1873

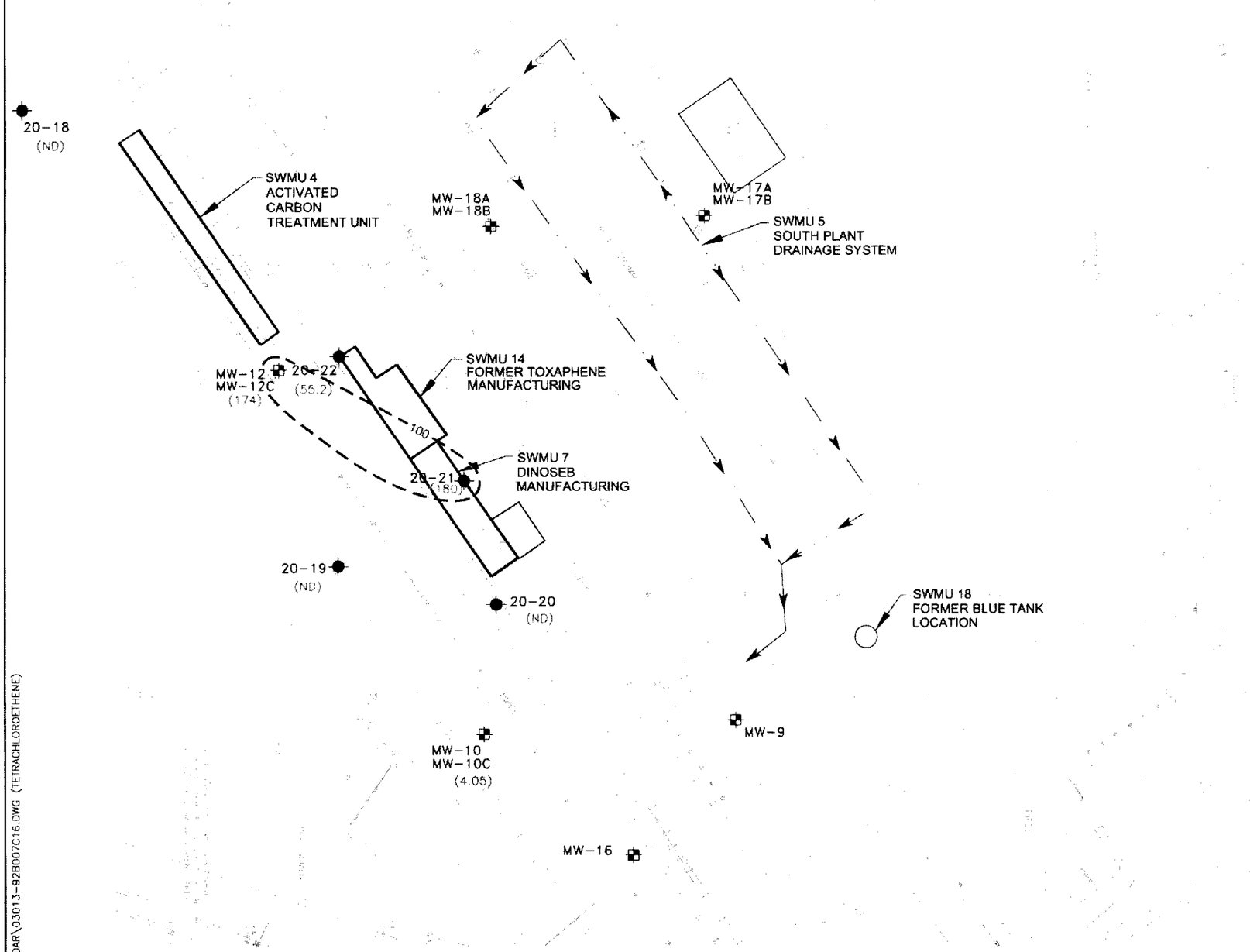
REFERENCE DRAWINGS

SCALE: 1"=100'
DESIGNED
DRAWN: GAT
CHECKED
PEER REVIEWED
DATE: 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE 1,2-DICHLOROETHENE COMPONENT

REVISION: 3
PROJECT: 35092B007C
FIGURE: 4-4D



N

SCALE: 1 INCH=100 FEET

100' 0 100'

LEGEND

BORINGS FOR SOIL SAMPLES AND CHEMICAL ANALYSIS

EXISITNG MONITOR WELLS

PHASE II BORINGS TO GROUNDWATER (3 SOIL SAMPLES & 1 GROUNDWATER SAMPLE PER BORING)

DRAINAGE SYSTEM

( ) CONCENTRATION OF TETRACHLOROETHENE IN ppb

--100-- TETRACHLOROETHENE CONCENTRATION IN GROUNDWATER ISOPLETH

K:\CEDAR\03013-92B007C16.DWG (TETRACHLOROETHENE)

REV	DESCRIPTION OF REVISION	BY	DATE
3	MODIFY RFI PHASE II "AS IS"	PCG	7/18/01
2	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
1	ADD PHASE II BORINGS	PCG	12/6
△			
△			
△			

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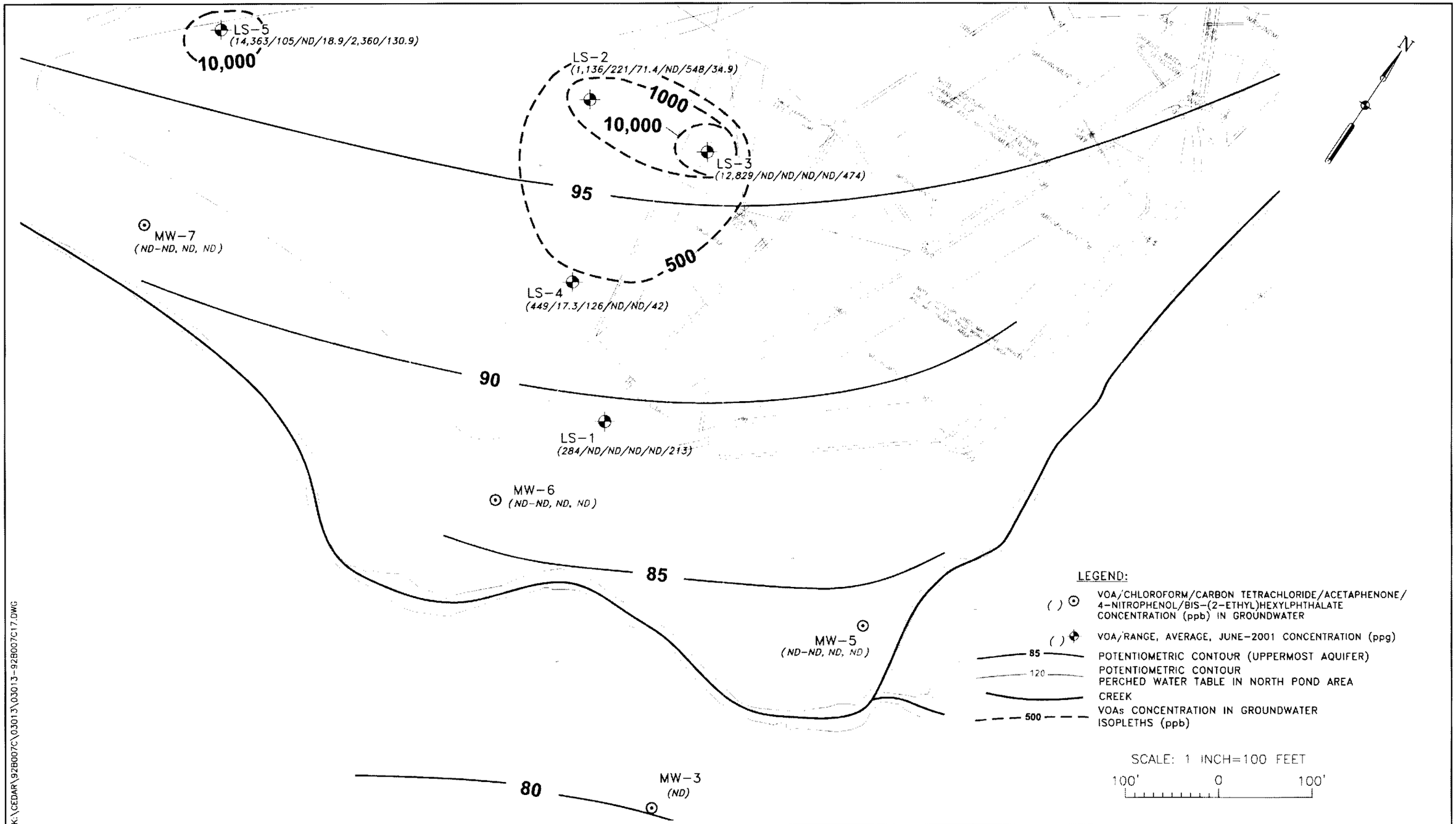
REFERENCE DRAWINGS

SCALE: 1"=100'
DESIGNED:
DRAWN: GAT
CHECKED:
PEER REVIEWED:
DATE: 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE TETRACHLOROETHENE COMPONENT

REVISION: 3
PROJECT: 35092B007C
FIGURE: 4-4J



K:\CEDAR\92B007C\03013\03013-92B007C17.DWG

REV	DESCRIPTION OF REVISION	BY	DATE
△			
△			
△			
△			
△			

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REFERENCE DRAWINGS

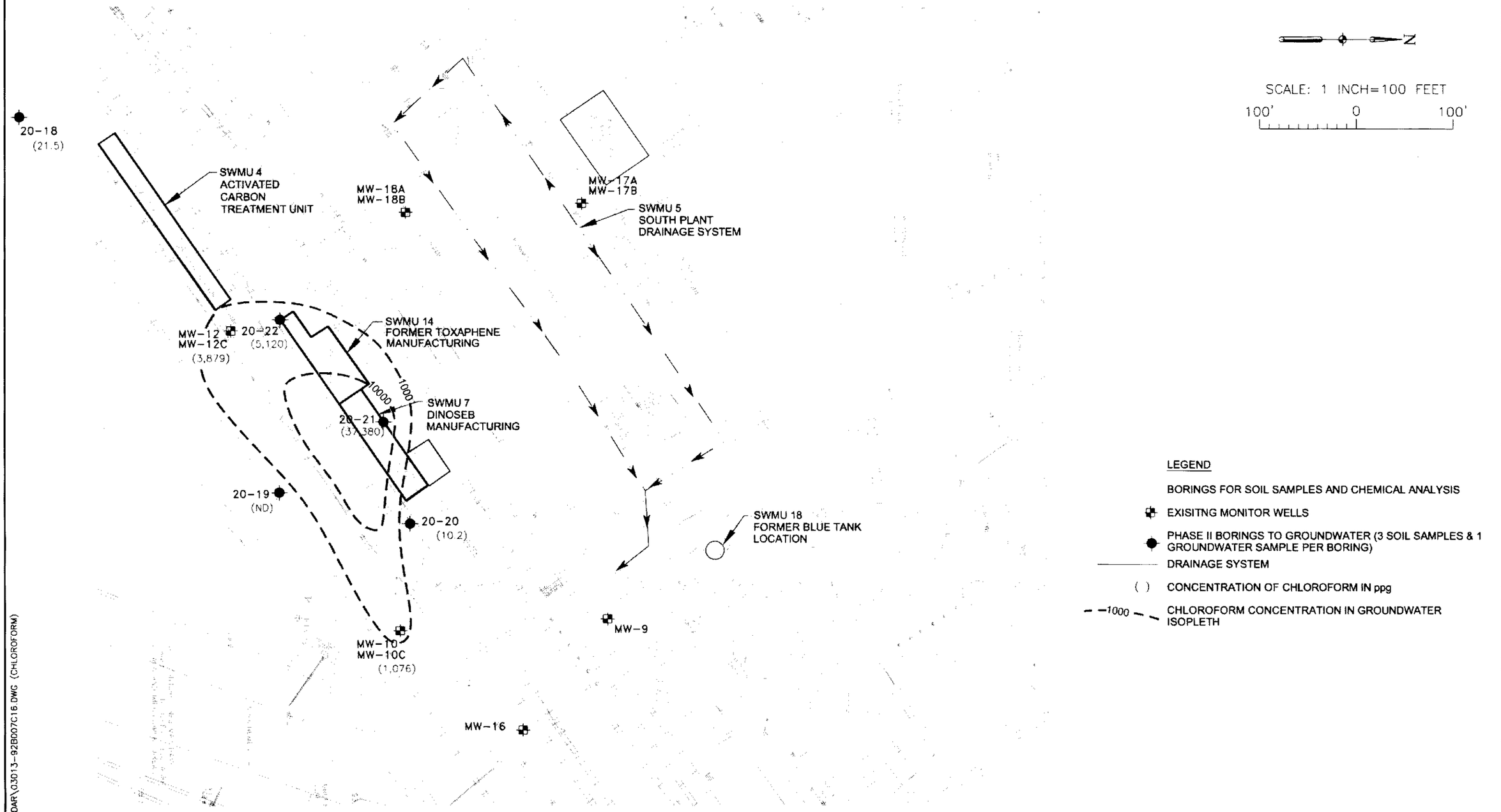
SCALE: 1" = 100'
DESIGNED:
DRAWN: GAT
CHECKED: RDK
PEER REVIEWED:
DATE: 9/12/01

GROUNDWATER ASSESSMENT

COMPONENTS OF VOA CONTAMINATION
AT SWMU 2

REVISION: △
PROJECT: 35092B007C

4-4K



K:\CEDAR\03013-92B007C16.DWG (CHLOROFORM)

REV	DESCRIPTION OF REVISION	BY	DATE
3	MODIFY RFI PHASE II "AS IS"	PCG	7/18/01
2	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
1	ADD PHASE II BORINGS	PCG	12/8

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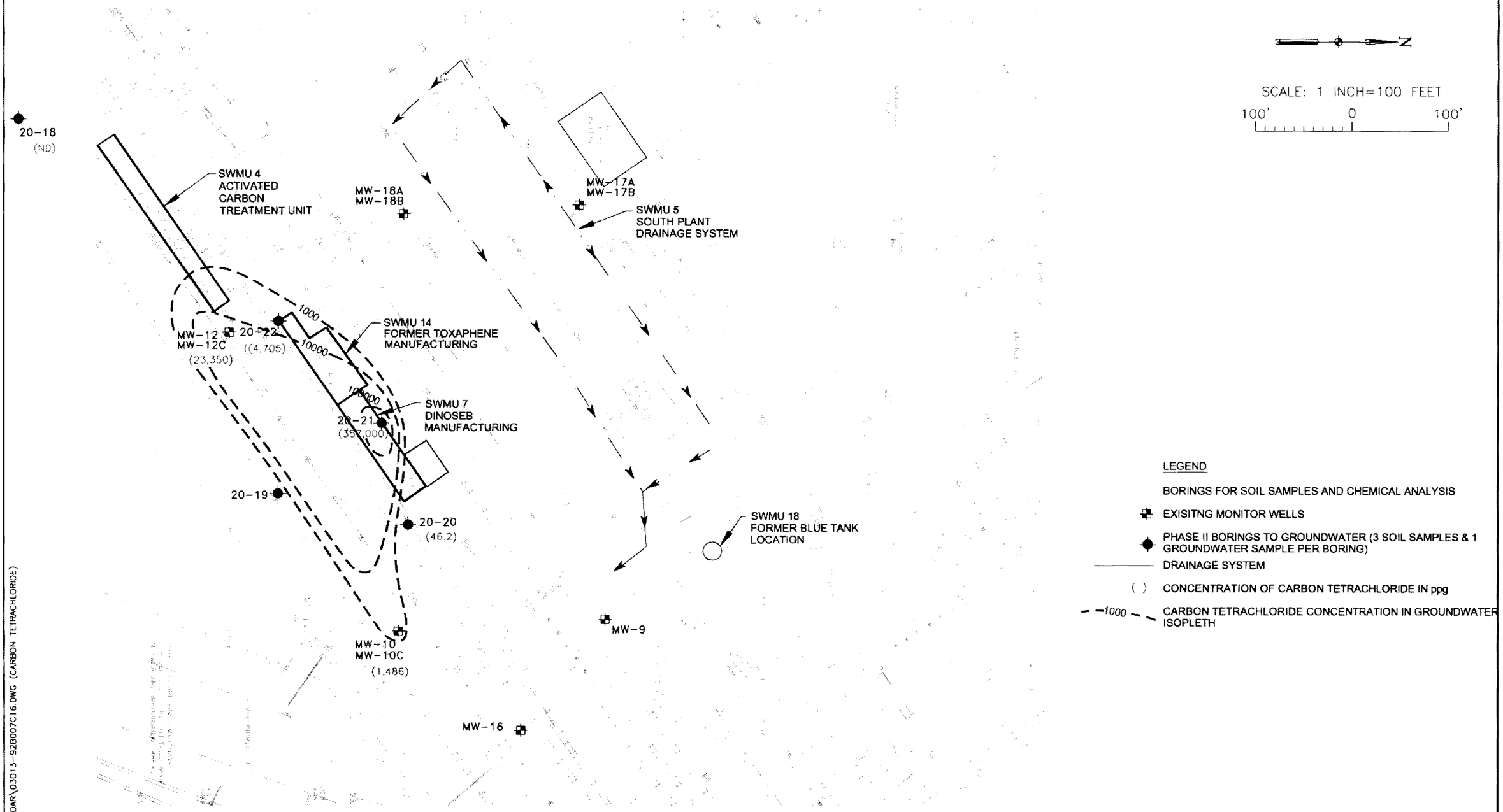
REFERENCE DRAWINGS

SCALE 1"=100'
DESIGNED
DRAWN GAT
CHECKED
PEER REVIEWED
DATE 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE CHLOROFORM COMPONENT

REVISION 3
PROJECT 35092B007C
FIGURE 4-4E



K:\CEDAR\03013-92B007C16.DWG (CARBON TETRACHLORIDE)

REV	DESCRIPTION OF REVISION	BY	DATE
3	MODIFY RFI PHASE II "AS IS"	PCC	7/18/01
2	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCC	1/18/01
1	ADD PHASE II BORINGS	PCC	12/8

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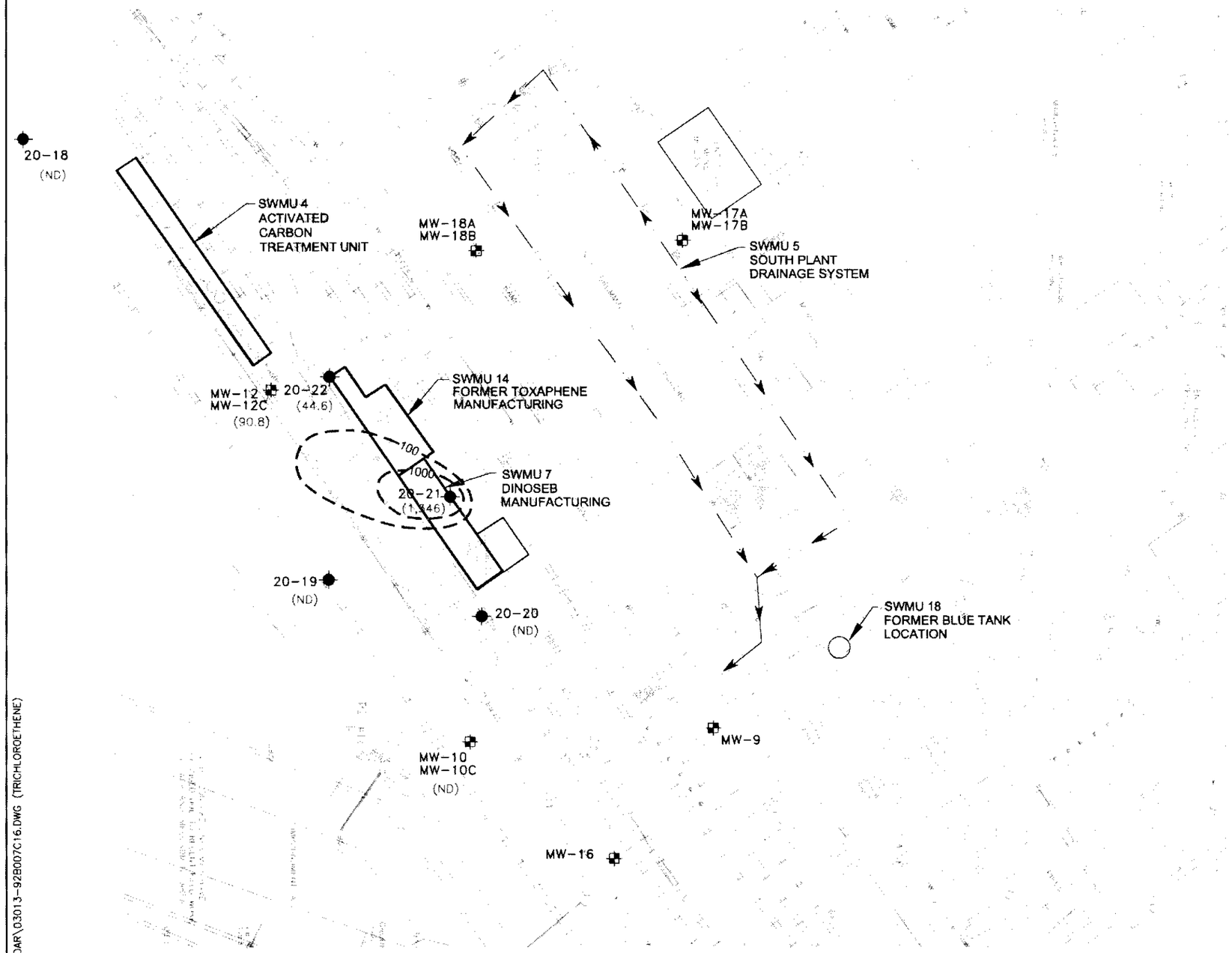
REFERENCE DRAWINGS

SCALE: 1"=100'
DESIGNED:
DRAWN: GAT
CHECKED:
PEER REVIEWED:
DATE: 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE CARBON TETRACHLORIDE COMPONENT

REVISION: 3
PROJECT: 35092B007C
FIGURE: 4-4F



K:\CEDAR\03013-92B007C16.DWG (TRICHLOROETHENE)

REV	DESCRIPTION OF REVISION	BY	DATE
3	MODIFY RFI PHASE II "AS IS"	PCG	7/18/01
2	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
1	ADD PHASE II BORINGS	PCG	12/8
△			
△			
△			

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225/751-1873

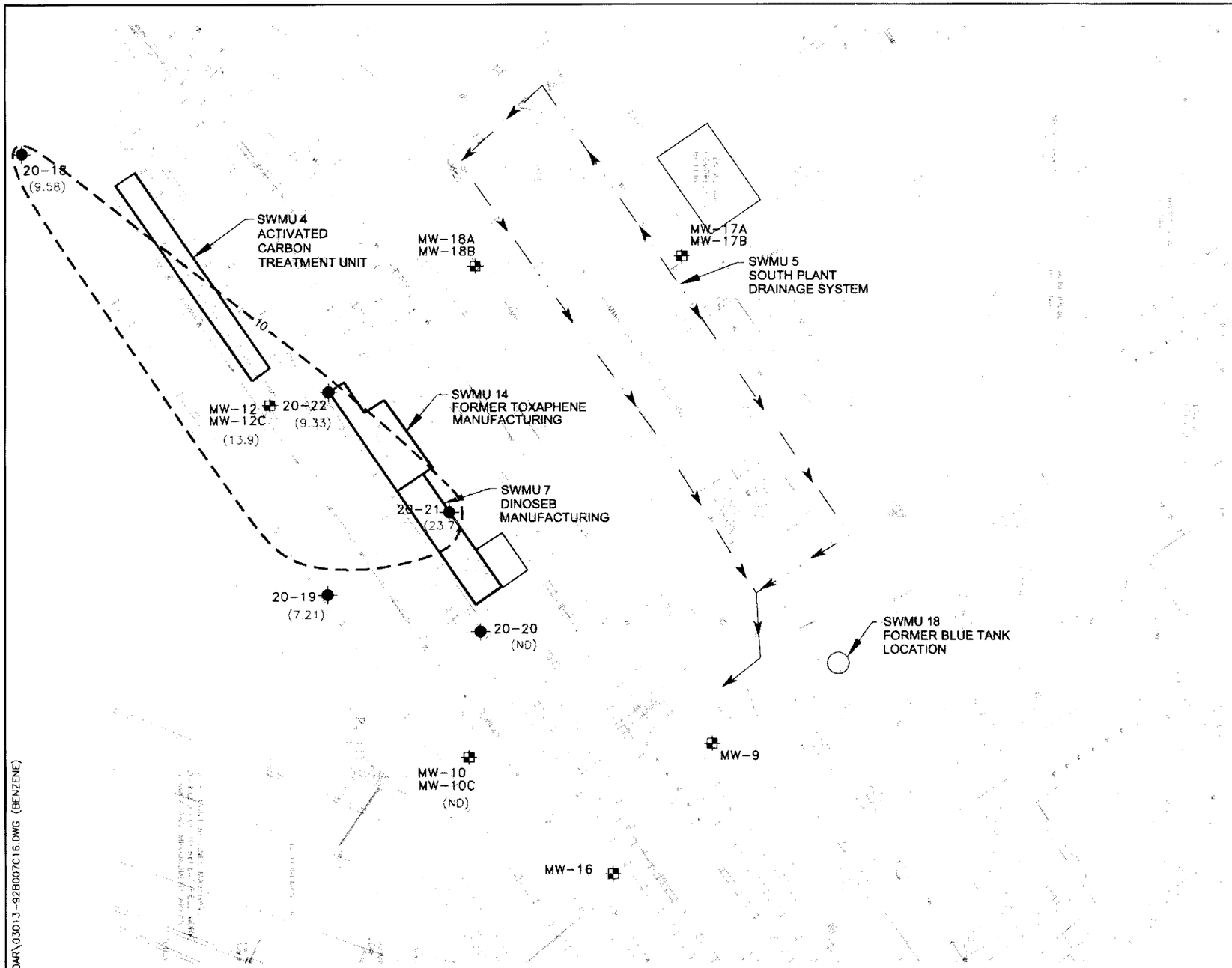
REFERENCE DRAWINGS

SCALE: 1"=100'
DESIGNED:
DRAWN: GAT
CHECKED:
PEER REVIEWED:
DATE: 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE TRICHLOROETHENE COMPONENT

REVISION: 3
PROJECT: 35092B007C
FIGURE: 4-4G



N

SCALE: 1 INCH=100 FEET

100' 0 100'

LEGEND

BORINGS FOR SOIL SAMPLES AND CHEMICAL ANALYSIS

EXISITNG MONITOR WELLS

PHASE II BORINGS TO GROUNDWATER (3 SOIL SAMPLES & 1 GROUNDWATER SAMPLE PER BORING)

DRAINAGE SYSTEM

( ) CONCENTRATION OF BENZENE IN ppg

10 BENZENE CONCENTRATION IN GROUNDWATER ISOPLETH

K:\CEDAR\03013-92B007C16.DWG (BENZENE)

REV	DESCRIPTION OF REVISION	BY	DATE
1	MODIFY RFI PHASE II "AS IS"	PCG	7/18/01
2	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
3	ADD PHASE II BORINGS	PCG	12/8

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URS
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

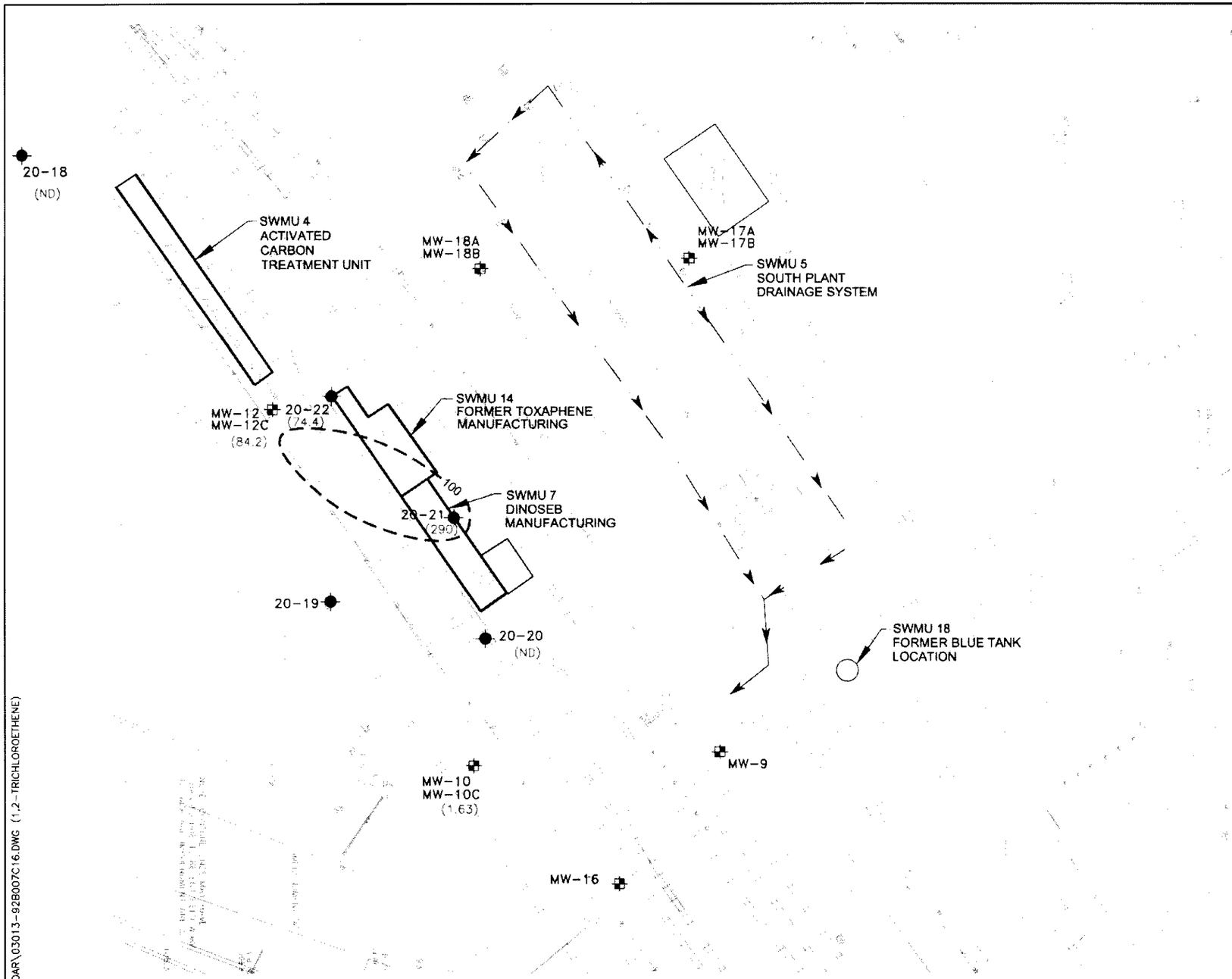
REFERENCE DRAWINGS

SCALE 1"=100'
DESIGNED
DRAWN GAT
CHECKED
PEER REVIEWED
DATE 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE BENZENE COMPONENT

REVISION 3
PROJECT 35092B007C
FIGURE 4-4H



K:\CEDAR\03013-92B007C16.DWG (1,2-TRICHLOROETHENE)

REV	DESCRIPTION OF REVISION	BY	DATE
3	MODIFY RFI PHASE II "AS IS"	PCG	7/18/01
2	MODIFY PER REVISED TOXAPHENE DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
1	ADD PHASE II BORINGS	PCG	12/8

VICKSBURG CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI

URS
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

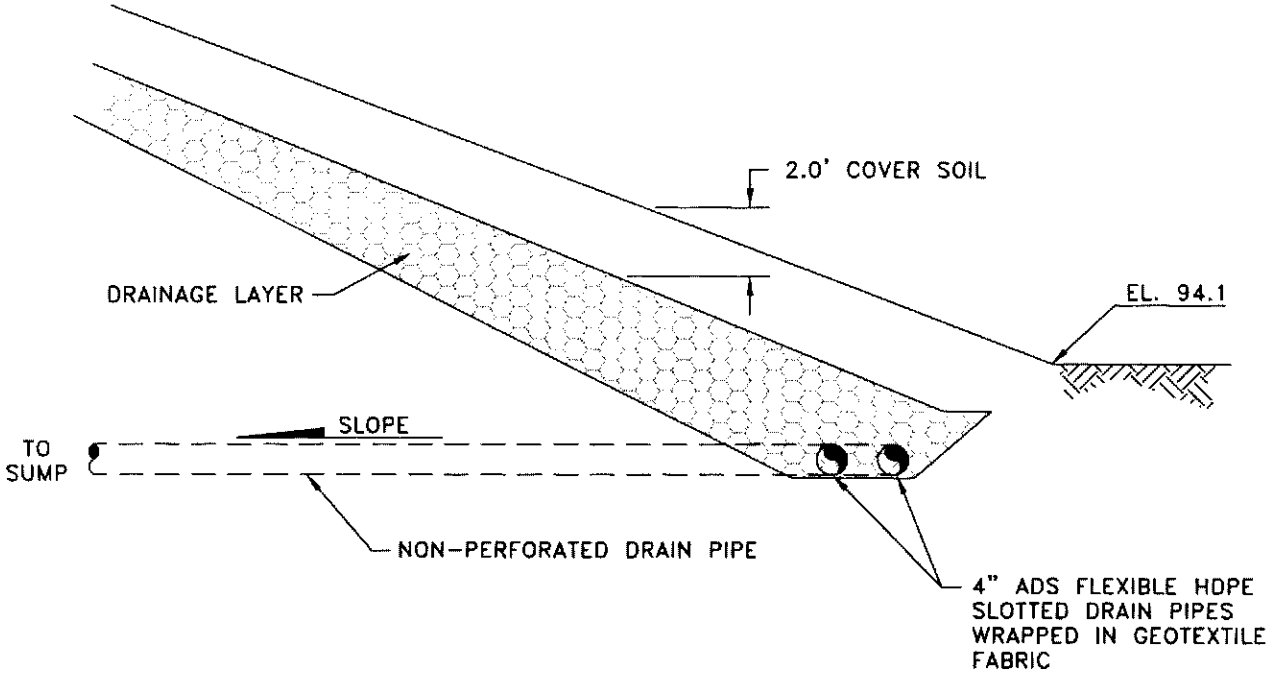
REFERENCE DRAWINGS

SCALE 1"=100'
DESIGNED
DRAWN GAT
CHECKED
PEER REVIEWED
DATE 9/11/01

GROUNDWATER ASSESSMENT

ADDITIONAL DETAIL ON VOAs AT
SWMU 20, THE 1,1,2-TRICHLOROETHANE COMPONENT

REVISION 3
PROJECT 35092B007C
FIGURE 4-4I



K:\CEDAR\03013\03013-FIG4-7.DWG

VICKSBURG CHEMICAL CORPORATION VICKSBURG, MISSISSIPPI	URS 2822 O'Neal Lane Baton Rouge, Louisiana 70816 225/751-1873	GROUNDWATER ASSESSMENT	PROJ. NO. 35097B007C.00
	SCALE: N.T.S. / DRAWN BY: GAT / DATE: 8/21/01 / CHKD. BY: RDK / DATE: 8/21/01	BLANKET DRAIN AND SOIL CONSTRUCTED TO SUPPORT SURFACE IMPOUNDMENT LINING	FIG. NO. 4.7

APPENDIX A

RELEVANT INFORMATION ON WELLS LOCATED IN 1-MILE RADIUS AREA (FROM APPENDIX F PRELIMINARY REPORT)

EXPOSURE INFORMATION REPORT
VERTAC CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI
OCTOBER, 1985

4.0 GROUNDWATER PATHWAY

4.1 GROUNDWATER BACKGROUND INFORMATION

Information on subsurface conditions at Vertac Chemical is presented in Sections E-1, E-2, and E-3 of the RCRA Part B Permit Application. Data collected by the ongoing groundwater monitoring program indicates the presence of groundwater contamination at one of the twelve monitoring wells. Work is continuing to further characterize the aquifer which underlies the facility and to determine the source of the contamination.

4.1.1 Regional Groundwater Data

A list of water wells, based upon USGS data, within a three mile radius of the facility is shown on Table 1. A map locating these water wells is included as Figure 1. This table and associated map may not indicate a complete tabulation of all water wells within the three miles radius of the plant. Shallower, smaller diameter water wells are not typically included in the USGS inventory, nor does the State of Mississippi maintain records on such wells.

Based on this inventory the following information was compiled:

- Five wells are located within a three mile radius of the approximate center of the facility.
- All of the abovementioned wells are generally east of the facility.
- The nearest well is located approximately one mile to the east-southeast; this well is listed as No. 82.
- There are no wells within three miles to the south, west, or north.
- The Mississippi River is approximately one mile to the northwest.

4.1.2 Regional Precipitation Data

The average annual precipitation in the Vicksburg, Mississippi area is 59 inches. The average annual gross lake surface evaporation rate for the region is 44 inches. Therefore, the net annual precipitation (rainfall minus evaporation) is approximately +15 inches.

TABLE 1

WATER WELLS WITHIN A THREE MILE RADIUS OF FACILITY

OWNER	WELL NUMBER
USCE	72
USCE WGC 2	73
Jack B. Smith	78
George Lee	82
USCE WES	83

SMR/Vertac-T1

TABLE 5

BACKGROUND GROUNDWATER QUALITY

Parameter	Vertac MW-4(1)	Recommended Limit	Source of Recommendation
pH	6.7	5-9	EPA, 1976
TDS(2)	632 mg/l	500 mg/l	NTAC, 1968
Hardness	600 mg/l	100 mg/l (as $CaCO_3$)	McKee & Wolf, 1978
Alkalinity	300 mg/l	400 mg/l (as $CaCO_3$)	NAS, 1974
Sodium	17 mg/l	115 mg/l	McKee & Wolf, 1978
Chloride	23 mg/l	250 mg/l	EPA, 1976
Sulfates	48 mg/l	250 mg/l	EPA, 1976
Nitrate	<1 mg/l	10 mg/l (as N)	EPA, 1976
Iron	0.3-0.7 mg/l	0.3 mg/l	EPA, 1976
Manganese	0.2-1.4 mg/l	0.05 mg/l	EPA, 1976

(1) Upgradient well; sampled on December 17, 1985.
(2) Total dissolved solids.

Sources:

National Technical Advisory Committee to the Secretary of the Interior, 1968, Water Quality Criteria, U.S. Government Printing Office, Washington, D.C.

U.S. Environmental Protection Agency, 1976, Quality Criteria for Water, U.S. Government Printing Office, Washington, D.C.

McKee & Wolf, Water Quality Criteria, Second Edition, 1978, California State Water Resources Control Board (originally published in 1963, data is used by reference).

National Academy of Sciences, National Academy of Engineering, 1974, Water Quality Criteria, 1972, U.S. Government Printing Office, Washington, D.C.

GMC/Vertac-T5

URS

APPENDIX D

MONITOR WELL CONSTRUCTION DETAILS AND SOIL BORING LOGS

MW-1A, MW-2, MW-4, MW-5, MW-7, MW-8, MW-9, MW-10,

MW-11, MW-12, MW-13, MW-14, MW-16, PZ-19B, PZ-19A,

PZ-12(R)B, PZ-12(R)A, PZ-20B, PZ-20A, PZ-21A, PZ-22B, PZ-22A,

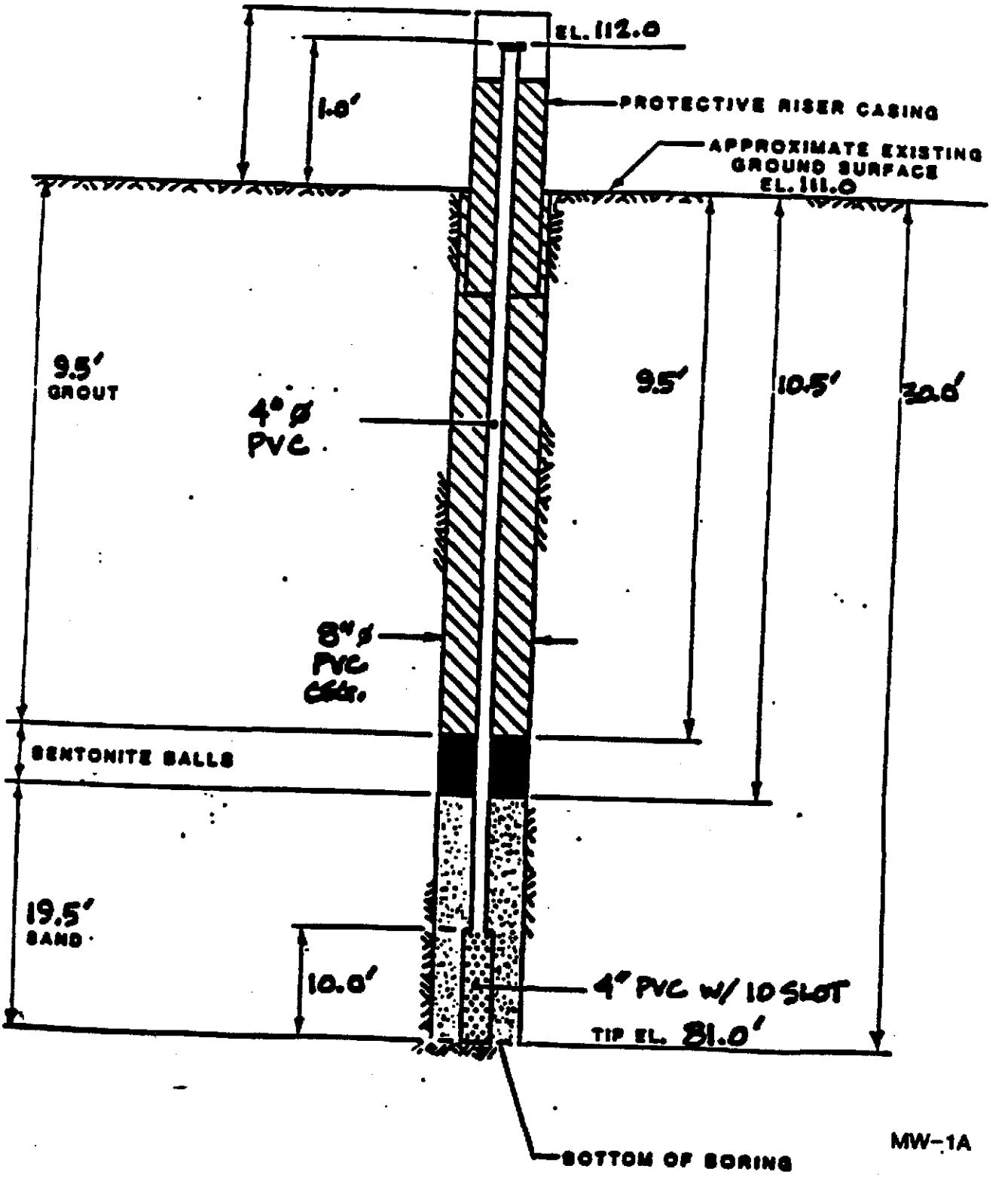
PZ-23B, PZ-23A, PZ-24B, PZ-24A, PZ-25B, MW-1C, MW-10C,

MW-12C, MW-17B, MW-17A, MW-18B, MW-18A, MW-26B, MW-26A

MONITOR WELL INSTALLATION SKETCH

PROJECT NAME Cedar
PROJECT NO. 485130
BORING NO. B-1A
MONITOR WELL NO. MW-1A

INSTALLED BY W-L DATE 7-25-84
CHECKED BY JJC DATE 7-25-84



MW-1A

IT CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 435130	PROJECT NAME: Cedar Chemical-Vicksburg		
BORING NUMBER: B-1A/MW-1A	COORDINATES:	DATE: 7/24/86	
ELEVATION: Approx. 111 ft. MSL	GWL: Depth 9 ft Date/Time 1300/7-24	DATE STARTED: 7/24/86	
ENGINEER/GEOLOGIST: J. B. Cange	Depth Date/Time	DATE COMPLETED: 7/24/86	
DRILLING METHODS: Dry Auger to 11 ft.; Wash Bore to 30 ft.		PAGE 1 OF 2	

DEPTH (ft)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (ft)	RECOVERY (ft)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	ST			Very Stiff Brown CLAYEY SILT with SILTY CLAY. Fe Staining, Roots; Very Dry; Silt Laminae;			Moderate to Strong Effervescence
2	ST						
3	ST			Stiff Brown and Tan CLAYEY SILT Mottled, Black Specks, Fe Staining; Oxide Coatings on Bedding Planes; Massive Texture, Softer at 5 ft.			Strong Effervescence
4	ST						
5							
6	ST			Soft Brown and Gray Silt, Becoming Hard Lower 6" with Black/Tan Inclusions, Calc. Concretions Mottled Texture Throughout			Moderate Effervesc... Except Gray Areas- No Effervescence
7							
8	ST			Soft Brown and Gray Silt, CLAYEY SILT; Mottled with Lower 6" Dark Brown Firm Silt; Becoming Stiffer Downward Swirling Texture			Same with Dark Brown Area with No Effervescence
9							
10	ST			Soft to Medium Stiff Brown CLAYEY SILT with Rootlets, Plant Matter, Gray Swirls in Dark Brown Areas; Massive Texture			Moderate Effervescence
11	ST			Soft To Stiff Brown CLAYEY SILT, Black Specks (Organic Matter)			No Effervescence
12							
13	ST			Same, with Mottled Zone in Center Having Tan, Black Color; Becoming Softer, Very Silty Below; Mottled Zone Plastic			No Effervescence
14							
	ST			Same; Incr. in Silt Content Less Plastic; Incr. Tan Mottles			No Effervenscence

NOTES:

Started drilling @ 11:30 am 7/24/86.
Encountered obstruction @ 1 ft.; Skidded rig 3 ft. to NE
Reamed hole to 10" down to 9 ft.; Set surface csg to 9.5 (pushed last 6") with 1 ft. stickup; Grouted in place
Resumed drilling 7/25/86

MW-1A

IT CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 435130	PROJECT NAME: Cedar Chemical-Vicksburg		
BORING NUMBER: B-1A/MW-1A	COORDINATES:	DATE: 7/24/86	
ELEVATION: Approx. 111 ft. MSL	GWL: Depth / Date/Time	DATE STARTED: 7/24/86	
ENGINEER/GEOLOGIST: J. B. Cange	Depth / Date/Time	DATE COMPLETED: 7/24/86	
DRILLING METHODS: Dry Auger to 11 ft.; Wash Bore to 30 ft.		PAGE 2 OF 2	

DEPTH (ft)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (ft)	RECOVERY (ft)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	ST			With Black Specks Throughout			No Effervescence
16				Same: Mottling Heavier with Increase in Root Traces and Organic Matter (Black Specks)			No Effervescence Fe Staining?
17	ST						
18				Same (Brown CLAYEY SILT) with Lower 1 ft. Being Tan Mottled Silt			No Effervescence
19	ST						
20				Same; Coarser at Top and Bottom, Pobably Due to Increase in Silt Content			
21	ST						No Effervescence
22				Brown CLAYEY SILT with Increase Mottling; Gray and Tan Mixed with Brown; Abundant Root Traces and Organic Material (Black)			No Effervescence
23	ST						
24				Brown, Tan and Gray CLAYEY SILT, Extensively Mottled, with Fe-Staining, Root Traces, Oxidation Layers			No Effervescence
25	ST						
26				Firm Gray and Tan Silt (Mostly Gray) with Abundant Gastropad Shell Fragments (Unbroken); Very Massive; Root Traces with Black and Iron Concentric Staining			Moderate Effervescence
27							
28							
29							

NOTES

Boring Terminated at 30 feet.

...ation of Well # 2

EP NO. 872

Project Vertac Chemical Corporation

Vicksburg, Mississippi

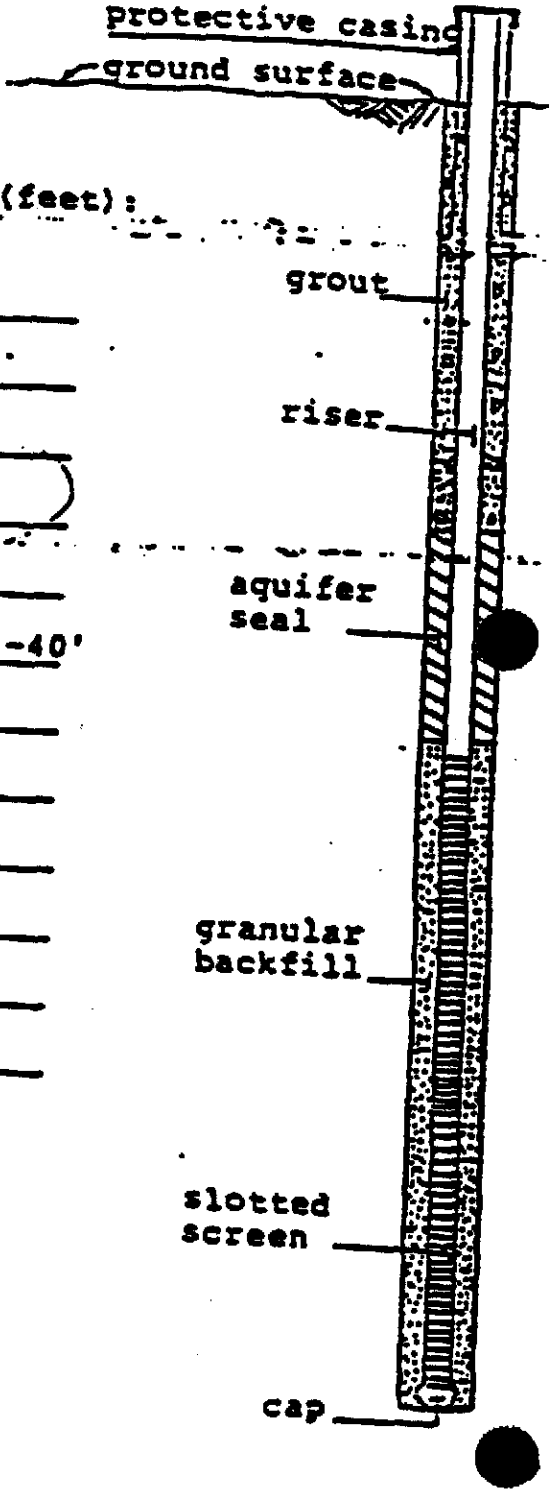
Date: Installed 29 Sep

Completed 29 Sep

Developed 01 O

Locations below ground surface (feet):

Bottom of Boring	40'
Bottom of Well	40'
Well Specification	4" PVC-Schd. 40
Screen Slot and Location	0.010" 30'-40'
Coupling Location	0', 10', 30'
Granular Backfill	Concrete Sand 10'-40'
Seals	Bentonite 8'-10'
Grout	Concrete 0-8'
Cave-in	None
Height of Riser	2'
Protective Casing	None
Elevation-top casing	105.0 MSL



MW-2

DISC

LOG OF BORING

PROJECT
Monitoring Wells
Vertac Chemical Corp.
Vicksburg, Mississippi

DRILLING RIG: B-40

JOB. NO.: 872

BORING NO.: B-2
SHEET 1 OF 1

GROUND SURFACE ELEVATION: 103.0

DATUM: MSL

BORING LOCATION
SEE PLAN

BORING TYPE
3 1/4" Hollow Auger
2" Spilt Spoon

GROUND WATER LEVEL
26' at drilling

DATE: 29 September 1981
WEATHER: clear and warm
DRILLER: Bill Barnes
INSPECTOR: Terry Primm
BORING TERMINATED AT: 40'

Sample No.	Sample Depth ft. From — To	Stand. Penet. Test Blow/ft.	Water Cont. %	SAMPLE DESCRIPTION AND REMARKS
1	3.5-5.0	7	25	Firm tan silty CLAY
2	8.5-10.0	7	24	Firm tan silty CLAY
3	13.5-15.0	6	24	Firm tan silty CLAY
4	18.5-20.0	6	25	Firm gray silt
5	23.5-25.0	6	23	Firm gray silt
6	28.5-30.0	8	23	Firm gray silt
7	33.5-35.0	7	23	Firm gray silt
8	38.5-40.0	8	32	Firm gray silt

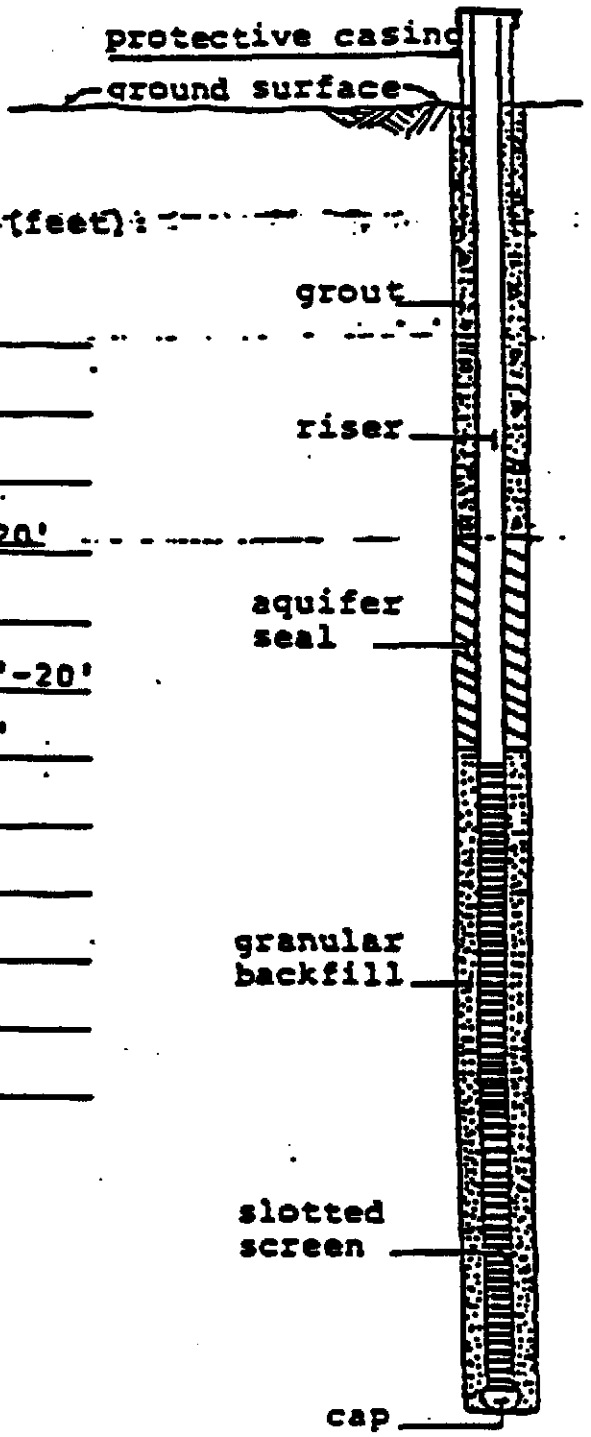
tion of Well # 4

Date: Installed 01 Oct. 1981
Completed 01 Oct. 1
Developed 01 Oct. 1981

No. 872

Project Vertac Chemical Corporation

Vicksburg, Mississippi



Locations below ground surface (feet):

tom of Boring	20'
tom of Well	20'
Specification	4" PVC-Schd. 40
teen Slot and Location	0.010" 10'-20'
ling Location	0,10'
ular Backfill	Concrete Sand 8'-20'
als	Bentonite 6'-8'
t	Concrete 0-6'
-in	None
ght of Riser	2'
ective Casing	None
evation-top casing	111.6 MSL

LOG OF BORING

NSC

PROJECT Monitoring Wells
Vertac Chemical Corp.
Vicksburg, Mississippi

DRILLING RIG: B-40

JOB. NO.: 872

BORING NO.: B-4

SHEET 1 OF 1

GROUND SURFACE ELEVATION: 109.6 MSL

DATUM:

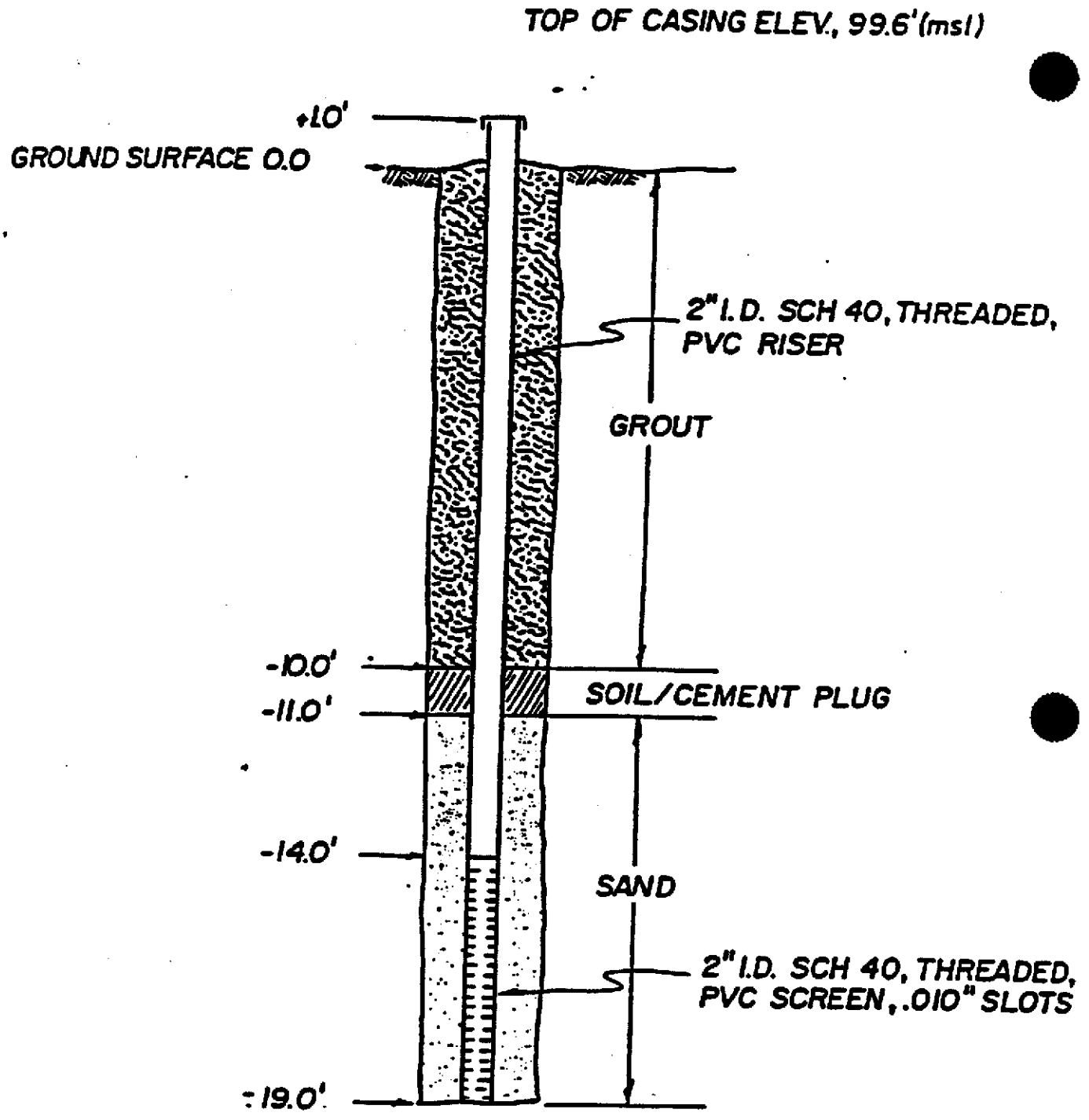
BORING LOCATION: SEE PLAN

BORING TYPE
3 1/4" Hollow Auger
2" Split Spoon

GROUND WATER LEVEL
9' at drilling

DATE: 01 October 1981
WEATHER: clear and warm
DRILLER: Bill Barnes
INSPECTOR: Terry Primm
BORING TERMINATED AT: 20

Sample No.	Sample Depth ft From — To	Stand. Penet. Test Blow/ft.	Water Cont. %	SAMPLE DESCRIPTION AND REMARKS
1	3.5-5.0	5	25	Firm tan silty CLAY w/gray silt marbeling
2	8.5-10.0	10	25	Stiff brown silty CLAY w/gray silt marbeling
3	13.5-15.0	11	27	Stiff dark brown silty CLAY w/gray silt marbeling
4	18.5-20.0	9	26	Stiff dark brown silty CLAY w/gray silt marbeling



MCI CONSULTING ENGINEERS
Nashville, Tennessee

MONITORING WELL No. 5
AS COMPLETED
VERTAC CHEMICAL CORP.
VICKSBURG, MS.
NO SCALE 12/2/83

MW-

MCI/ CONSULTING ENGINEERS, INC.
4301 Hillsboro Road
Suite 224
Nashville, Tennessee 37215
Telephone (615) 383-4807

Corporate Headquarters:
Nashville, Tennessee

Branch Offices:
Knoxville, Tennessee
Arvada, Colorado

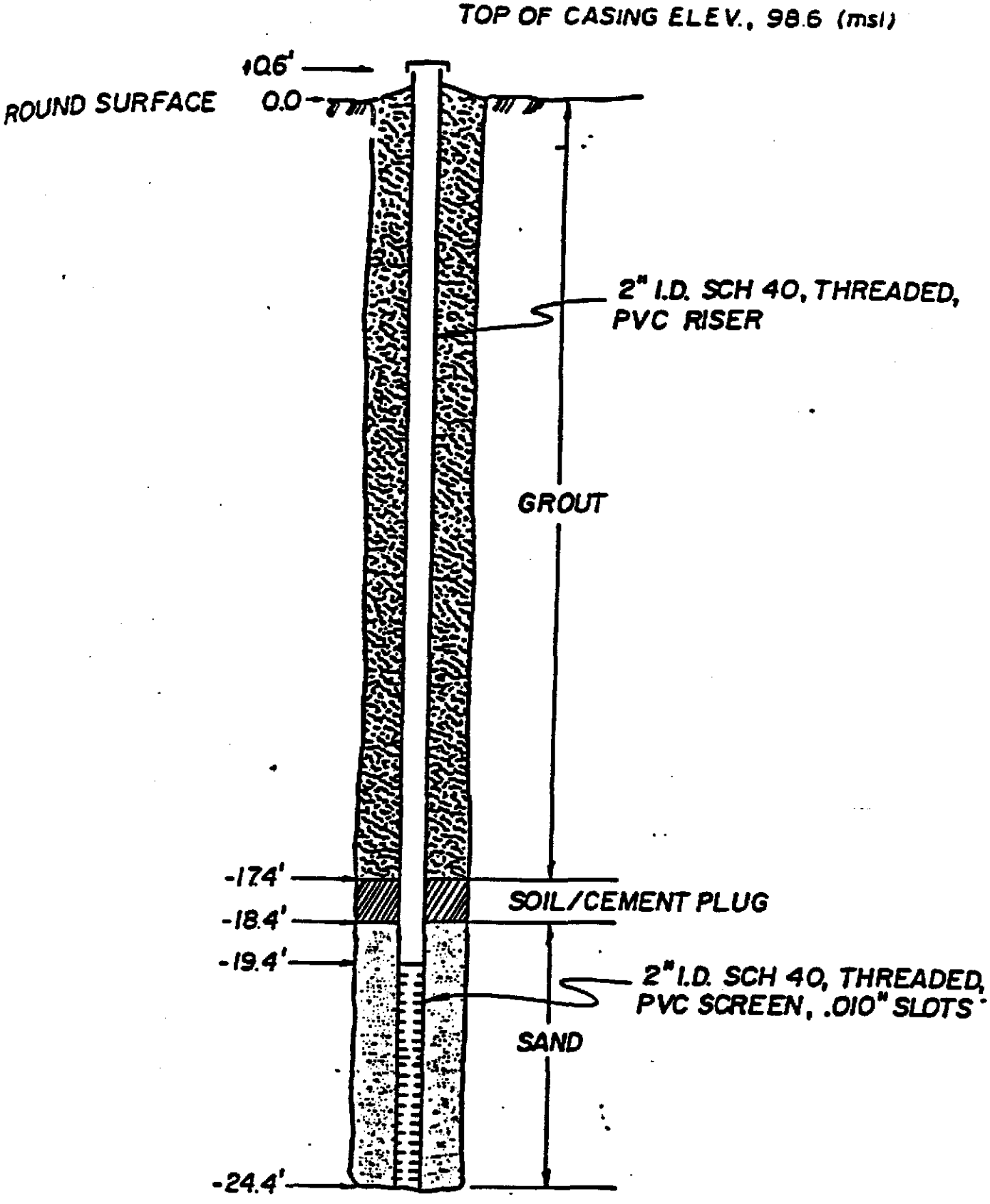
DRILLER'S LOG

SHIFT REPORT OF DRILLING OPERATIONS AT Vertac Chemical Corporation (VCC) Vicksburg, MS		SITE
HOLE LOCATION See Site Sketch Map	SHIFT	DATE 3-2-83
SURFACE ELEVATION 98.6' (msl)	RIG NO	HOLE NO 5
DEPTH AT BEGINNING OF SHIFT	TOP ROCK	
FOOTAGE FISHTAILED	BOTTOM OF HOLE	
FOOTAGE SAMPLED	DRILLER C. Nelson - H.B.A.	
FOOTAGE CORED	HELPER	
DEPTH AT END OF SHIFT	DRILLED FOR	

SAMPLING RECORD

LOGGED BY: GDM

SPLIT NO	FROM	TO	SPLIT BLOWS	DESCRIPTION AND REMARKS
	0.0	0.5		Topsoil
1	5.0	6.0		Brown silty CLAY, v. moist
2	10.0	11.0		Brown v. silty CLAY, Moist
3	15.0	16.0		Brown sl. clayey SILT, with gray mottles
				Stratum change at 17.0 feet - by driller
				Saturated returns at 19.0'
4	20.0	21.0		Brown and gray sl. clayey SILT, saturated
5	25.0	26.0		Gray sl. clayey SILT, saturated
				Hard drilling at 29 feet
6	30.0	31.0		Greenish gray clayey SAND
7	34.0	35.0		Greenish gray MARL
				NOTES: (1) Monitoring Well # 5 set in test boring at 19.0'
				(2) Top of casing Elev. = 99.6' (msl)
				Bottom of casing Elev. = 79.6' (msl)



MCI CONSULTING ENGINEERS
Nashville, Tennessee

MONITORING WELL No. 6
AS COMPLETED
VERTAC CHEMICAL CORP.
VICKSBURG, MS.
NO SCALE 12/2/83

MCI/ CONSULTING ENGINEERS, INC.
4301 Hillsboro Road
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Nashville, Tennessee 37215
Telephone (615) 383-4807

Corporate Headquarters:
Nashville, Tennessee
Branch Offices:
Knoxville, Tennessee
Arvada, Colorado

DRILLER'S LOG

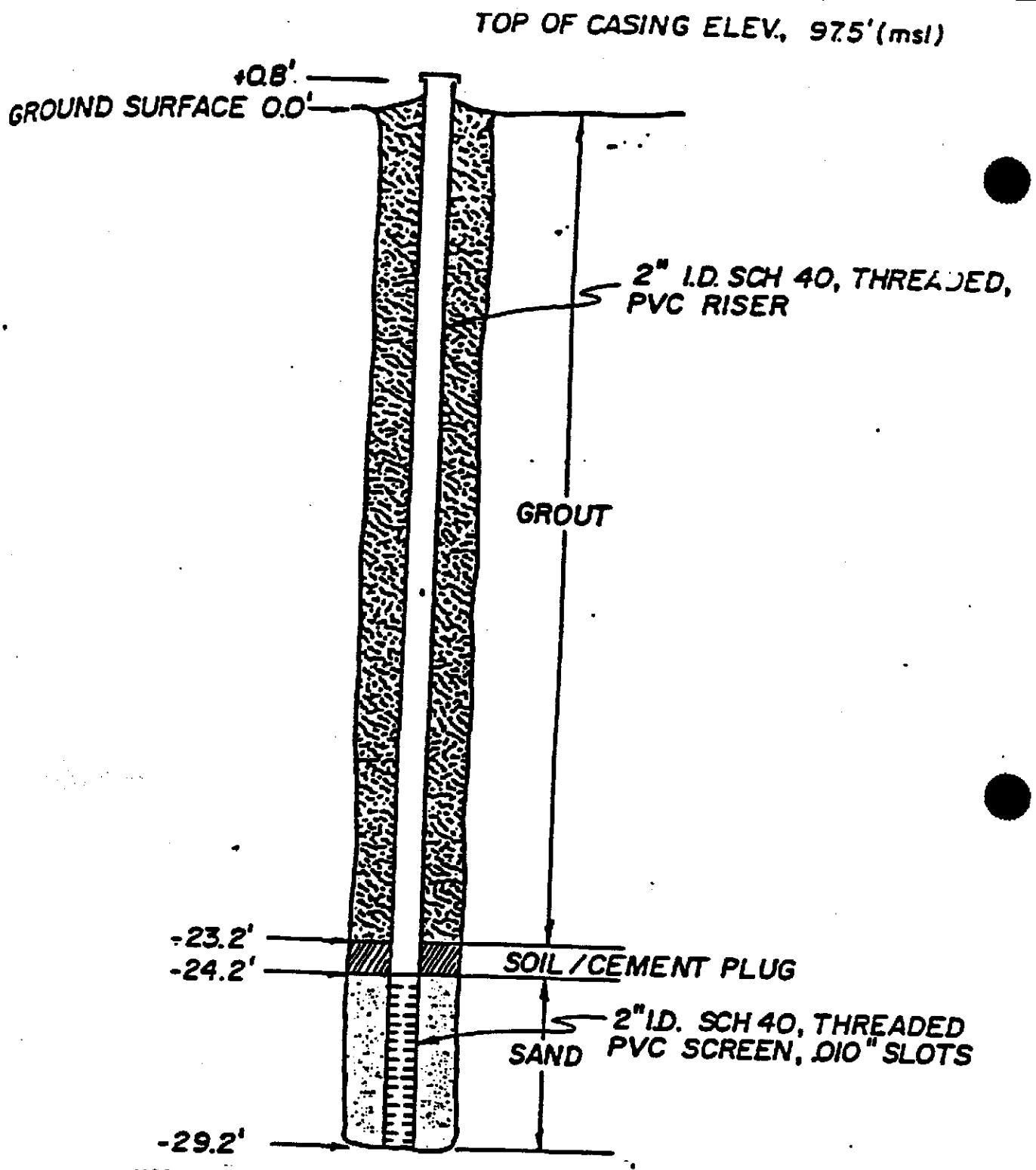
SHIFT REPORT OF DRILLING OPERATIONS AT	VCC, Vicksburg, MS		SITE
HOLE LOCATION	See Site Sketch Map	SHIFT	DATE 3-1-83
SURFACE ELEVATION	98.0' (msl)	RIG NO.	HOLE NO. 6
DEPTH AT BEGINNING OF SHIFT		TOP ROCK	
FOOTAGE FISHTAILED		BOTTOM OF HOLE	
FOOTAGE SAMPLED		DRILLER	C. Nelson, HBA
FOOTAGE CORED		HELPER	
DEPTH AT END OF SHIFT		DRILLED FOR	

SAMPLING RECORD

LOGGED BY: GDM

SPLT NO	FROM	TO	SPLT BLOWS	DESCRIPTION AND REMARKS
	0.0	0.5		Topsoil
1	5.0	6.0		Brown clayey SILT, v. moist
2	10.0	11.0		Brown v. silty CLAY, moist
				Saturated returns at 14.5'
3	15.0	16.0		Brown v. silty CLAY, lam. lignite, wet.
4	20.0	21.0		Brown silty, clay with gray mottles
				Stratum change at 22.0' - by driller
5	25.0	26.0		Gray sl. clay SILT, saturated
				Hard drilling at 28.0'
6	30.0	31.0		Greenish gray sandy CLAY
7	35.0	36.0		Greenish gray MARL
8	39.0	40.0		Greenish gray MARL

NOTES: (1) Monitoring Well #6 in additional borings, 5' southwest of test boring at 24.5'
(2) Top of casing elev. = 98.6' (msl)
Bottom of casing elev. = 73.6' (msl)



MCI CONSULTING ENGINEERS
Nashville, Tennessee

MONITORING WELL No. 7
AS COMPLETED
VERTAC CHEMICAL CORP.
VICKSBURG, MS.
NO SCALE 12/2/83

MW-7

MCI/CONSULTING ENGINEERS, INC.
4301 Hillsboro Road
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Telephone (615) 383-4807

Corporate Headquarters:
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Branch Offices
Knoxville, Tennessee
Arvada, Colorado

DRILLER'S LOG

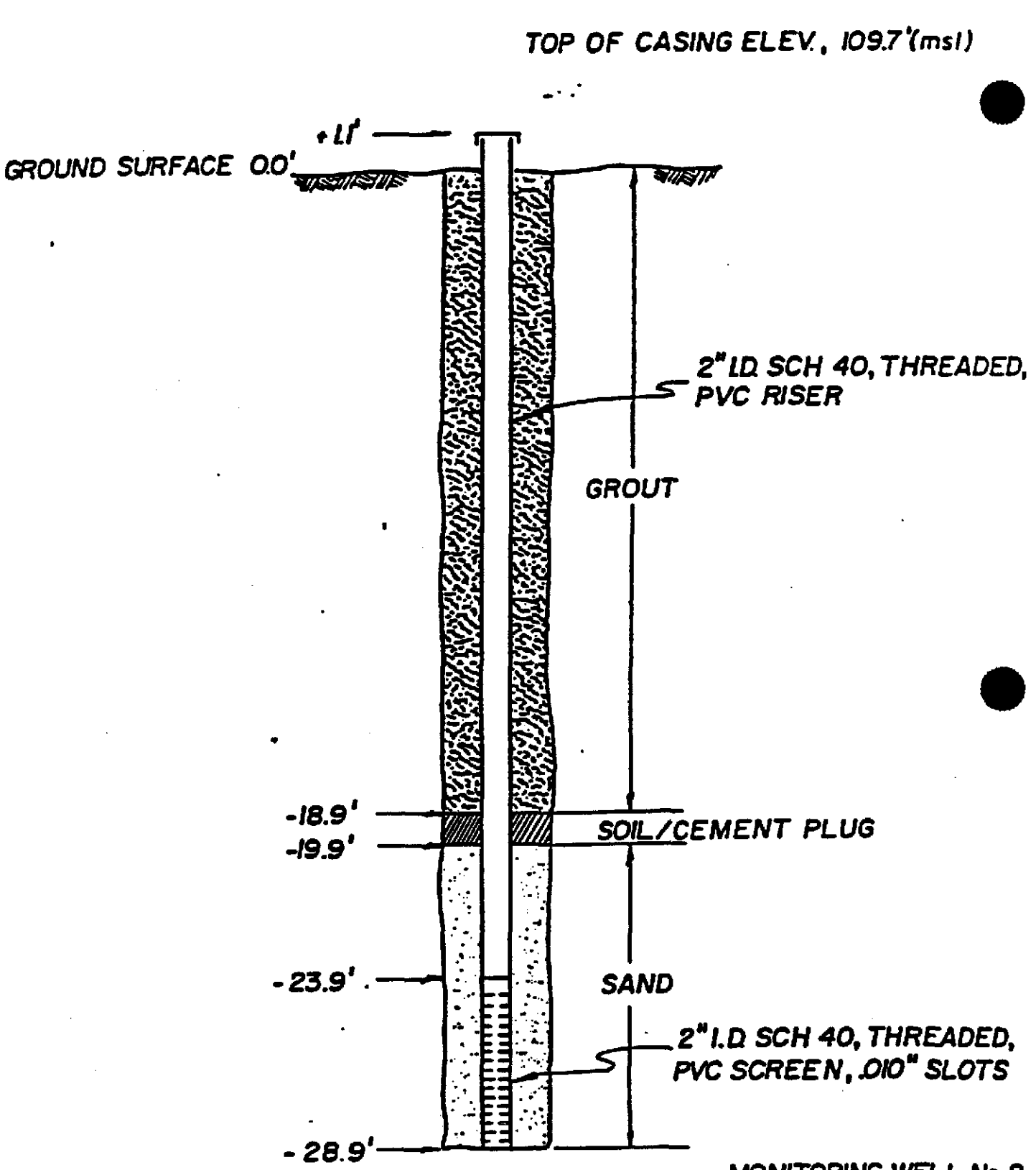
SHIFT REPORT OF DRILLING OPERATIONS AT	VCC, Vicksburg, MS		SITE
HOLE LOCATION	See Site Sketch Map	SHIFT	DATE 3-1-83
SURFACE ELEVATION	96.7' (msl)	RIG NO	HOLE NO. 7
DEPTH AT BEGINNING OF SHIFT		TOP ROCK	
FOOTAGE FISHTAILED		BOTTOM OF HOLE	
FOOTAGE SAMPLED		DRILLER	C. Nelson - HBA
FOOTAGE CORED		HELPER	
DEPTH AT END OF SHIFT		DRILLED FOR	

SAMPLING RECORD

LOGGED BY: GDM

SPLIT NO	FROM	TO	SPLIT BLOWS	DESCRIPTION AND REMARKS
	0.0	0.5		Topsoil
1	5.0	6.0		Brown Clayey SILT, v. moist
				Saturated returns at 8.2'
2	10.0	11.0		Brown v. silty CLAY, wet
3	15.0	16.0		Brown silty CLAY, with gray mottles, saturated
4	20.0	21.0		Brown v. silty CLAY, saturated
5	25.0	26.0		Brown and gray sl. clay SILT, saturated
				Hard drilling at 28.0'
6	30.0	31.0		Greenish gray sandy CLAY, with small gravel
7	34.0	35.0		Greenish gray MARL

NOTES: (1) Monitoring Well #7 set in test boring at 29'
(2) Top of casing Elev. = 97.5' (msl)
Bottom of casing Elev. = 67.5' (msl)



MCI CONSULTING ENGINEERS

Nashville, Tennessee

MONITORING WELL No. 8
AS COMPLETED
VERTAC CHEMICAL CORP.
VICKSBURG, MS.
NO SCALE 12/2/83

MW-8

MCI/ CONSULTING ENGINEERS, INC.
4301 Hillsboro Road
Suite 224
Nashville, Tennessee 37215
Telephone (615) 383-4807

Corporate Headquarters:
Nashville, Tennessee
Branch Offices:
Knoxville, Tennessee
Arvada, Colorado

DRILLER'S LOG

SHIFT REPORT OF DRILLING OPERATIONS AT	VCC, Vicksburg, MS		SITE
HOLE LOCATION	See Site Sketch Map	SHIFT	DATE 3-2-83
SURFACE ELEVATION	108.6 (msl)	RIG NO	HOLE NO 8
DEPTH AT BEGINNING OF SHIFT		TOP ROCK	
FOOTAGE FISHTAILED		BOTTOM OF HOLE	
FOOTAGE SAMPLED		DRILLER	C. Nelson - HBA
FOOTAGE CORED		HELPER	
DEPTH AT END OF SHIFT		DRILLED FOR	

SAMPLING RECORD

LOGGED BY: GDM

SPLT NO	FROM	TO	SPLT BLOWS	DESCRIPTION AND REMARKS
	0.0	0.5		Topsoil
1	5.0	6.0		Brown silty CLAY
2	10.0	11.0		Brown clayey SILT, with lt. brown mottles, moist
3	15.0	16.0		Brown clayey SILT
				Stratum change at 18.0' - by driller
4	20.0	21.0		Gray silty CLAY, with small roots, wet
5	25.0	26.0		Gray silty CLAY, saturated
				Water rising at 29.0'
6	30.0	31.0		Gray SILT, saturated
7	35.0	36.0		Gray SILT, saturated
				Hard drilling at 38.5'
8	39.0	40.0		Brownish orange MARL, hard
	40.0	49.5		Pushed split spoon refused at 49.5'

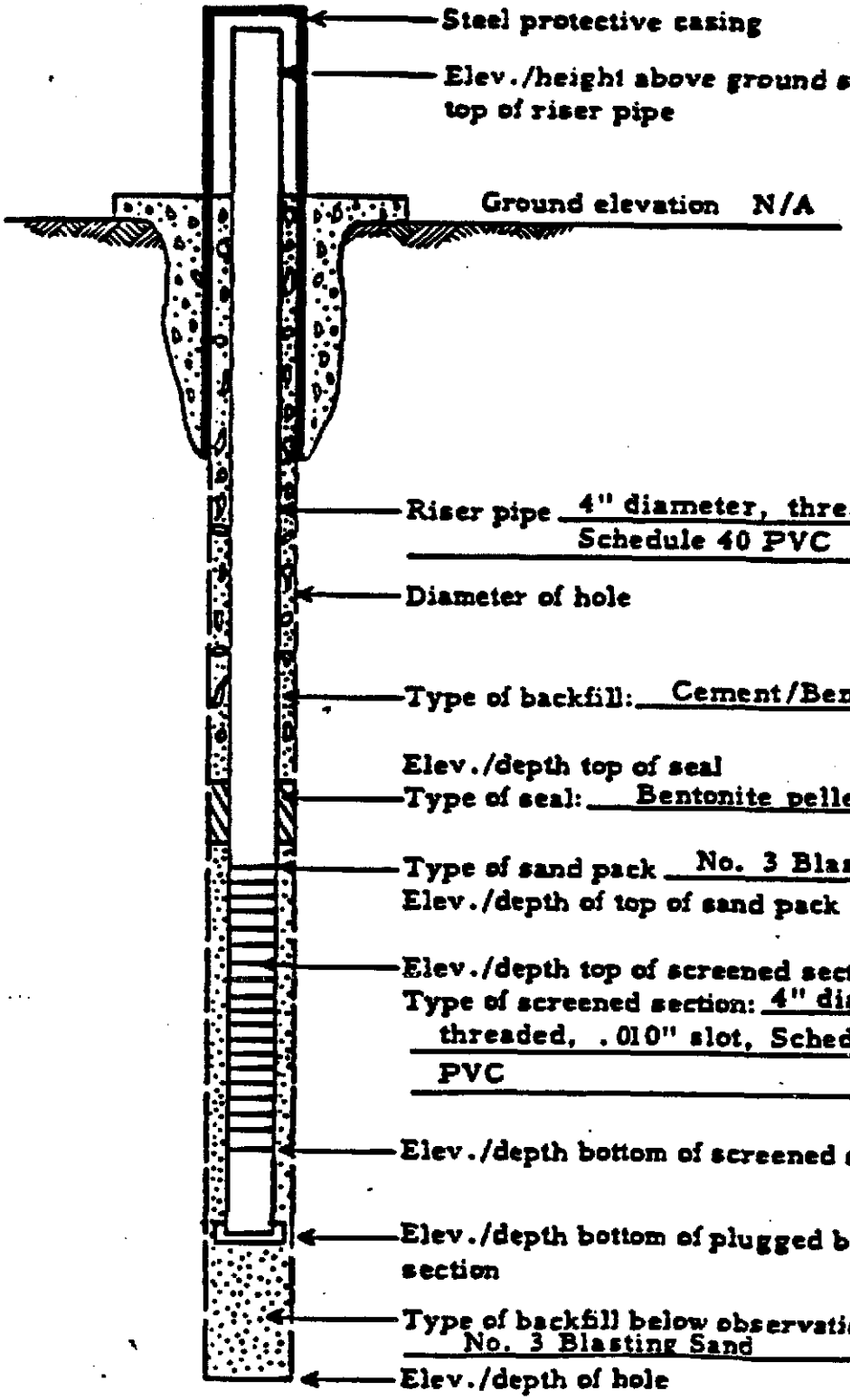
NOTES: (1) Monitoring Well #8 set in additional borings, 8' east of test boring, at 29' on 3-3-83
(2) Top of casing elev. = 109.7' (msl)
Bottom of casing elev. = 79.7' (msl).

GROUNDWATER OBSERVATION WELL REPORT

Project Vertac Chemical Corporation

Location Vicksburg, Mississippi

Well No. MW-9 Date Completed 10/9/85 Technician J. Malanchak



Steel protective casing	
Elev./height above ground surface top of riser pipe	Approx. 4 ft
Ground elevation N/A	
Riser pipe 4" diameter, threaded, Schedule 40 PVC	
Diameter of hole	8 in.
Type of backfill: Cement/Bentonite	
Elev./depth top of seal	36 ft
Type of seal: Bentonite pellets	
Type of sand pack No. 3 Blasting Sand	
Elev./depth of top of sand pack	39 ft
Elev./depth top of screened section	43 ft
Type of screened section: 4" diameter, threaded, .010" slot, Schedule 40 PVC	
Elev./depth bottom of screened section	53 ft
Elev./depth bottom of plugged blank section	58 ft
Type of backfill below observation pipe No. 3 Blasting Sand	
Elev./depth of hole	58.5 ft

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 846545-2	PROJECT NAME: Vertac-Vicksburg		
BORING NUMBER: MW-9	COORDINATES:		DATE:
ELEVATION: 116.02 Ft. MSL (TofC)	GWL: Depth	Date/Time	DATE STARTED: 10-9-85
ENGINEER/GEOLOGIST: L.W. Cronk	Depth	Date/Time	DATE COMPLETED: 10-9-85
DRILLING METHODS: Rotary Wash			PAGE 1 OF 2

DEPTH (FT.)	SAMPLE TYPE & NO.	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
			Gravelly clay fill at surface			
5						
10	QT-1		Brown & Gray Silt			
15			Shell fragments @ 14'			
20			Becoming Gray Silt @ 19' w/occasional Shell Fragments			
25						
	QT-3		Gray Silt			

NOTES

MW-9

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 846545-2	PROJECT NAME: Vertac-Vicksburg		
BORING NUMBER: MW-9	COORDINATES:		DATE:
ELEVATION: 116.02 Ft. MSL (TofC)	GWL: Depth	Date/Time	DATE STARTED: 10-9
ENGINEER/GEOLOGIST: L.W. Cronk	Depth	Date/Time	DATE COMPLETED: 10-9-85
DRILLING METHODS: Rotary Wash			PAGE 2 OF 2

DEPTH (FT)	SAMPLE TYPE & NO.	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
30			--			
35						
40			Becoming Brown & Gray Silt w/Numerous Shell Fragments @ 41'			
45	QT-5		Dark Gray Clayey Silt @ 43.5'		2.25	Penetrometer
50			Marl @ 52'			
55						

NOTES

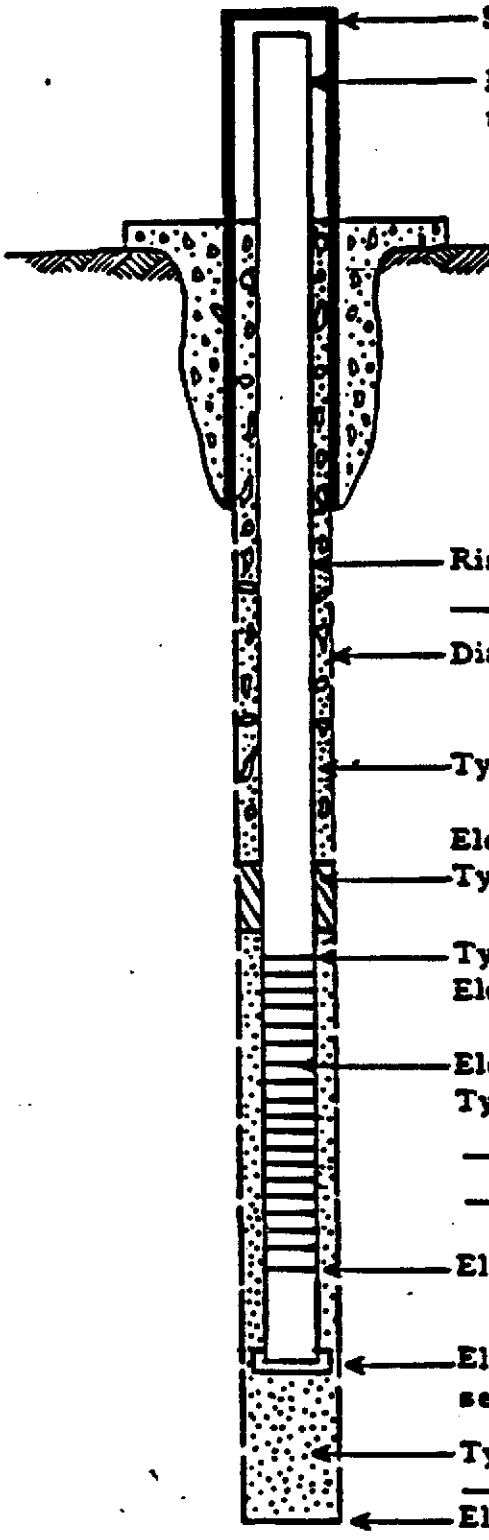
Completion Depth @ 58'

GROUNDWATER OBSERVATION WELL REPORT

Project: Vertac Chemical Corporation

Location: Vicksburg, Mississippi

Well No.: MW-10 Date Completed: 10/7/85 Technician: J. Malanchak



Steel protective casing	
Elev./height above ground surface top of riser pipe	Approx. 2.5 ft
Ground elevation N/A	
Riser pipe 4" diameter, threaded, Schedule 40 PVC	
Diameter of hole	8 in.
Type of backfill: Cement/Bentonite	
Elev./depth top of seal	33 ft
Type of seal: Bentonite pellets	
Type of sand pack No. 3 Blasting Sand	
Elev./depth of top of sand pack	35 ft
Elev./depth top of screened section	40 ft
Type of screened section: 4" diameter, threaded, .010" slot, Schedule 40 PVC	
Elev./depth bottom of screened section	50 ft
Elev./depth bottom of plugged blank section	53 ft
Type of backfill below observation pipe No. 3 Blasting Sand	
Elev./depth of hole	53.5 ft

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 846545-2	PROJECT NAME: Vertac-Vicksburg		
BORING NUMBER: MW-10	COORDINATES:		DATE:
ELEVATION: 114.73 Ft. MSL (TofC)	GWL: Depth	Date/Time	DATE STARTED: 10-7-85
ENGINEER/GEOLOGIST: G. M. Combs	Depth	Date/Time	DATE COMPLETED: 10-7-85
DRILLING METHODS: Rotary Wash			PAGE 1 OF 2

DEPTH (FT)	SAMPLE TYPE & NO	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
			Clayey fill at surface			
10	QT-1		Tan and Light Gray Slightly Clayey Silt		1.5 1.6	Penetrometer Torvane
20			Becoming More Clayey @ 22'			
25	QT-3		Gray Silt w/Shell Fragments		1.75	Penetrometer

NOTES:

VISUAL CLASSIFICATION OF SOILS

CT NUMBER: 846545-2	PROJECT NAME: Vertac-Vicksburg	
AING NUMBER: MW-10	COORDINATES:	DATE: —
LEVATION: 114.73 Ft. MSL (TofC)	GWL: Depth Date/Time	DATE STARTED: 10-7-85
NGINEER/GEOLOGIST: G.M. Combs	Depth Date/Time	DATE COMPLETED: 10-7-85
RILLING METHODS: Rotary Wash		PAGE 2 OF 2

DEPTH (FT)	SAMPLE TYPE & NO	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
31			—			
35						
40	QT-5		Dark Gray Slightly Clayey Silt w/shell Fragments		1.0 0.43	Penetrometer Torvane
45						
50			Marl below 48.5 Clayey Sand Seam 48.5'-49.5' Gravel from 49.0' to 52.0'			
55						

NOTES:

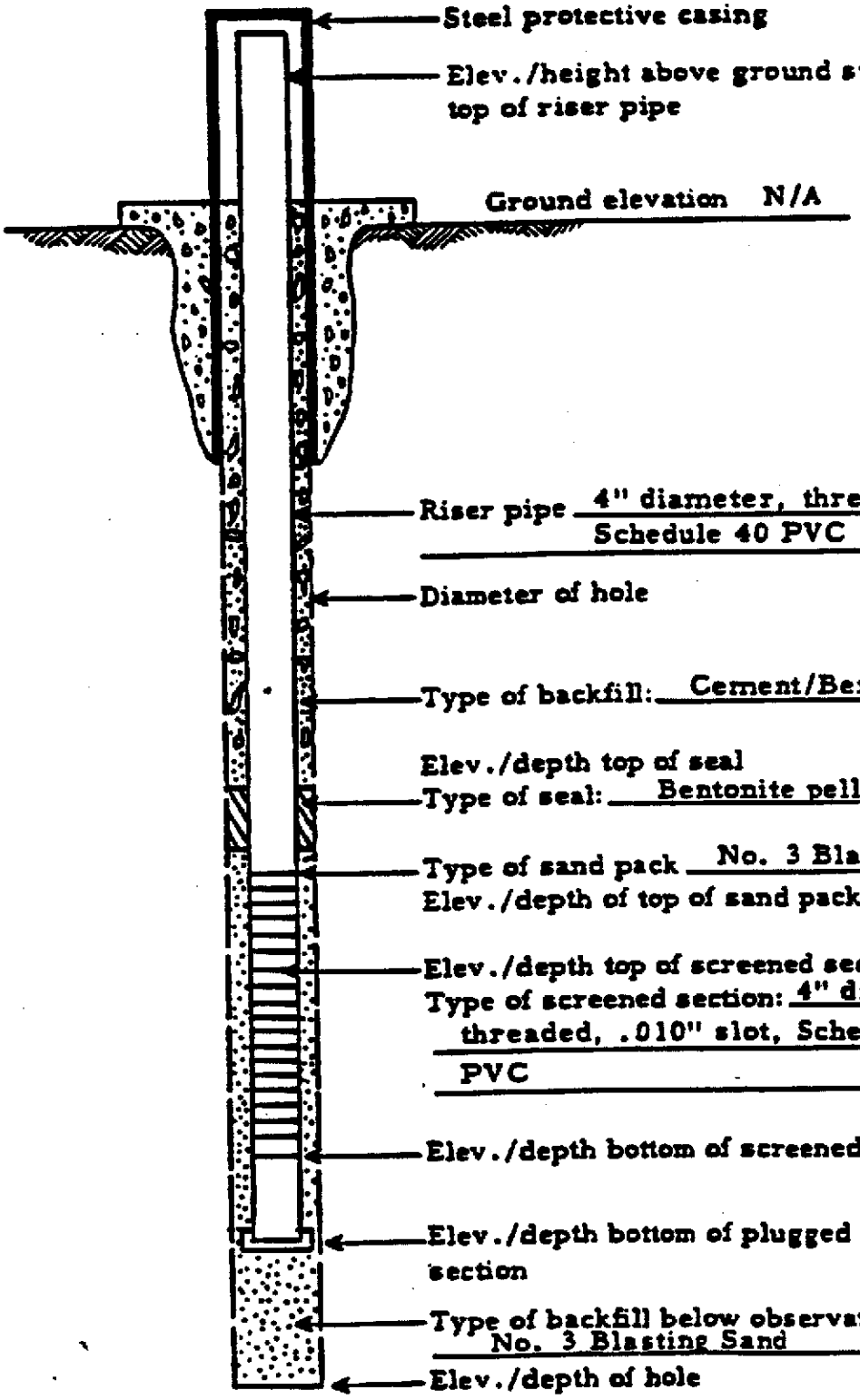
Completion Depth 52.0'

GROUNDWATER OBSERVATION WELL REPORT

Project: Vertac Chemical Corporation

Location: Vicksburg, Mississippi

Well No.: MW-11 Date Completed: 10/8/85 Technician: J. Malanch



Steel protective casing	
Elev./height above ground surface top of riser pipe	Approx. 4.5 ft
Ground elevation	N/A
Riser pipe	4" diameter, threaded, Schedule 40 PVC
Diameter of hole	8 in.
Type of backfill:	Cement/Bentonite
Elev./depth top of seal	29 ft
Type of seal:	Bentonite pellets
Type of sand pack	No. 3 Blasting Sand
Elev./depth of top of sand pack	33 ft
Elev./depth top of screened section	35 ft
Type of screened section:	4" diameter, threaded, .010" slot, Schedule 40 PVC
Elev./depth bottom of screened section	45 ft
Elev./depth bottom of plugged blank section	48 ft
Type of backfill below observation pipe	No. 3 Blasting Sand
Elev./depth of hole	48.5 ft

MW-1

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER 846545-2	PROJECT NAME: Vertac-Vicksburg		
BORING NUMBER MW-11	COORDINATES:		DATE:
ELEVATION 105.62 Ft. MSL (TofC)	GWL: Depth	Date/Time	DATE STARTED: 10-8-85
ENGINEER/GEOLOGIST: L.W. Cronk	Depth	Date/Time	DATE COMPLETED: 10-8-85
DRILLING METHODS Rotary Wash			PAGE 1 OF 2

DEPTH (FT)	SAMPLE TYPE & NO	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
			Dark Gray Clayey Silt to 5.0			
5	QT-1		Dark Gray Silt @ 5.0			
10						
15						
20						
25						
	QT-3		Tan & Gray Silt @ 29.5'		2.5	Penetrometer

NOTES:

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 846545-2	PROJECT NAME: Vertac-Vicksburg	
BORING NUMBER: MW-11	COORDINATES:	DATE:
ELEVATION: 105.62 Ft. MSL (TofC)	GWL: Depth Date/Time	DATE STARTED: 10-8-85
ENGINEER/GEOLOGIST: L.W. Cronk	Depth Date/Time	DATE COMPLETED: 10-8-85
DRILLING METHODS Rotary Wash		PAGE 2 OF 2

DEPTH (FT)	SAMPLE TYPE & NO.	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
30						
35			Gray & Tan Sandy Clay @ 43.0' - 44.0'			
40						
45	QT-5		Gray and Tan Clay @ 44.0' to 51.0'		2.5	Penetrometer
50			Marl @ 51'			
55						

NOTES

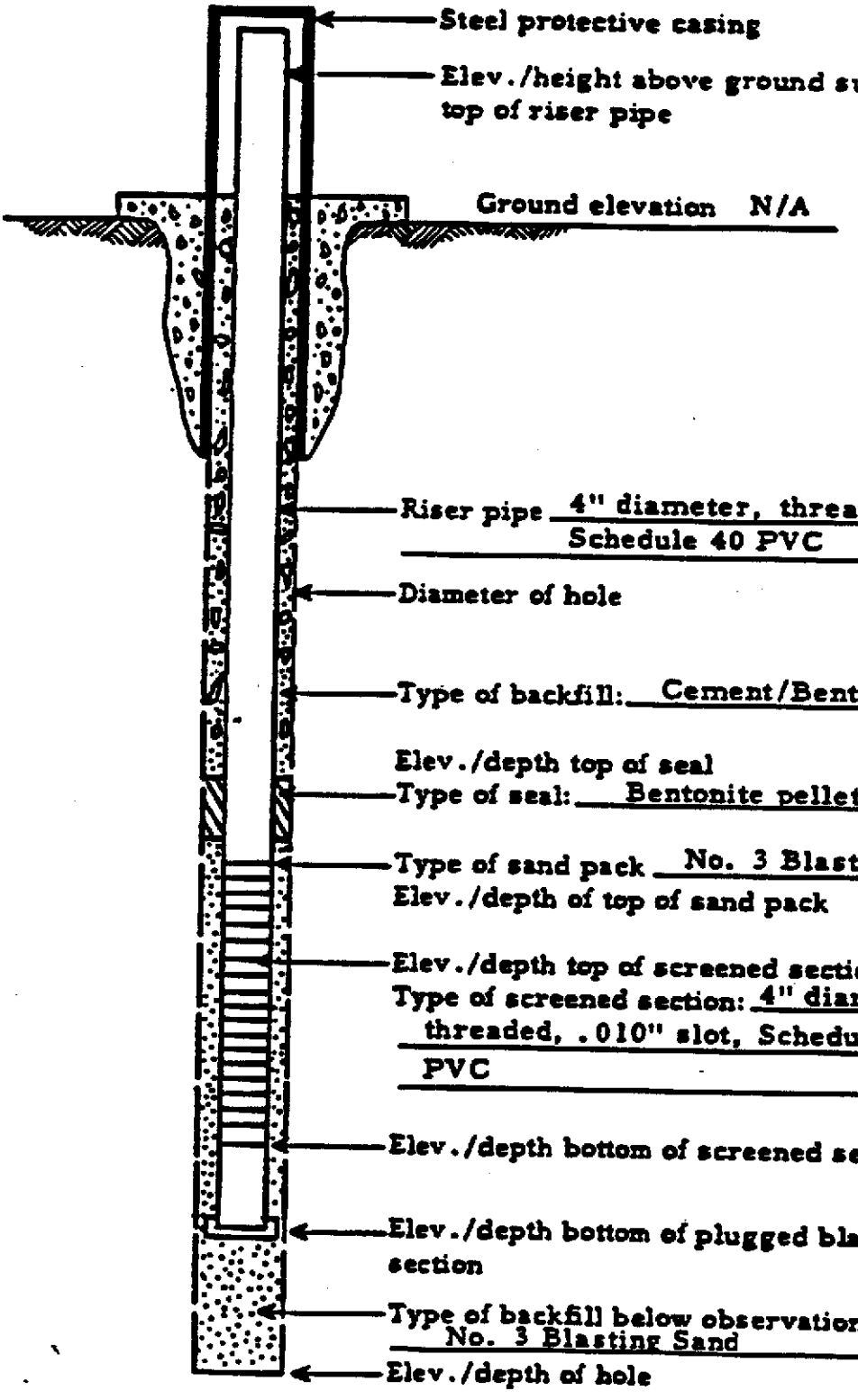
Completion Depth 56'

GROUNDWATER OBSERVATION WELL REPORT

Project Vertac Chemical Corporation

Location Vicksburg, Mississippi

Well No. MW-12 Date Completed 10/8/85 Technician J. Malanchak



Steel protective casing

Elev./height above ground surface top of riser pipe — Approx. 3 ft

Ground elevation N/A

Riser pipe 4" diameter, threaded, Schedule 40 PVC

Diameter of hole — 7 in.

Type of backfill: Cement/Bentonite

Elev./depth top of seal — 20 ft

Type of seal: Bentonite pellets

Type of sand pack No. 3 Blasting Sand

Elev./depth of top of sand pack — 26 ft

Elev./depth top of screened section — 32 ft

Type of screened section: 4" diameter, threaded, .010" slot, Schedule 40 PVC

Elev./depth bottom of screened section — 42 ft

Elev./depth bottom of plugged blank section — 47.5 ft

Type of backfill below observation pipe No. 3 Blasting Sand

Elev./depth of hole — 48 ft

MW-12

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 846545-2	PROJECT NAME: Vertac-Vicksburg		
BORING NUMBER: MW-12	COORDINATES:		DATE:
ELEVATION: 112.06 Ft. MSL (TofC)	GWL: Depth	Date/Time	DATE STARTED: 10-8-85
ENGINEER/GEOLOGIST: G.M. Combs	Depth	Date/Time	DATE COMPLETED: 10-8-85
DRILLING METHODS: Rotary Wash			PAGE 1 OF 2

DEPTH IN FT	SAMPLE TYPE & NO.	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
			Fill Material to 4'			
5			Tan Silt (Slightly Clayey) @ 4'			
10			Tan Silt		1.25	Penetrometer
15						
20						
25	QT-3		Becoming Gray & Tan Silt @ 27'		1.1	Penetrometer

NOTES:

MW-12

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 846545-2	PROJECT NAME: Vertac-Vicksburg		
BORING NUMBER: MW-12	COORDINATES:		DATE:
ELEVATION: 112.06 Ft. MSL (TofC)	GWL: Depth	Date/Time	DATE STARTED: 10-8-85
ENGINEER/GEOLOGIST: G.M. Combs	Depth	Date/Time	DATE COMPLETED: 10-8-85
DRILLING METHODS: Rotary Wash			PAGE 2 OF 2

DEPTH (FT)	SAMPLE TYPE & NO.	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
30			--			
35						
40			Shell Fragments @ 40'			
45	QT-5		Gray Clayey Sand w/Sand Pkts and Gravel 44'-46' Beginning of Marl @ 46'		1.24	Penetrometer
50						
55						

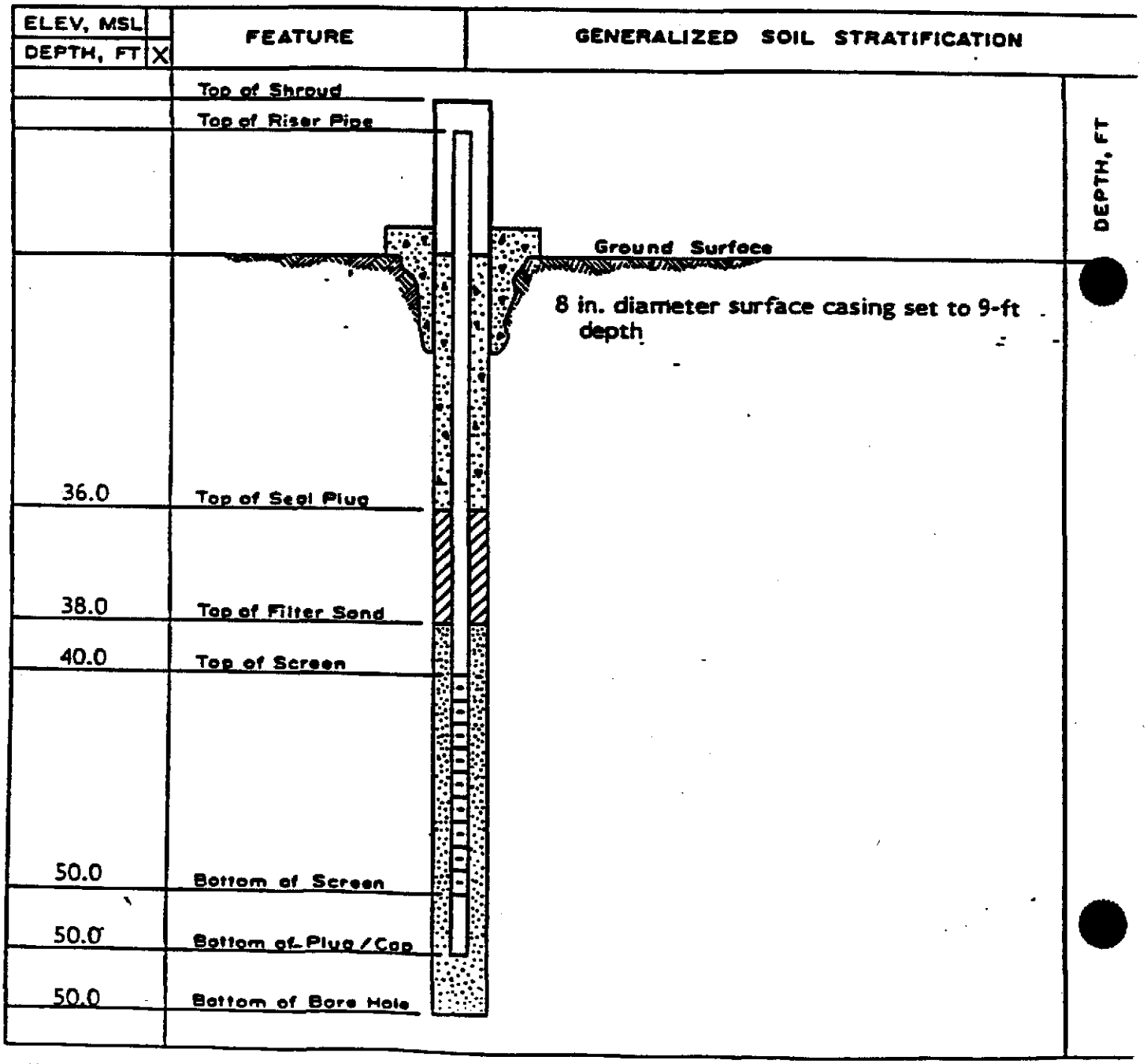
NOTES:

Completion Depth @ 48.5'

LOG OF GROUNDWATER OBSERVATION WELL

Project & Location Vertac Chemical Corporation, Vicksburg, Mississippi
Client Vertac Chemical Corporation Date of Report

Observation Well No. MW-13 Date Completed 12/3/86 Technician J. Malanchak
Riser Pipe: Material Sch 40 PVC Diameter 4 in. Type of Joints Threaded
Screen: Material Sch 40 PVC Slot Size .010" Diameter 4 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 blasting sand
Method of Placement of Filter Material Tremie
Type of Seal Above Screen Bentonite pellets Backfill Above Seal Cement/bent. grou
Drilling Mud was used. Fresh Water Flush Before Setting Well Screen No
Well Developed by Development Time hr:
Groundwater Level @ 2 hrs @ 24 hrs Other



IT

IT CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 435130	PROJECT NAME: Cedar Chemical	
BORING NUMBER: MW-13	COORDINATES:	DATE: 12-1-86
ELEVATION:	GWL: Depth 8.5 Date/Time 12-1-86	DATE STARTED: 12-1-86
ENGINEER/GEOLOGIST: HES	Depth 2.0 Date/Time 12-3-86	DATE COMPLETED: 12-3-86
DRILLING METHODS: Dry Auger to 8.5', Wet Rotary to 50.0		PAGE 1 OF 2

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (FT)	RECOVERY (FT)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				Brown Clayey Silt with Roots			No Odor
5	ST-1		2.0	Brown Silty Clay with Ferrous Nodules Below 4.0'		1.0	No Odor
				Light Brown Clayey Sand			
10	ST-2		2.0	Brown & Light Brown Silty Sand -With Clay Pockets Below 10.0' -Reddish Brown Below 19.0'			
15	ST-3		2.0				No Odor
20	ST-4		2.0				
25	ST-5		2.0	Bluish Gray Clay with Slickensides -Greenish Gray with Red Streaks Below 28.0'		3.5	
	ST-6		2.0			3.5	No Odor

NOTES:

IT CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 435130	PROJECT NAME: Cedar Chemical		
BORING NUMBER: MW-13	COORDINATES:	DATE: 12-1-86	
ELEVATION:	GWL: Depth 8.5 Date/Time 12-1-86	DATE STARTED: 12-1-86	
ENGINEER/GEOLOGIST: HES	Depth 2.0 Date/Time 12-3-86	DATE COMPLETED: 12-3-86	
DRILLING METHODS: Dry Auger to 8.5', Wet Rotary to 50.0		PAGE 2 OF 2	

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER -	RECOVERY (FT)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				Blueish Gray Clay with Slickensides -with Sand Pockets 28.0 to 33.0'			No Odor
35	ST-7		2.0	Light Brown & Greenish Gray Silty Sand with Silt Pockets & Seams		2.5	No Odor
	ST-8		2.0	Greenish Gray Silty Clay with Sand Seams & Partings		2.0	
40	ST-9		2.0			3.5	No Odor
	ST-10		2.0			3.5	
45	ST-11		2.0			3.5	
	ST-12		2.0	Greenish Gray & Gray Sandy Clay with Silt Partings & Pockets		4.0	No Odor
50							

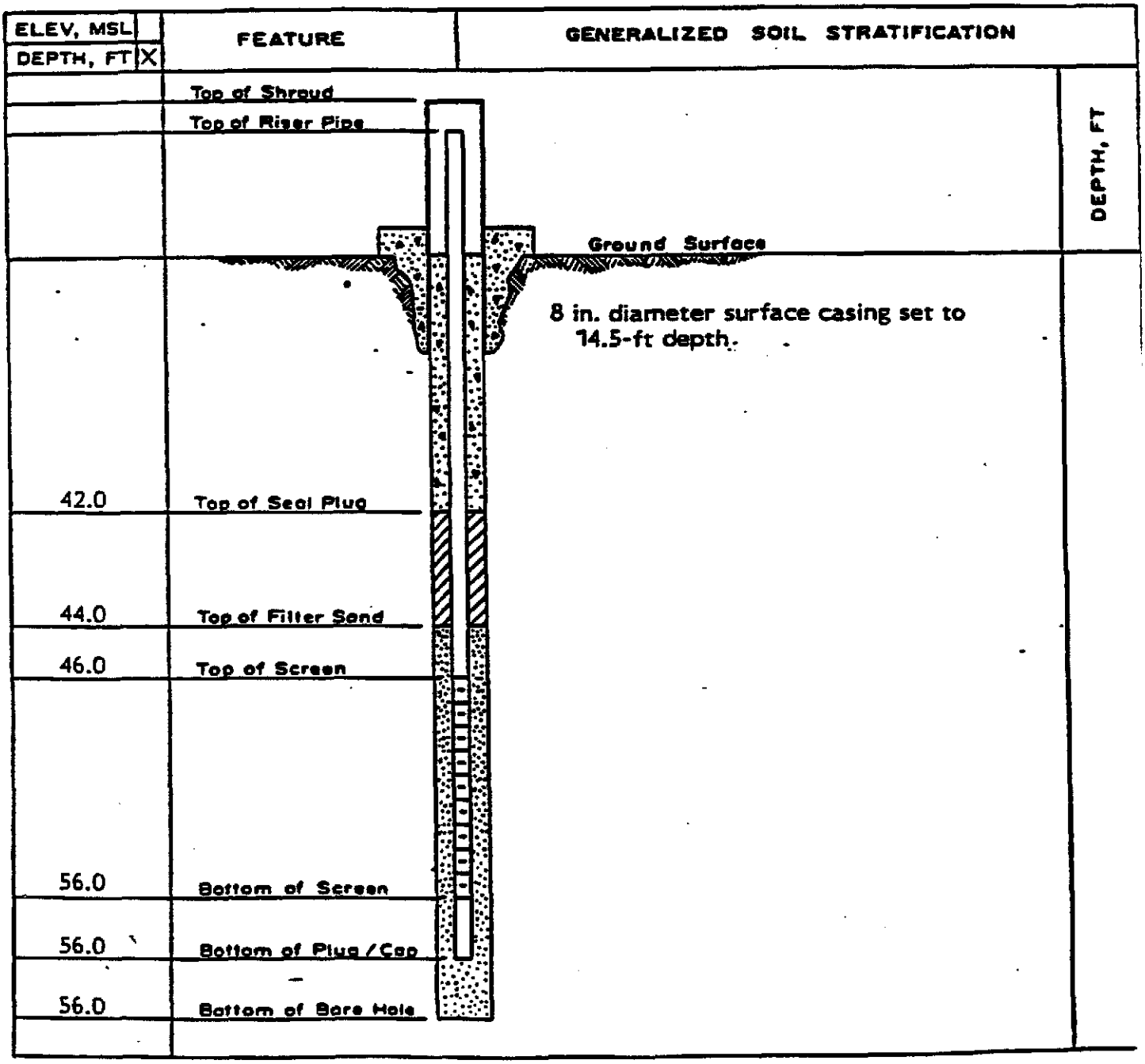
NOTES:

Bottom of Boring - 48.0'
Bottom of Well - 50.0'

LOG OF GROUNDWATER OBSERVATION WELL

Project & Location Vertac Chemical Corporation, Vicksburg, Mississippi
Client Vertac Chemical Corporation Date of Report

Observation Well No. MW-14 Date Completed 12/4/86 Technician J. Malanchak
Riser Pipe: Material Sch 40 PVC Diameter 4 in. Type of Joints Threaded
Screen: Material Sch 40 PVC Slot Size .010" Diameter 4 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 blasting sand
Method of Placement of Filter Material Tremie
Type of Seal Above Screen Bentonite pellets Backfill Above Seal Cement/bent. grout
Drilling Mud was used. Fresh Water Flush Before Setting Well Screen Yes
Well Developed by Development Time hrs
Groundwater Level @ 2 hrs @ 24 hrs Other



IT CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 435130	PROJECT NAME: Cedar Chemical		
BORING NUMBER: MW-14	COORDINATES:	DATE: 12-1-86	
ELEVATION:	GWL: Depth 13.0 Date/Time 12-1-86	DATE STARTED: 12-1-86	
ENGINEER/GEOLOGIST: HES	Depth 9'8" Date/Time 12-3-86	DATE COMPLETED: 12-4-86	
DRILLING METHODS: Dry Auger to 13.0', Wet Rotary to 56.0		PAGE 1 OF 2	

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (')	RECOVERY (FT)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
5	ST-1		1.5	Brown Clayey Silt with Sand Partings & Silt Seams -Bluish Gray Below 9.0' -with Sand Seams Below 9.5' -with Wood Fragments & Roots Below 18.0'		2.0	
10	ST-2		1.5			4.5	No Odor
15	ST-3		1.5			2.0	
20	ST-4		1.5			2.0	
25	ST-5		2.0	Greenish Gray Silty Clay with Silty Fine Sand -with Silt Partings Below 28.0'		0.5	
	ST-6		2/0			0.5	No Odor

NOTES:

IT CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 435130	PROJECT NAME: Cedar Chemical		
BORING NUMBER: MW-14	COORDINATES:	DATE: 12-1-86	
ELEVATION:	GWL: Depth 13.0 Date/Time 12-1-86	DATE STARTED: 12-1-86	
ENGINEER/GEOLOGIST: HES	Depth 9'8" Date/Time 12-3-86	DATE COMPLETED: 12-4-86	
DRILLING METHODS: Dry Auger to 13.0', Wet Rotary to 56.0'		PAGE 2 OF 2	

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (-)	RECOVERY (FT)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				-with Shell from 33.0' to 40.0'			No Odor
	ST-7		2.0			0.5	
35				Greenish Gray Clayey Silt with Silty Fine Sand -with Calcareous Nodules Below 43.0'			
	ST-8		2.0			0.5	
40							
	ST-9		2.0			2.0	No Odor
45	ST-10		2.0			2.0	
	ST-11		2.0			4.0	
50	ST-12		2.0			4.0	
				Greenish Gray Sandy Clay with Silt Pockets			
	ST-13		1.5			4.0	
55							

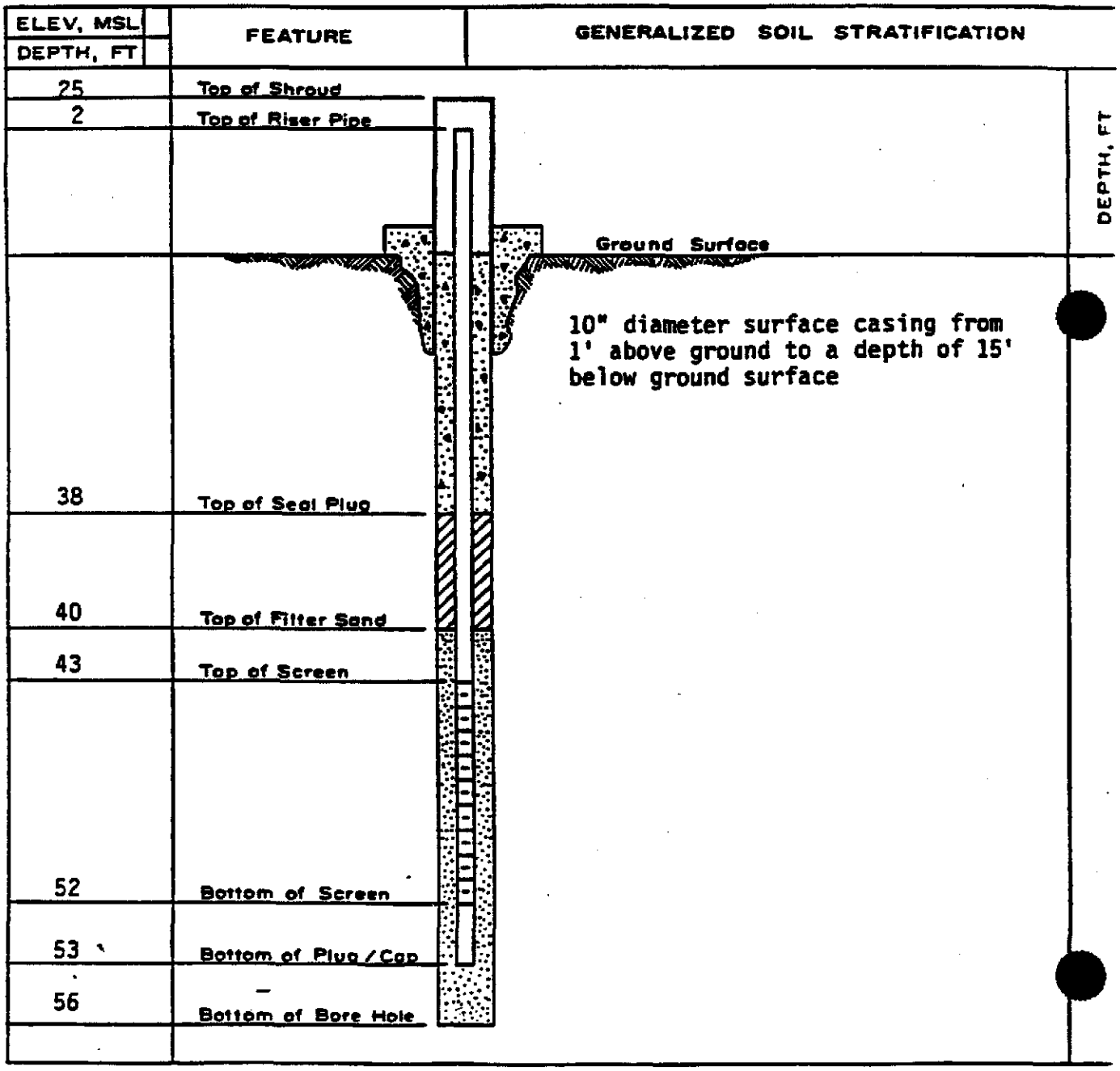
NOTES:

Bottom of Boring - 55.0'
Bottom of Well - 56.0'

LOG OF GROUNDWATER OBSERVATION WELL

Project & Location Vicksburg Chemical Vicksburg, Mississippi
Client Vicksburg Chemical Date of Report 7/15/88

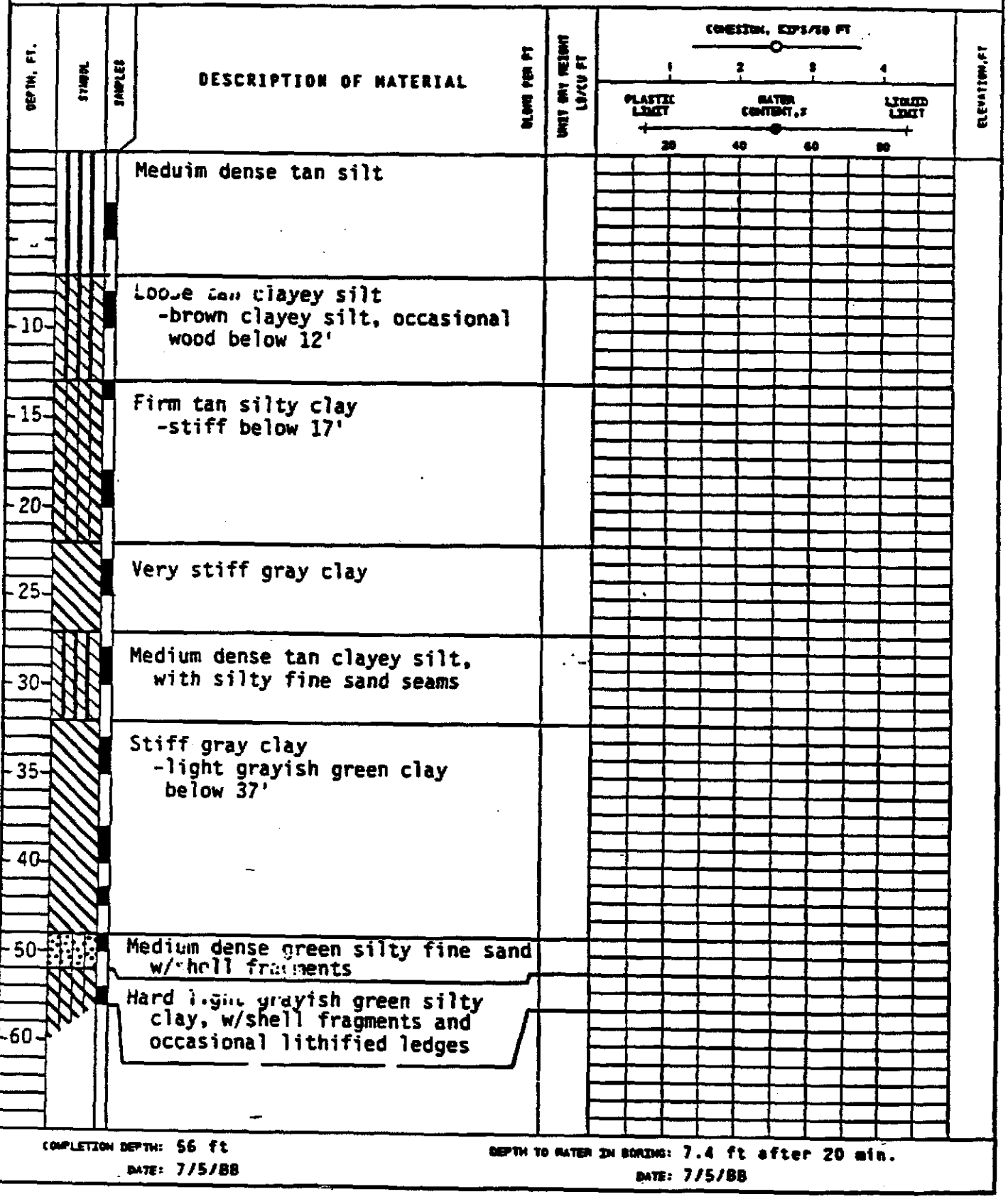
Observation Well No. 16 Date Completed 7/16/88 Technician J. Malanchak
Riser Pipe: Material PVC Diameter 4 in. Type of Joints thread
Screen: Material PVC Slot Size .010" Diameter 4 in. Length 10
Diameter of Borehole 8 in. Type of Filter Pack No. 3 blasing sand
Method of Placement of Filter Material 1¼" PVC tremie pipe
Type of Seal Above Screen bentonite pellets Backfill Above Seal cement/bentonit
Drilling Mud _____ used. Fresh Water Flush Before Setting Well Screen yes
Well Developed by air lift Development Time 1½
Groundwater Level @ 2 hrs N/A @ 24 hrs _____ Other _____



LOG OF BORING NO. MW-16
VICKSBURG CHEMICAL
VICKSBURG, MISSISSIPPI

TYPE: Rotary wash & Shelby tube

LOCATION: See Plate 1



COMPLETION DEPTH: 56 ft
DATE: 7/5/88

DEPTH TO WATER IN BORING: 7.4 ft after 20 min.
DATE: 7/5/88

RARE LIND FURLOW ENGINEERS

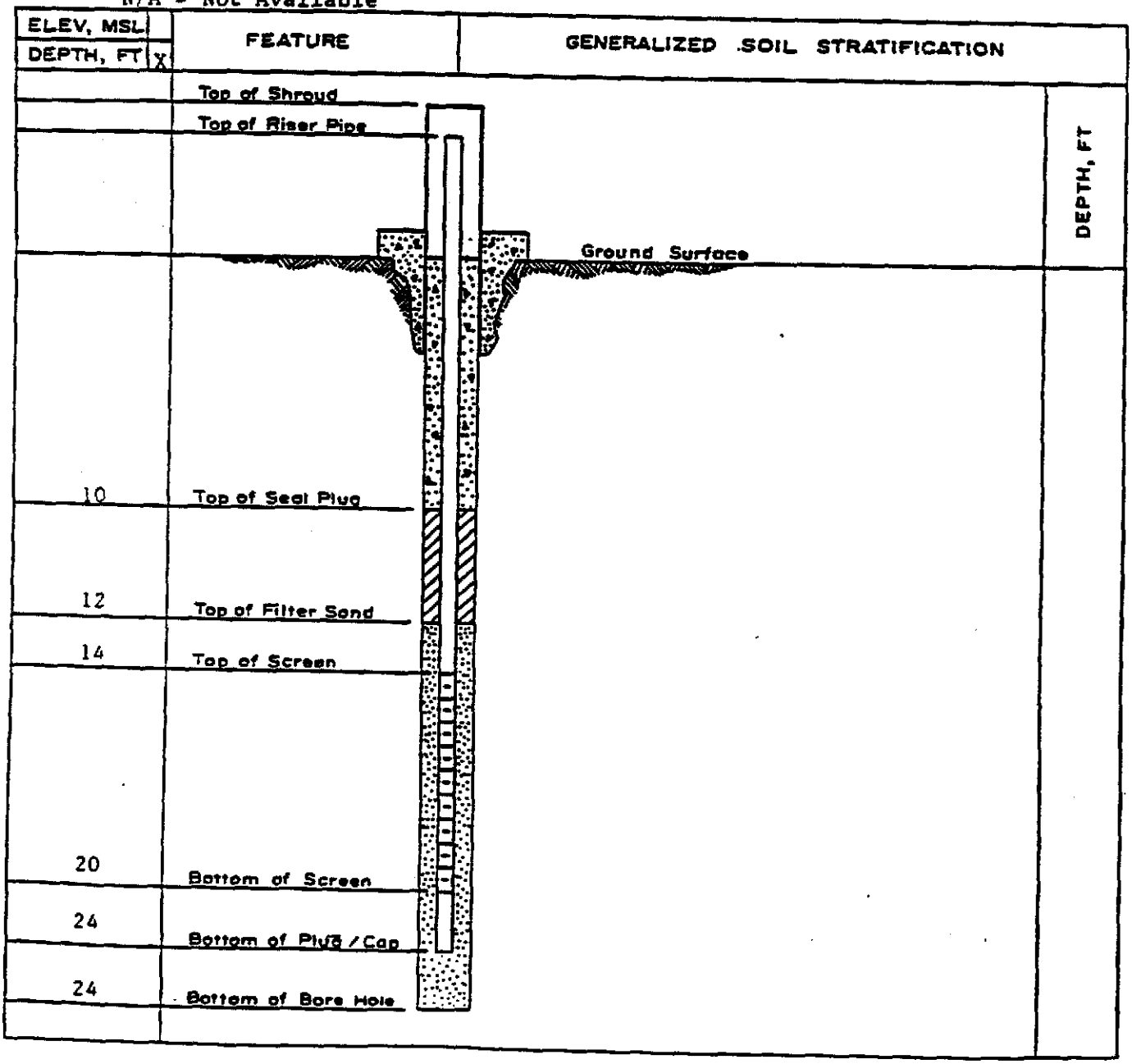
STE
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report

Observation Well No. 19B Date Completed 11/2/93 Technician B. Till
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs Other N/A

*N/A = Not Available



PZ-19E

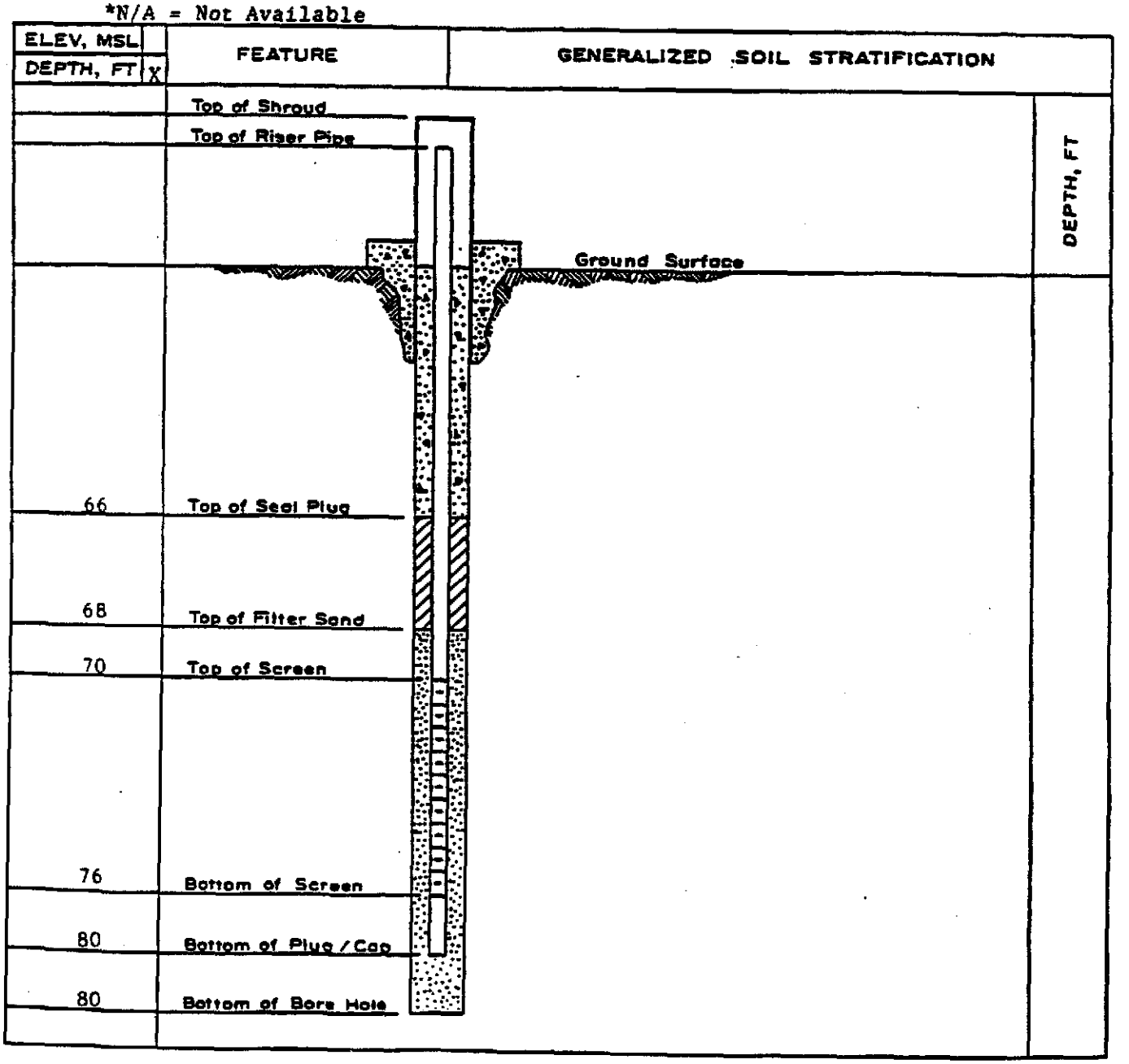
STE
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/2/93

Observation Well No. 19A Date Completed 11/2/93 Technician B. Till
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs _____ Other N/A

*N/A = Not Available



PZ-19A

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-19A
FILE: 92B007C-4001
DATE: 11/1/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 2

Hollow-stem Augered: Full Depth

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
0		3.0		12	Stiff tan Silty CLAYS (CL)
		1.5		18	—medium, 2'- 4'
5		>4.0		18	Very stiff tan Clayey SILTS / Silty CLAYS (ML/CL)
		0.75			
		0.75		24	—soft below 5'
		2.25		24	Soft tan and light gray Clayey SILTS, damp to wet (ML)
		<0.25			—stiff, 8'- 9'
10		1.00		24	—very soft, 9'- 10'
					—tan below 9'
		1.25		24	—wet, 9'- 16'
					—firm to dense below 10'
					—with ferrous streaks, 10'- 14'
					—with white specks, 12'- 16'
15		1.75		24	—with a trace of organics, 14'- 16'
		1.25		24	—damp, 16'- 24'
		1.25		18	
20		1.25		24	—with a trace of shell fragments, 20'- 24'
		1.25		24	
		1.50		18	—less clayey below 24'
25		1.50		24	
		2.25			Stiff gray Clayey SILTS / Silty CLAYS (ML/CL)
		2.50		16	Stiff light gray Silty CLAYS with silt pockets and ferrous streaks (CL)
30					
		1.75		24	Stiff light gray CLAYS (CH)
35					—with silt seams and calcareous nodules, slickensides, 33'- 35'
		1.75		24	—with silt and ferrous stains, organics, 38'- 40'
40					

Continued Next Page

Unified Soil Classifications based on visual observations.

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-19A
FILE: 92B007C-4001
DATE: 11/1/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 2 of 2

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
40					Stiff light gray CLAYS with silt seams and ferrous stains, organics (CH)
45		1.75		24	—tan and light gray, slickensides, 43'- 45' —with ferrous stains, 43'- 50'
50		2.75		24	—with white vertical streaks, 48'- 50'
55		2.5		24	—gray, slickensides, 53'- 55'
60		2.25		24	Dense light gray SANDS (SP) —with traces of silt and clay below 59.5' —with wood and alternating layers of clay and sandy clay below 60'
65					
70					
75					

Bottom of boring at 79'.
Borehole grouted full depth.

Unified Soil Classifications based on visual observations.

DEC 13 93 ENVIR34 28007

Woodward-Clyde Consultants

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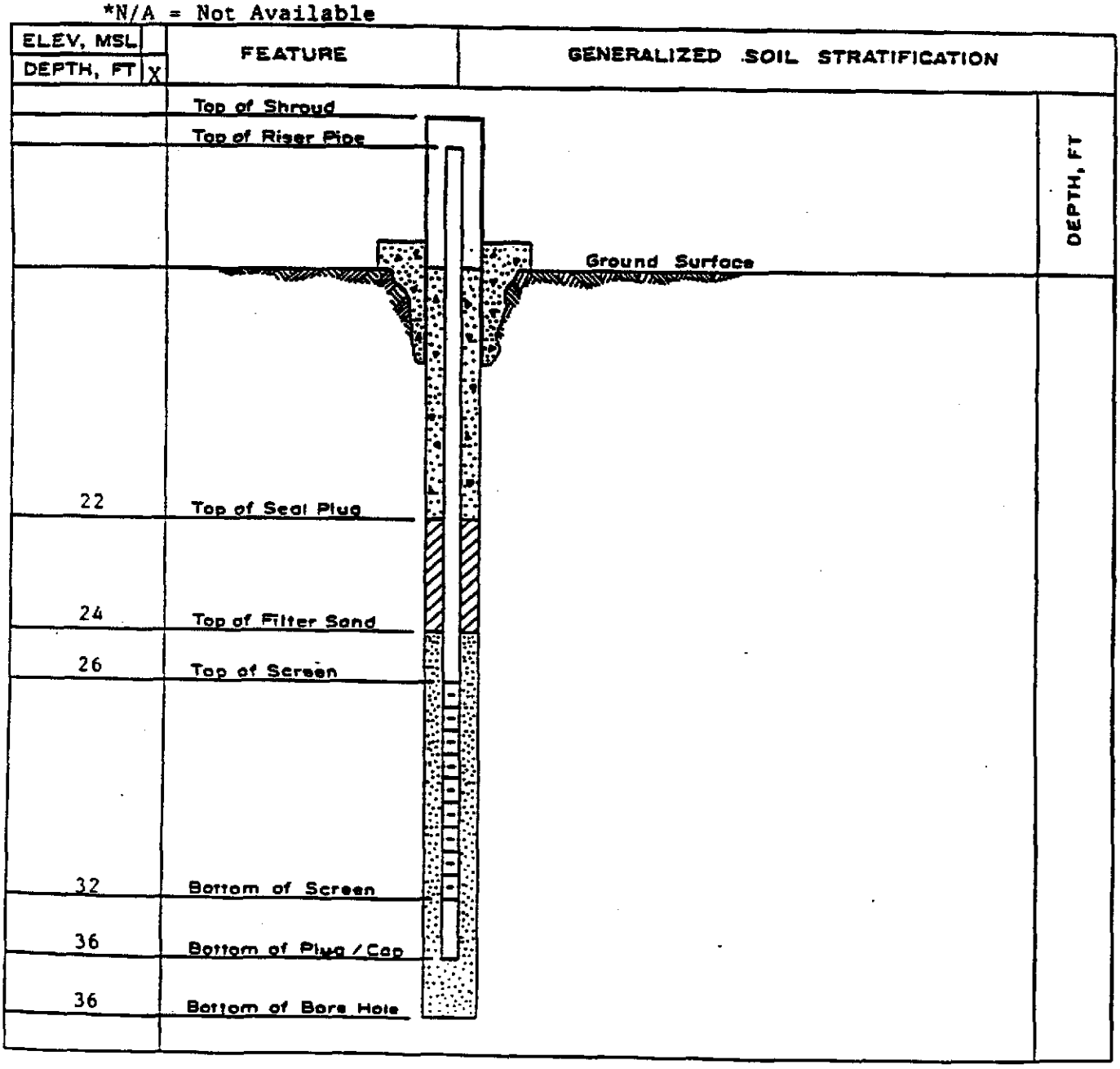
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/10/93
Observation Well No. 12 26B Date Completed 11/10/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs _____ Other N/A

*N/A = Not Available



LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-12B(R)
FILE: 92B007C-4001
DATE: 11/10/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 1

Hollow-stem Augered: Full Depth

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
0					Augered down to 12' B.L.S.
10		NR			Firm tan Clayey SILTS, wet (ML)
15		1.00		14	—with a trace of organics and white specks, 14'- 16'
		0.75		24	—tan and light gray below 16'
		0.50		24	—with a trace of rootlets, 18'- 20'
20		0.50		24	—with a trace of organics below 20'
		1.25		16	—firm to dense, with a trace of ferrous nodules, 22'- 26'
25		1.50		20	—damp, 24'- 28' —light gray below 25'
		2.00		24	—dense, 26'- 28'
		<0.25		14	—loose to firm, 28'- 30' —wet below 28'
30		0.25		24	—firm, 30'- 32'
		2.25		20	—dense below 32' —with a trace of organics and shell fragments, 32'- 34'
35		3.50		14	Dense to stiff light gray Clayey SILTS / Silty CLAYS (ML/CL)
					Bottom of boring at 36'. Borehole grouted full depth. Set piezometer with screen interval at 26'- 36' BLS.

NR = No Recovery

Unified Soil Classifications based on visual observations.

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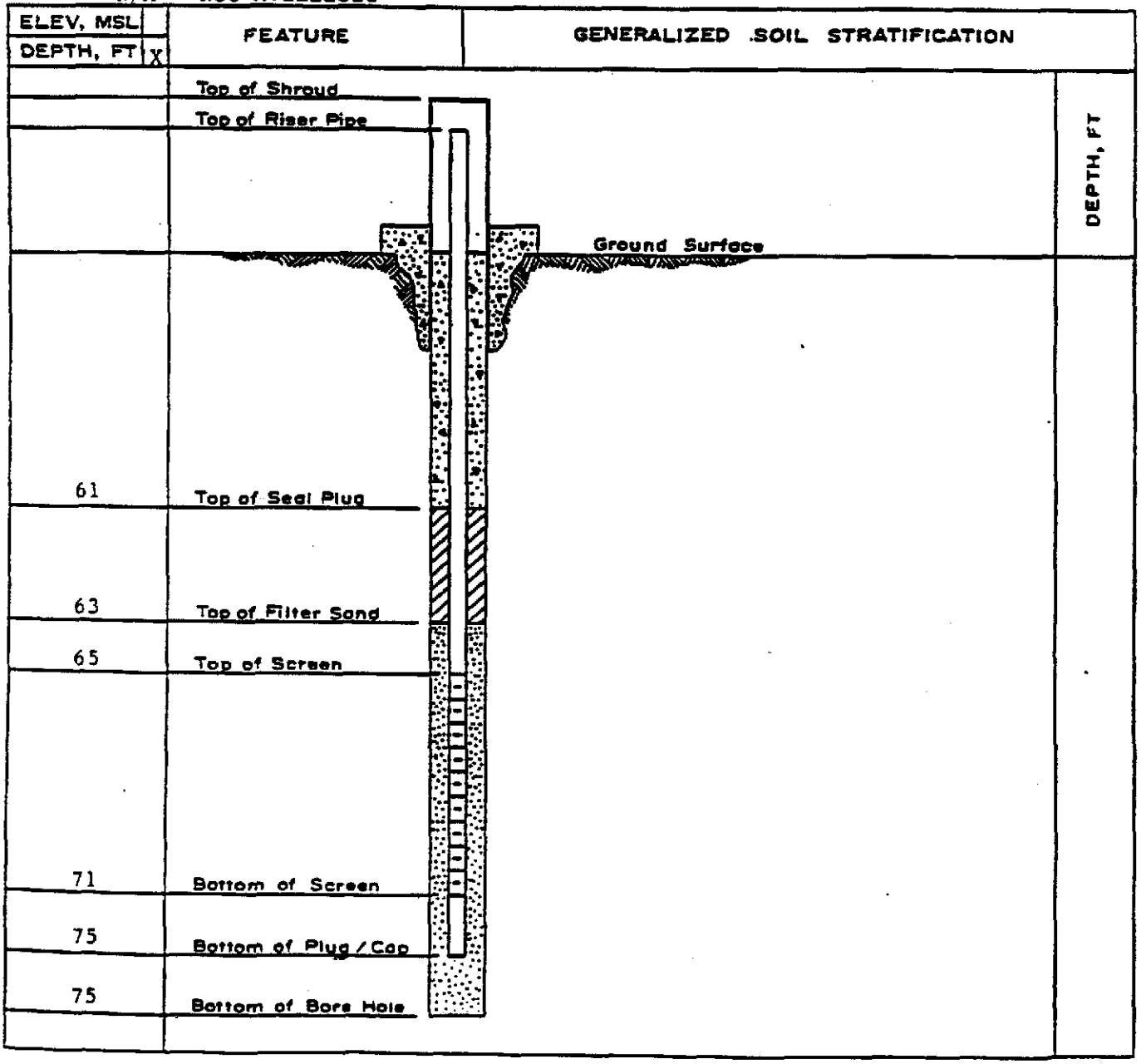
MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/11/93
Observation Well No. 26A Date Completed 11/11/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 Used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs _____ Other N/A

*N/A = Not Available



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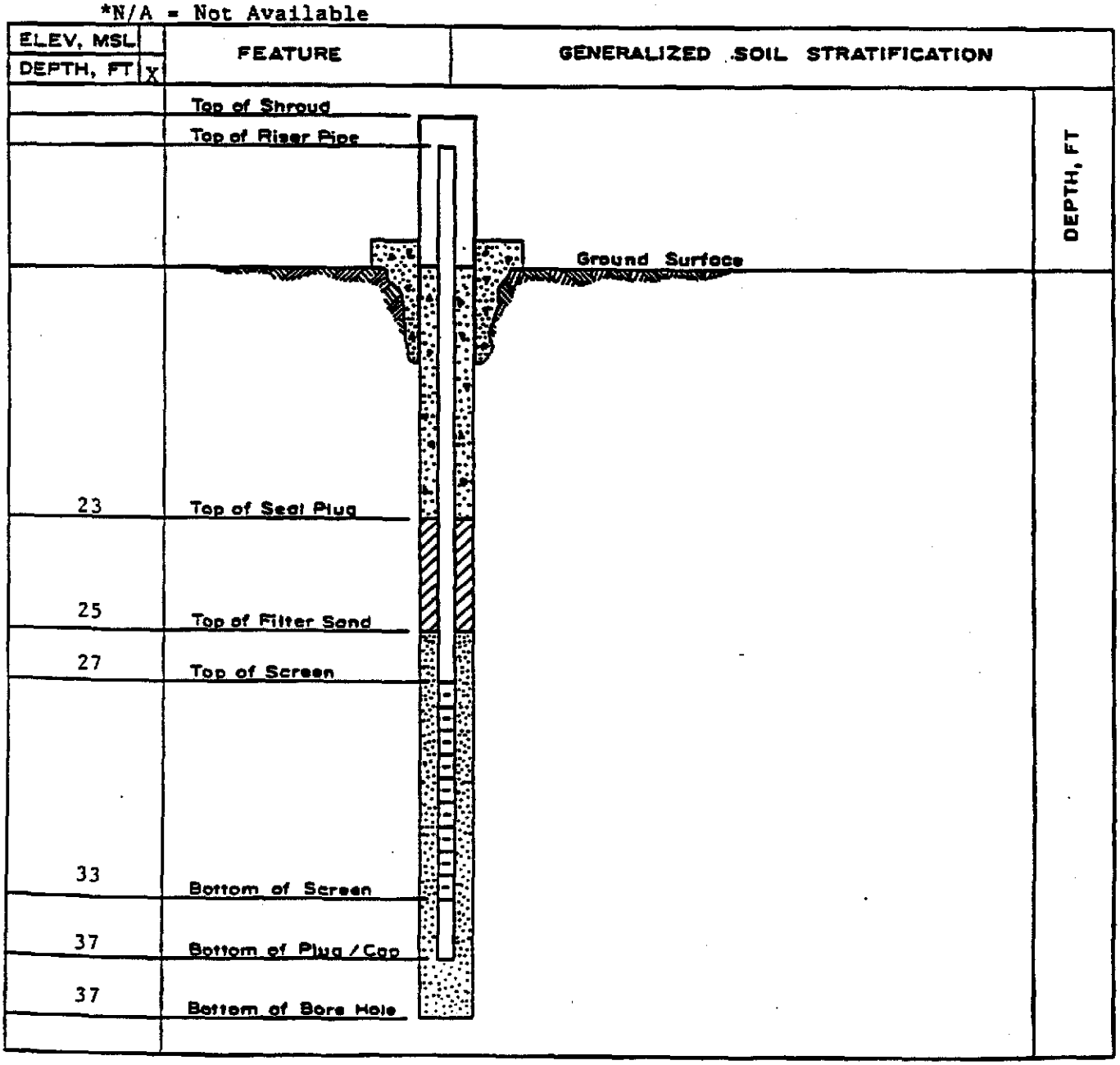
MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 10/28/93

Observation Well No. 20B Date Completed 10/28/93 Technician R. Sanders
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs Other N/A

*N/A = Not Available



PZ-20E

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-20B
FILE: 92B007C-4001
DATE: 10/28/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 1

Hollow-stem Augered: Full Depth

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
0					Medium tan SILTS with white streaks (ML)
5					
10					
15				9	
20					
25					
30					
35		1.25		24	Medium CLAYEY SILTS with little moisture (ML)
		1.25		24	Medium light gray fine SILTS (ML)

Bottom of boring at 39'.
Borehole grouted full depth.

Unified Soil Classifications based on visual observations.

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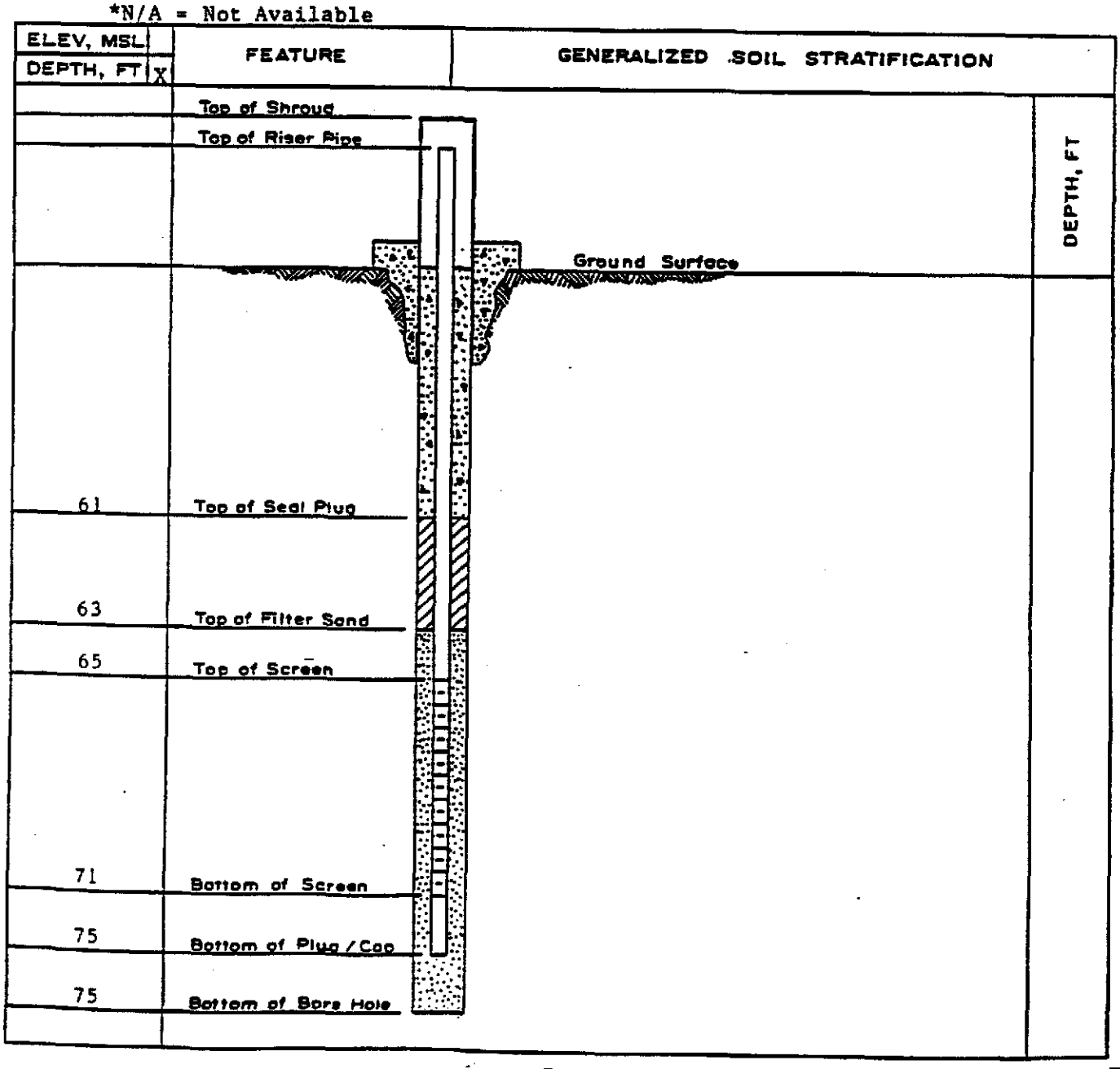
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 10/28/93

Observation Well No. 20A Date Completed 10/28/93 Technician R. Sanders
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs _____ Other N/A

*N/A = Not Available



LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-20A
FILE: 92B007C-4001
DATE: 10/26/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 2

Hollow-stem Augered: Full Depth

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)				Description of Stratum
0		4.5		6				Stiff tan and light gray Silty CLAYS (CL)
		–		2				
5		0.75		12				—soft, 4'- 8'
		1.75		12				—medium, tan, 8'- 10'
10		>4.5		14				
		>4.5		0				Soft, brown and tan Silty CLAYS / Clayey SILTS (CL/ML)
		1.50PT 0.25PB		24				
15		>0.25		24				—firm, with ferrous nodules below 16'
		1.25PT 0.75PB		24				
20								—becomes medium to stiff at 20' —brown, 20'- 21' —soft, 21'- 22'
				24				—tan below 21' —firm to dense, 22'- 33'
25				24				
				24				—with shell fragments and traces of ferrous nodules below 26'
30				6				
				12				Medium to dense, light gray and tan Clayey SILTS (ML)
35								
		2.5		24				Stiff light gray Silty CLAYS with silt pockets (CL)
40								

Continued Next Page

Unified Soil Classifications based on visual observations.

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-20A
FILE: 92B007C-4001
DATE: 10/26/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 2 of 2

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
40					Stiff light gray Silty CLAYS with silt pockets (CL)
		3.75		24	
45					—with shells and sandy clay at 45'
		2.25		24	—slickensided, with ferrous stains and silt pockets, 48'- 50'
50					
		1.75		24	—with more silt below 53'
55					
		–		24	—with a layer of medium light gray silty sand at 58'
60					
		–		18	—medium, with organics, becoming more clayey, 63'- 65'
65					
		NR			Firm to dense gray medium to coarse SANDS with a trace of gravel and clay (SP)
70					
				24	Alternating layers of CLAYS and Clayey SILTS with shells (CH/ML)
75					Bottom of boring at 75'. Borehole grouted full depth.

Unified Soil Classifications based on visual observations.

DEC 13 93 ENVIR34 28007

Woodward-Clyde Consultants

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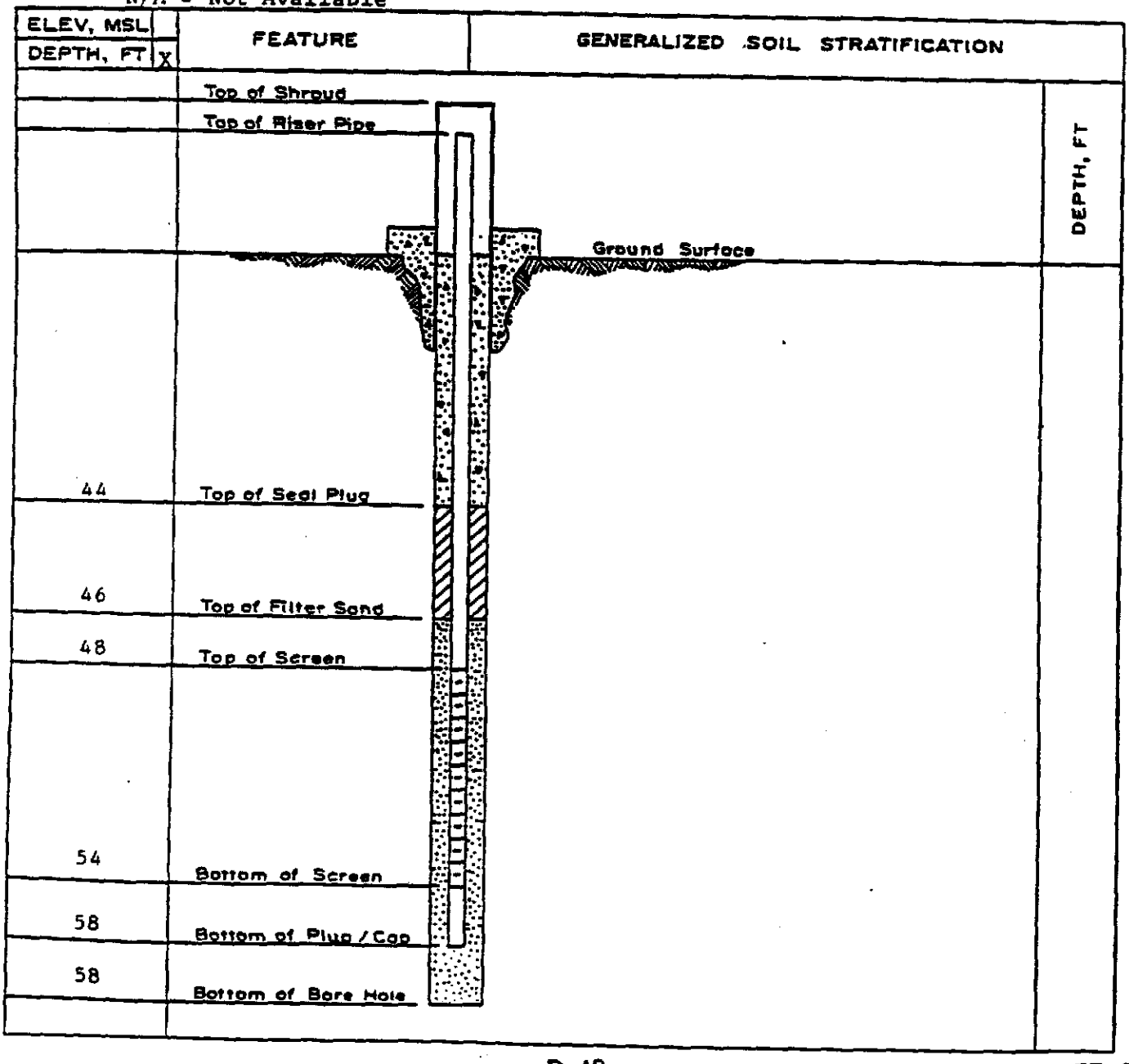
MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/5/93

Observation Well No. 21A Date Completed 11/5/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs Other N/A

*N/A = Not Available



PZ-21A

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-21A
FILE: 92B007C-4001
DATE: 11/3/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 2

Hollow-stem Augered: Full Depth

Free water was encountered at a depth of 33' during hollow stem augering. The water level rose to depths of 33.1' and 32.9' after observation periods of 10 and 15 minutes, respectively.

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)				Description of Stratum
0								CLAYS, shell and gravel (FILL)
5		>4.0		24				Very dense tan Clayey SILTS (ML)
		2.5						
		2.0		24				—becoming firm to dense at 5.75'
		2.5						—with a trace of ferrous stains below 6'
		2.25		24				Stiff light gray and tan Silty CLAYS (CL)
10		1.5		24				—with a trace of organics and ferrous stains, 8'- 15.5'
								—medium below 10'
		1.75		24				
		1.75		24				
15		2.5		24				—stiff, gray below 15.5'
								—with rootlets, 15.5'- 18'
								—with silt pockets below 16'
		2.5		24				—with ferrous stains, 16'- 26'
20		2.25		24				
		2.25		24				
		1.75		24				
25		–		24				—with white vertical seams and streaks, 25'- 26'
		3.0		24				—light gray and tan, 28'- 30'
30								
		2.25		24				Alternating layers of stiff gray Silty CLAYS and firm to dense light gray Clayey SANDS (CL/SC)
35								
		–		24				—with a layer of wood at 39.5'
40								

Continued Next Page

Unified Soil Classifications based on visual observations.

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-21A
FILE: 92B007C-4001
DATE: 11/3/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 2 of 2

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)				Description of Stratum
40								Alternating layers of stiff gray Silty CLAYS and firm to dense light gray Clayey SANDS (CL/SC)
45		–		22				Firm to dense light gray medium to coarse SANDS becoming stiff light gray Silty Sandy CLAYS (SP/CL)
		0.50		24				—soft, gray below 48'
50								
55		NR						
		NR						Bottom of boring at 58.5'. Borehole grouted full depth. Piezometer installed in borehole.

Unified Soil Classifications based on visual observations.

DEC 13 93 ENVIR54 28007

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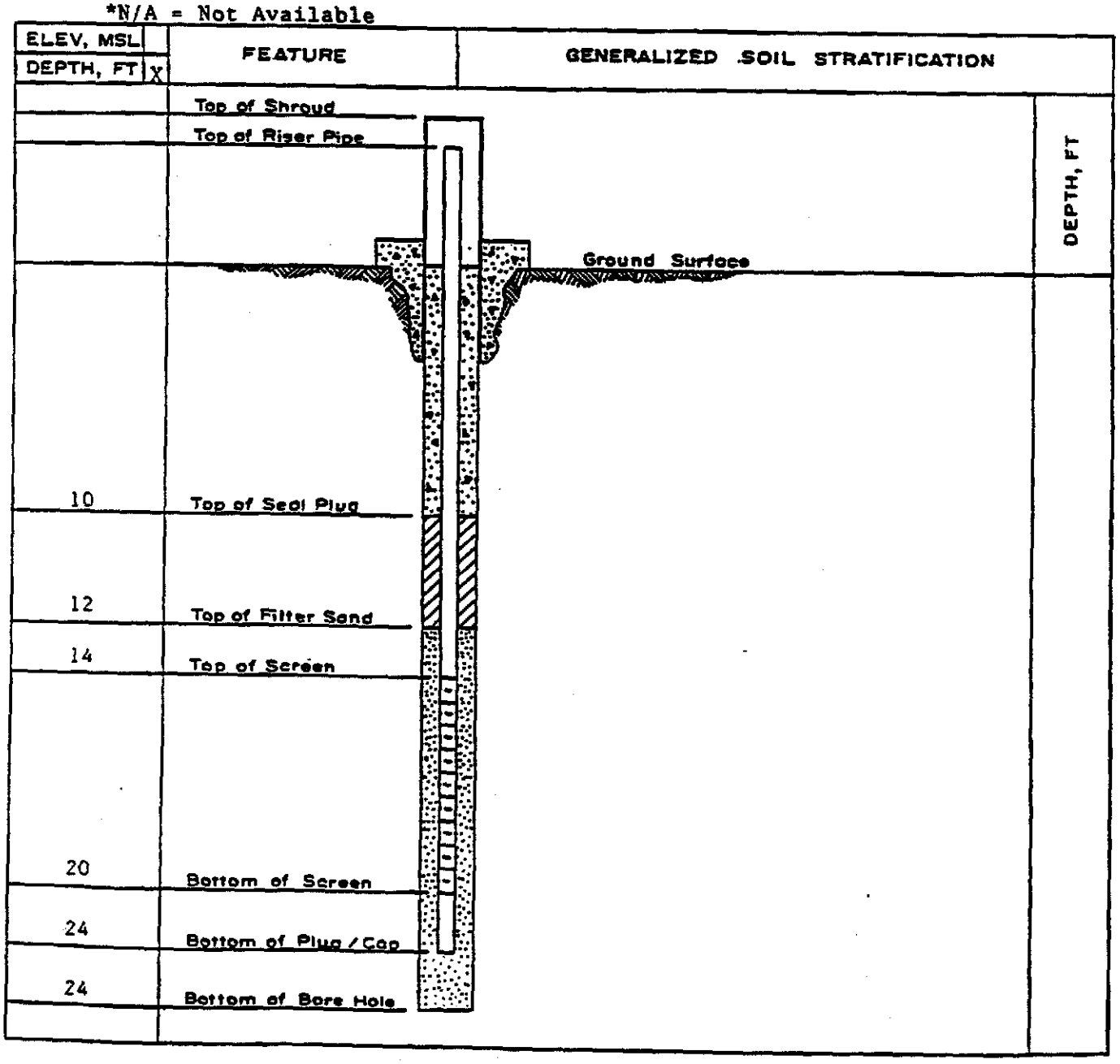
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/8/93

Observation Well No. 22B Date Completed 11/8/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs _____ Other N/A

*N/A = Not Available



PZ-22B

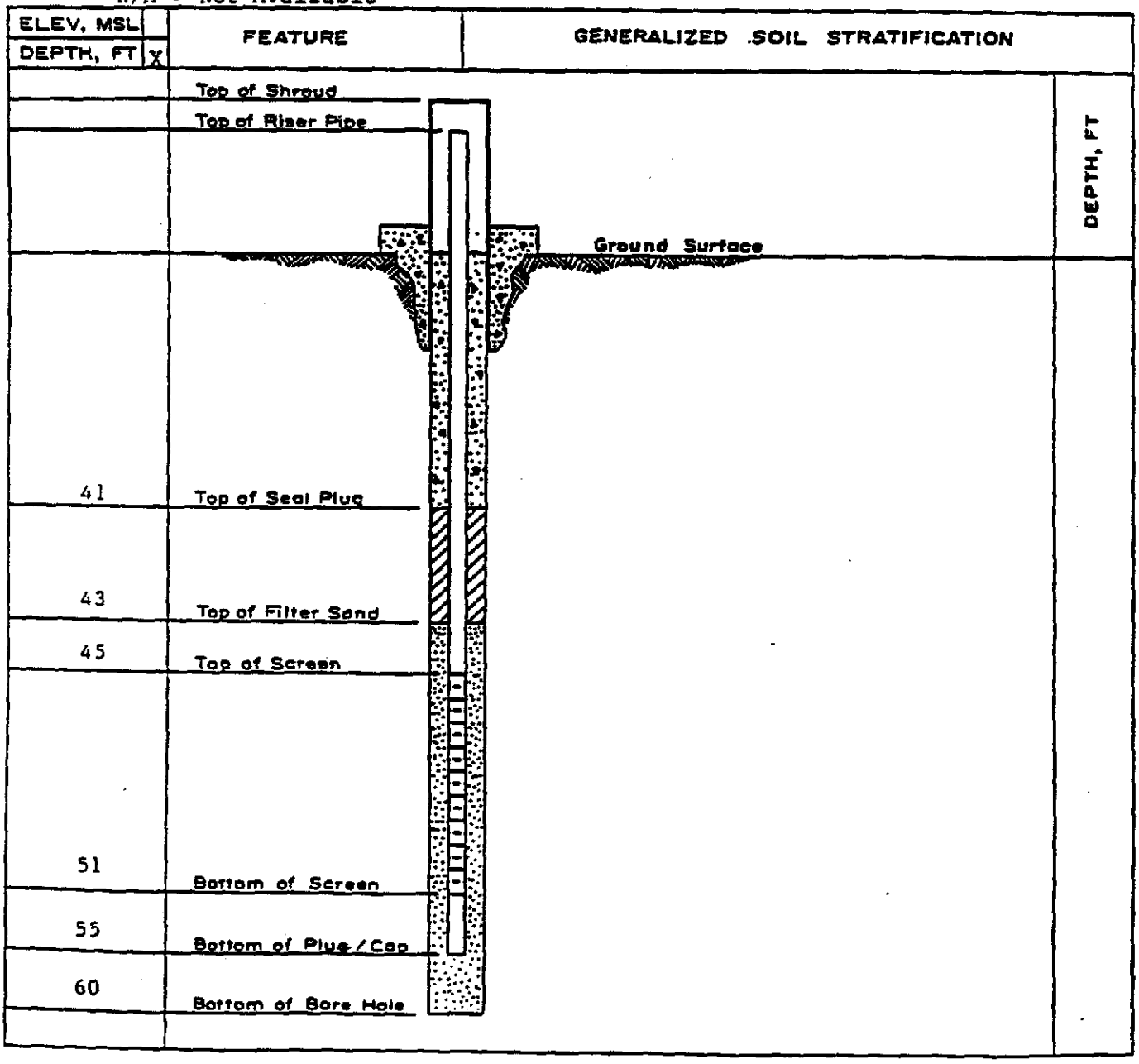
STE
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/6/93

Observation Well No. 22A Date Completed 11/6/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs _____ Other N/A

*N/A = Not Available



LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-22A
FILE: 92B007C-4001
DATE: 11/6/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 2

Hollow-stem Augered: Full Depth

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)				Description of Stratum
0								Toe of slope and Drainage Ditch Fill Material (FILL)
5		2.25		20				Firm to dense tan and light gray Clayey SILTS with ferrous stains (ML)
		2.25		22				—with more silt, 6'- 8'
		2.25		22				—tan, with more ferrous stains, 8'- 10'
10		2.50		24				—tan and light gray with more silt, 10'- 12'
		3.00		24				—light gray below 12' —with shell fragments, 12'- 18' —damp to wet, 12'- 22'
15		2.75		24				
		1.75		22				—gray, with a trace of organics, 16'- 20'
		1.50		24				
20		1.50		24				—gray and tan, with more clay, 20'- 22'
		1.75		24				—light gray, with a trace of shell fragments below 22'
25								
		2.75		24				Dense to stiff light gray Clayey SILTS / Silty CLAYS with silt pockets and a trace of shell fragments (ML/CL)
30								
35								
40								

Continued Next Page

Unified Soil Classifications based on visual observations.

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-22A
FILE: 92B007C-4001
DATE: 11/6/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 2 of 2

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(taf)	OVA (ppm)	Recovery (inch)	Description of Stratum
40					Dense to stiff light gray Clayey SILTS / Silty CLAYS with silt pockets and a trace of shell fragments (ML/CL)
45					
50					Bottom of boring at 52'. Borehole grouted full depth. Set piezometer in borehole.

Unified Soil Classifications based on visual observations.

DEC 13 93 ENVIR34 28007

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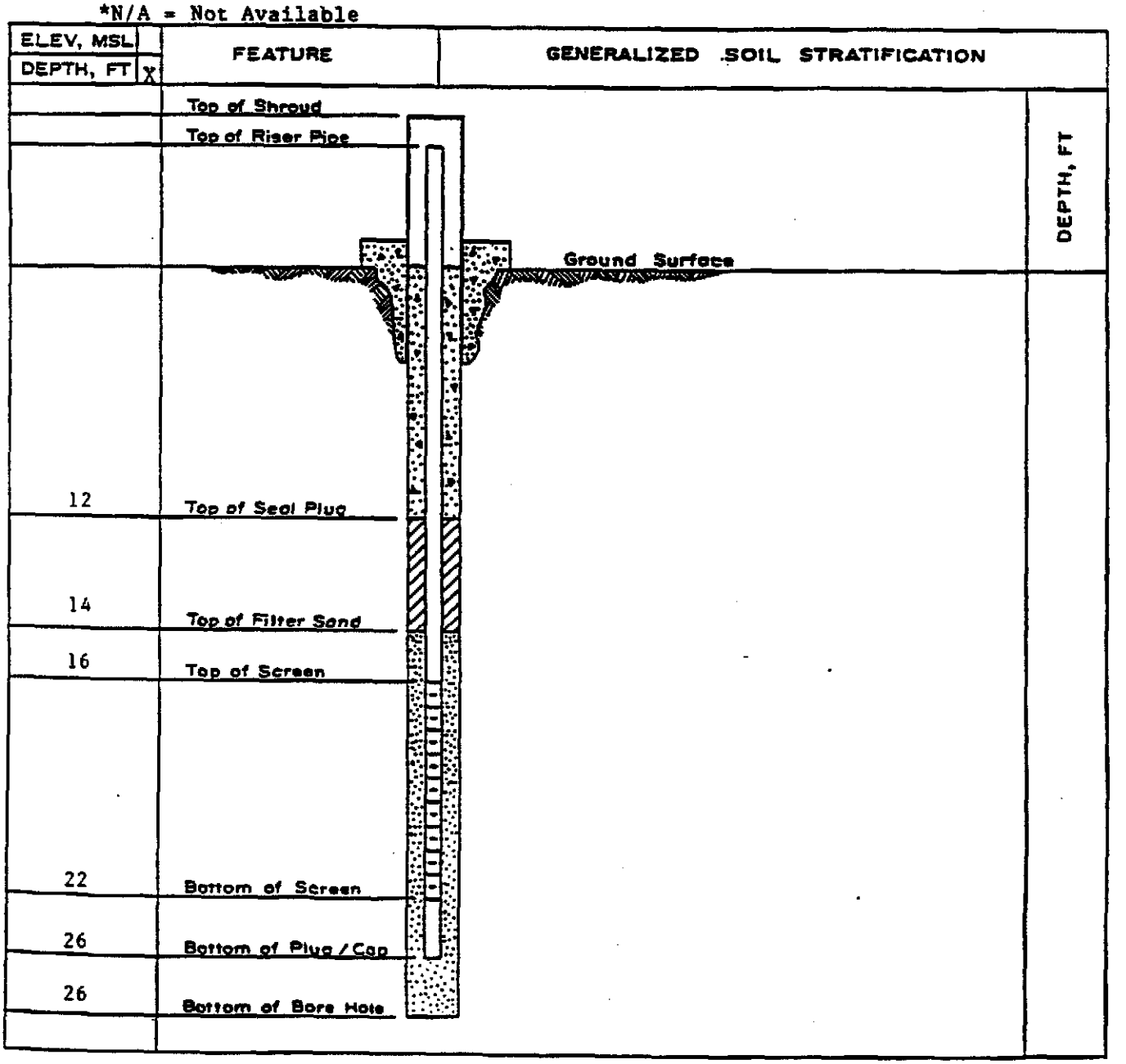
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/8/93

Observation Well No. 23B Date Completed 11/8/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs Other N/A

*N/A = Not Available



PZ-23B

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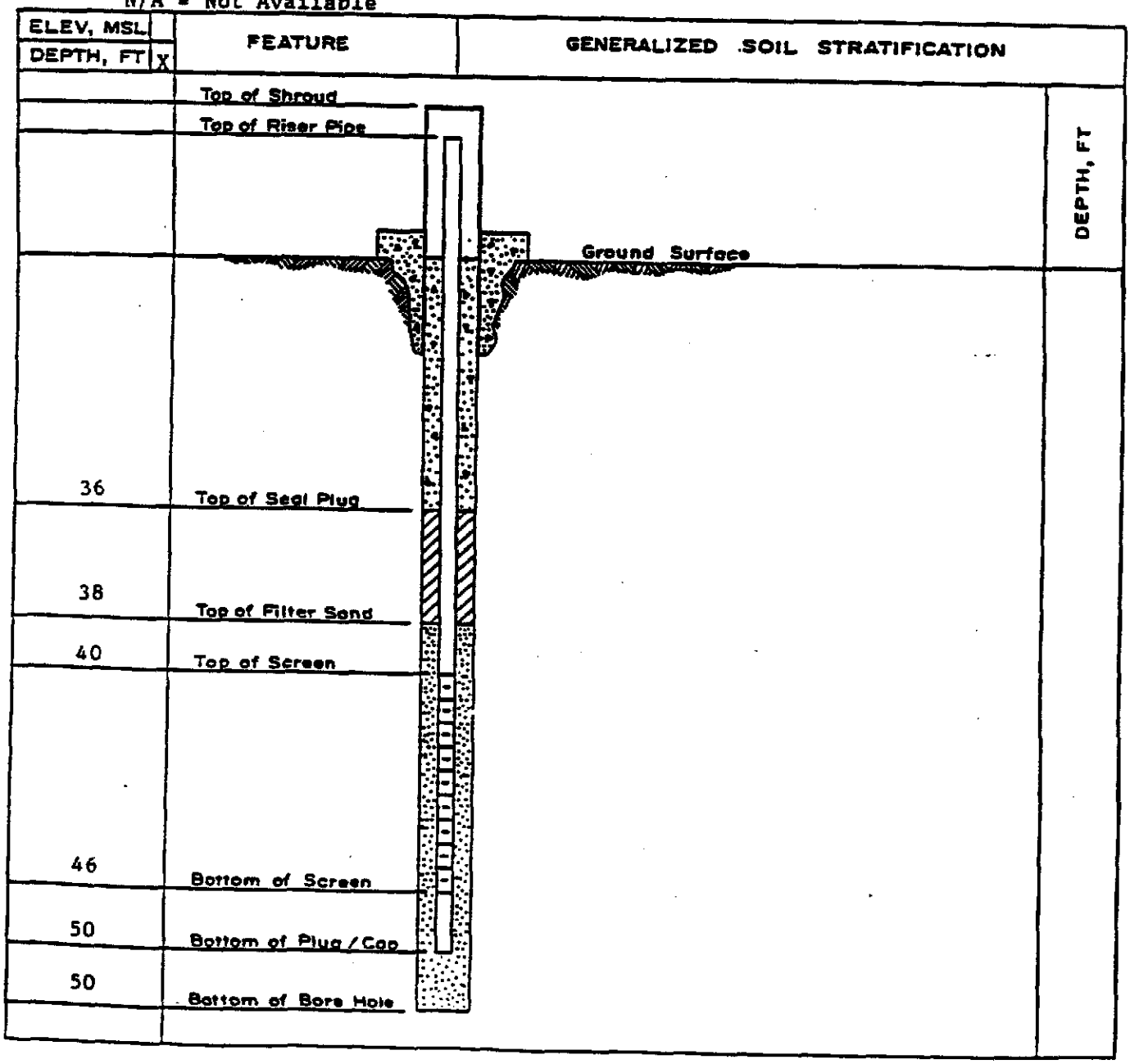
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/7/93

Observation Well No. 23A Date Completed 11/7/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs Other N/A

*N/A = Not Available



LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-23A
FILE: 92B007C-4001
DATE: 11/7/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 2

Hollow-stem Augered: Full Depth

Free water was encountered at a depth interval of 16'- 18' during hollow stem augering. The water level rose to depths of 15.65' and 15.25' after observation periods of 15 and 20 minutes, respectively.

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
0					Limestone and FILL (FILL)
5		1.25		22	Firm to dense tan and dark gray Clayey SILTS, damp (ML)
		1.00		24	—with organics, 4'- 6'
		1.00		20	—tan below 6'
10		2.25		24	—tan and light gray, with a traces of rootlets, 10'- 12'
		3.00		24	Dense to stiff light gray and tan Clayey SILTS / Silty CLAYS with traces of ferrous stains (ML/CL)
15		3.00		24	
		4.25			—dense, 15'- 16'
		<4.50		24	—dense to stiff, light gray with greenish gray streaks, 16'- 20'
		2.00		16	
20		2.00		18	—stiff, light gray below 20'
		–		16	Dense light gray medium to coarse SANDS, wet (SP)
		2.00			
25		2.00		14	Stiff light gray and gray Silty CLAYS (CL)
		2.50		24	—with silt pockets and traces of ferrous stains, slighly slickensided and blocky fractures, 24' - 31.5'
		2.00		24	—with a trace of calcareous nodules, 26'- 31.5'
30		2.00		24	—with a trace of organics at 30'
		0.50			
35					Firm to dense light gray and tan Clayey SANDS (SC)
		2.00		24	Stiff light gray and tan Silty Sandy CLAYS with a trace of ferrous nodules (CL)
40					

Continued Next Page

Unified Soil Classifications based on visual observations.

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-23A
FILE: 92B007C-4001
DATE: 11/7/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 2 of 2

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
40					Stiff light gray and tan Silty Sandy CLAYS with a trace of ferrous nodules (CL)
		2.50		24	
		0.50			
45					Stiff gray Silty CLAYS with fine sand layers (CL)
		3.00		18	
					—greenish gray, slightly blocky fractures and a trace of gravel below 48'
50					Bottom of boring at 50'.
					Borehole grouted full depth.
					Piezometer installed in borehole.

Unified Soil Classifications based on visual observations.

DEC 13 93 ENVIRS4 28007

Woodward-Clyde Consultants

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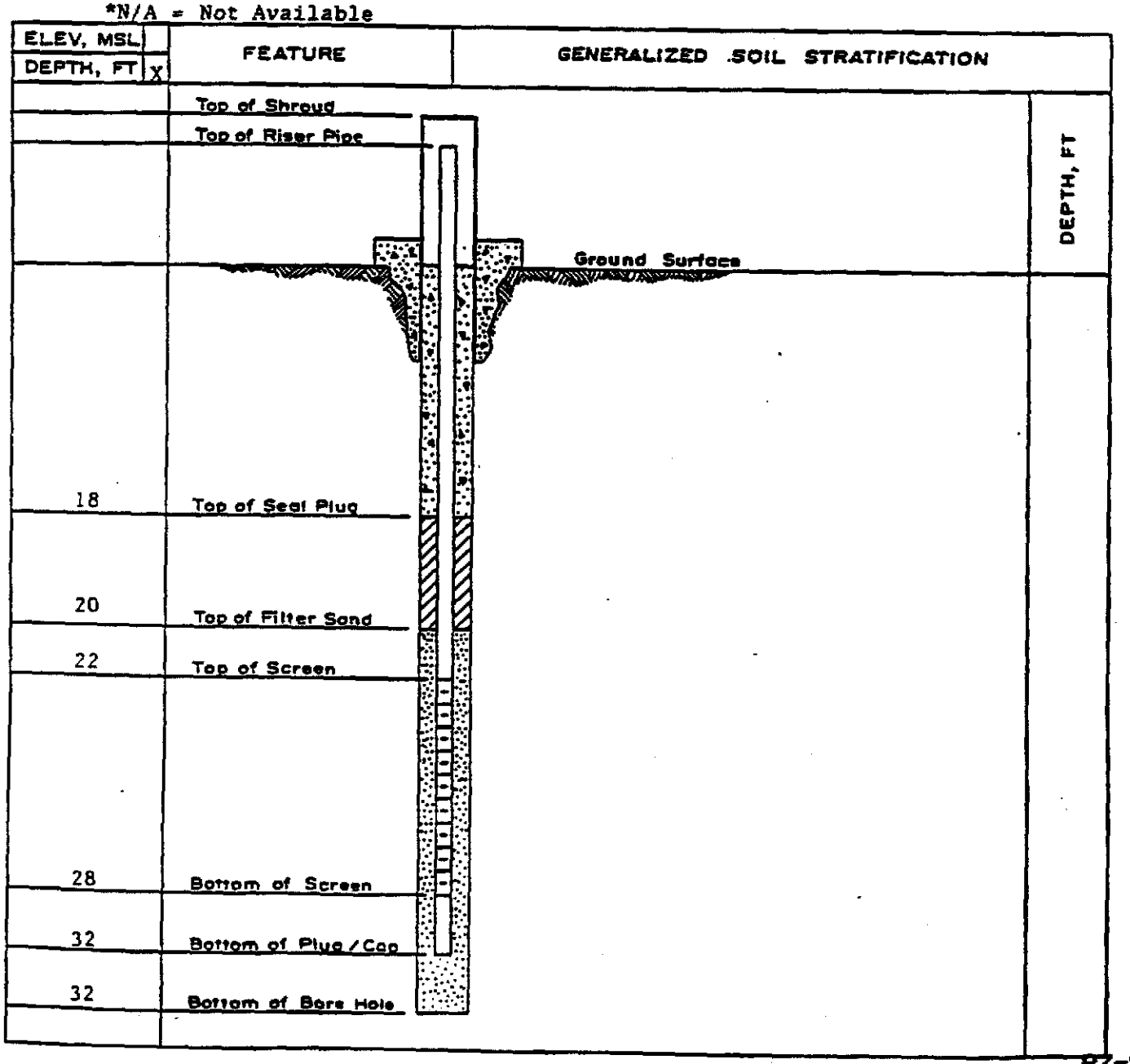
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/9/93

Observation Well No. 24B Date Completed 11/9/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs _____ Other N/A

*N/A = Not Available



PZ-24B

LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-24B
FILE: 92B007C-4001
DATE: 11/9/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 1

Hollow-stem Augered: Full Depth

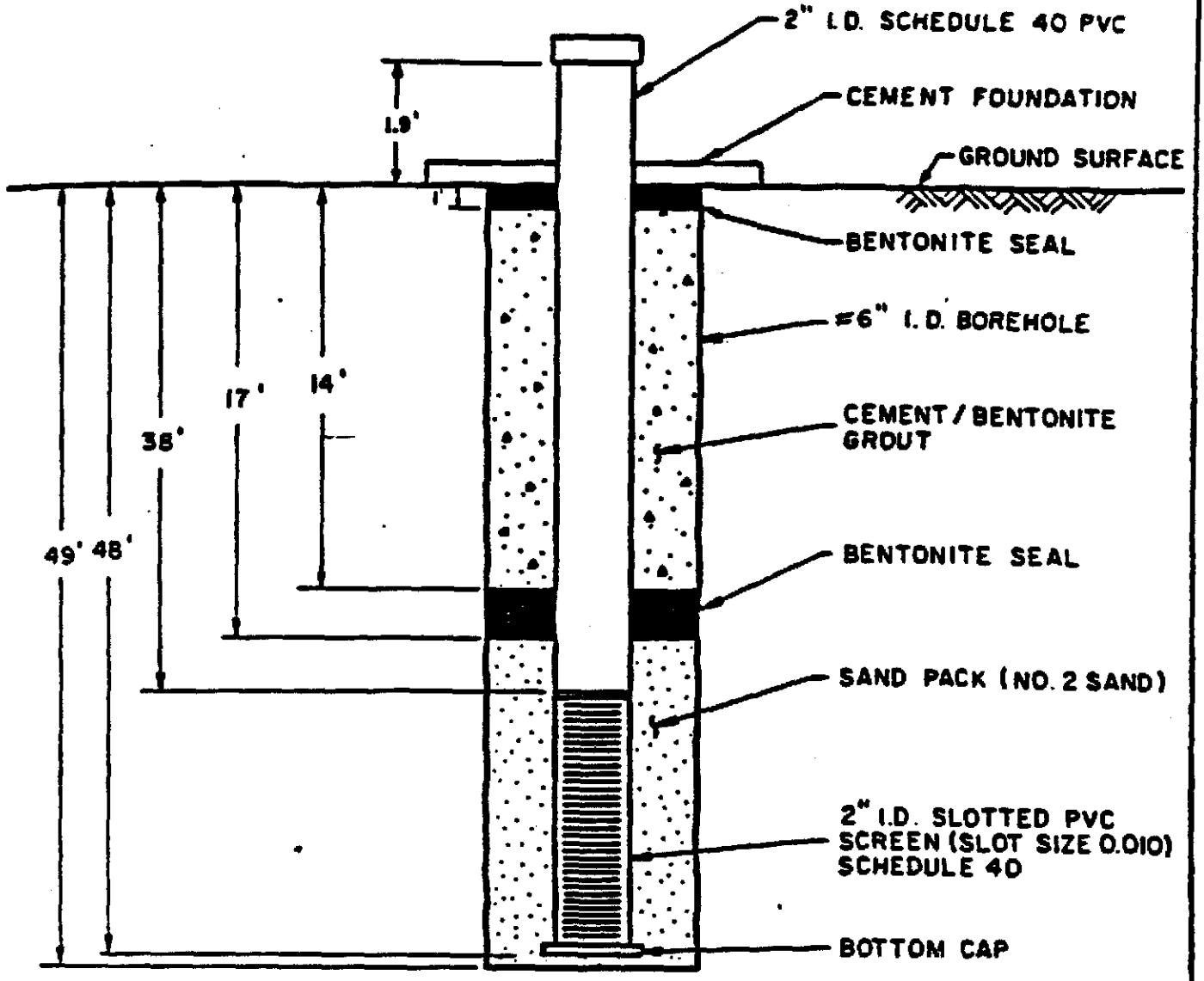
DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
0					Limestone / Gravel FILL (FILL)
5		1.50		24	Firm to dense tan Clayey SILTS with a trace of gravel (FILL)
		2.25		12	
		3.25		20	Firm to dense tan Clayey SILTS (ML)
10		2.00		24	—with 6" layer of dark brown layer at 10.7'
					—moist to damp below 10'
		2.00		24	—with a trace of organics, 12'- 15'
					—with ferrous stains below 12'
		0.25		24	—tan and light gray, 14'- 21'
15		0.50			
		2.25		24	
		1.75		24	
20		0.75		20	
		0.50		22	Medium gray and dark gray Silty CLAYS with a trace of ferrous stains (CL)
25		1.00		22	Medium to stiff light gray Sandy CLAYS (CL)
		0.75		24	—with ferrous stains and a trace of white specks to 26'
					—medium, with a trace of organics, 26'- 28'
		0.25		24	—damp below 26'
					—soft, gray, 28'- 30'
30		1.75		24	Stiff light gray Silty Sandy CLAYS with a trace of ferrous stains and blocky fractures (CL)
					Bottom of boring at 32.5'.
					Borehole grouted full depth.
					Piezometer installed in borehole.

Unified Soil Classifications based on visual observations.

DEC 13 93 ENVIRS4 2B007

Woodward-Clyde Consultants

PZ-24B



DATE INSTALLED: 12/7/84

ELEVATION, TOP OF CASING: 114.24'

FIGURE

PIEZOMETER PZ-4
CONSTRUCTION DETAILS

PREPARED FOR

VERTAC CHEMICAL CORP.
VICKSBURG, MS.

DRAWING NOT TO SCALE

DRAWN BY DRS 12/10/84 CHECKED BY APPROVED BY DRAWING NUMBER 8465-3-A

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER 846545	PROJECT NAME VERTAC Chemical		
BORING NUMBER PZ-4	COORDINATES	DATE 12/7/84	
ELEVATION 114.24 Ft. MSL (TofC)	GWL: Depth / Date/Time	DATE STARTED 12/7/84	
ENGINEER/GEOLOGIST JDD	Depth / Date/Time	DATE COMPLETED 12/7/84	
DRILLING METHODS Auger & Rotary Wash		PAGE 1 OF 2	

DEPTH (FT)	SAMPLE TYPE & NO	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0			Gravel mixed w/shells 4.0'-5.0'			
5			Brown, Silty-clay, w/gravel	CL		
10						
15			Gray-tan color 12'-18' Clayey-Silt	ML		
20	ST-1		Dark gray, organics		.75	Sample 19.5'-20.0', moist, Light grey silt seams
25						
30						

NOTES:

Used 6" auger from 0'-15'. Rotary wash from 15'-49'. Lost water between 4.0'-5.0' and therefore used 6' of surface casing to block it off while drilling.

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER 846545	PROJECT NAME VERTAC Chemical	
BORING NUMBER: P7-4	COORDINATES:	DATE: 12/7/84
ELEVATION: 114.24 Ft. MSL (TofC)	GWL: Depth Date/Time	DATE STARTED: 12/7/84
ENGINEER/GEOLOGIST: JDD	Depth Date/Time	DATE COMPLETED: 12/7/84
DRILLING METHODS: Auger & Rotary Wash		PAGE 2 OF 2

DEPTH (FT)	SAMPLE TYPE & NO	PROFILE	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
30			Wood & grass cuttings @ 30.0'			
35			Light gray, silt w/clay @ 37.0'			
40						
45	ST-2		Gray, clayey-sand, very calc., brown mottled areas	SC	1.5	Sample 44.0'-44.5'
			Mix marl @ 49.0'			
50			Bottom of boring @ 49.0'			

NOTES:

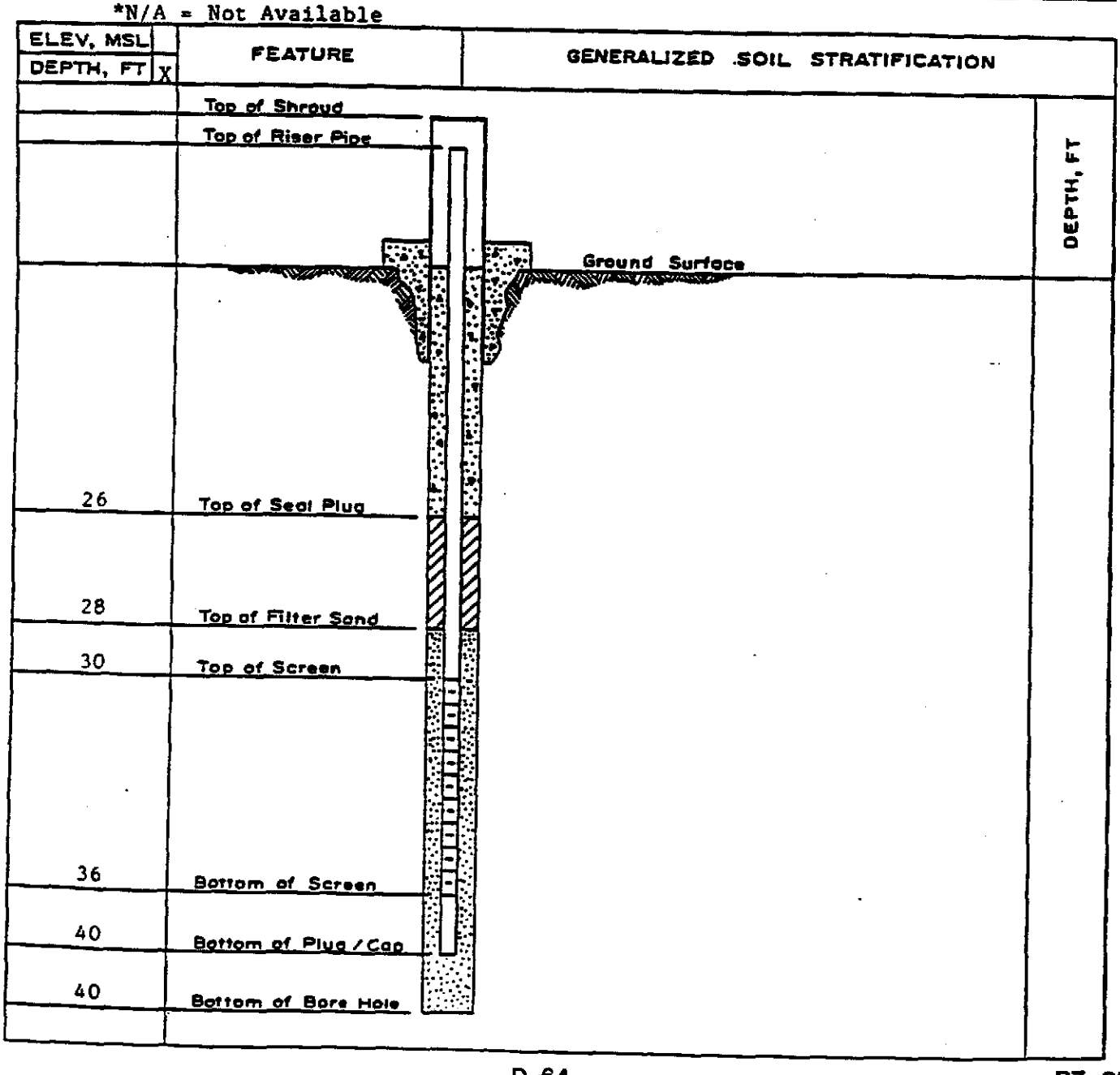
STE
Soil Testing Engineers, Inc.

MONITOR WELL LOG

Project & Location Vicksburg Chemical Company North Pond Investigation
Client Woodward-Clyde Consultants Date of Report 11/12/93

Observation Well No. 25B Date Completed 11/12/93 Technician M. Biglane
Riser Pipe: Material PVC Diameter 2 in. Type of Joints Threaded
Screen: Material PVC Slot Size 0.01 Diameter 2 in. Length 10 ft
Diameter of Borehole 8 in. Type of Filter Pack No. 3 Blasting Sand
Method of Placement of Filter Material Pour from Top of Hollow Stem Auger
Type of Seal Above Screen Bentonite 1/2 Pellets Backfill Above Seal Grout
Drilling Mud 0 used. Fresh Water Flush Before Setting Well Screen 0
Well Developed by Woodward-Clyde Consultants Development Time N/A hrs
Groundwater Level @ 2 hrs N/A @ 24 hrs Other N/A

*N/A = Not Available



LOG OF BORING

PROJECT: North Pond RFI
LOCATION: Vicksburg, Mississippi
CLIENT: Vicksburg Chemical Corporation

BORING: B-25B
FILE: 92B007C-4001
DATE: 11/12/93
TECHNICIAN: M. Olson
APPROVED:
PAGE: 1 of 1

Hollow-stem Augered: Full Depth

DEPTH (FEET)	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
0					Fill Material (FILL)
		<0.25		20	Loose tan Clayey SILTS, wet (ML)
5		<0.25		20	—with a trace of ferrous nodules, 2'- 4'
		<0.25		24	—with a trace of organics, 4'- 14'
		<0.25		24	—with ferrous seams, 8'- 10'
10		<0.25		24	—tan and light gray, 10'- 23'
		<0.25		24	—with a trace of ferrous nodules, 12'- 23'
		1.25		24	—firm, 14'- 16'
15		0.25		24	—loose below 16'
		<0.25		24	
20		<0.25		24	
		<0.25		24	
		0.25		24	—light gray below 23'
25		0.25		24	—with a trace of shells, 23'- 26'
		0.25		24	
		<0.25		24	—with a trace of organics, 28'- 30'
30		0.25		24	
		0.75		24	—firm below 40'
35		0.75		24	—with a trace of shells, 34'- 38'
		0.75		24	
		0.75		24	Firm to medium, light gray and tan Clayey fine SANDS / Sandy CLAYS with ferrous stains and a trace of organics (SC/CL)
40					

Bottom of boring at 40'.
Borehole grouted full depth.
Piezometer installed in borehole.

Unified Soil Classifications based on visual observations.

DEC 13 93 ENVIRS4 28007

Woodward-Clyde Consultants

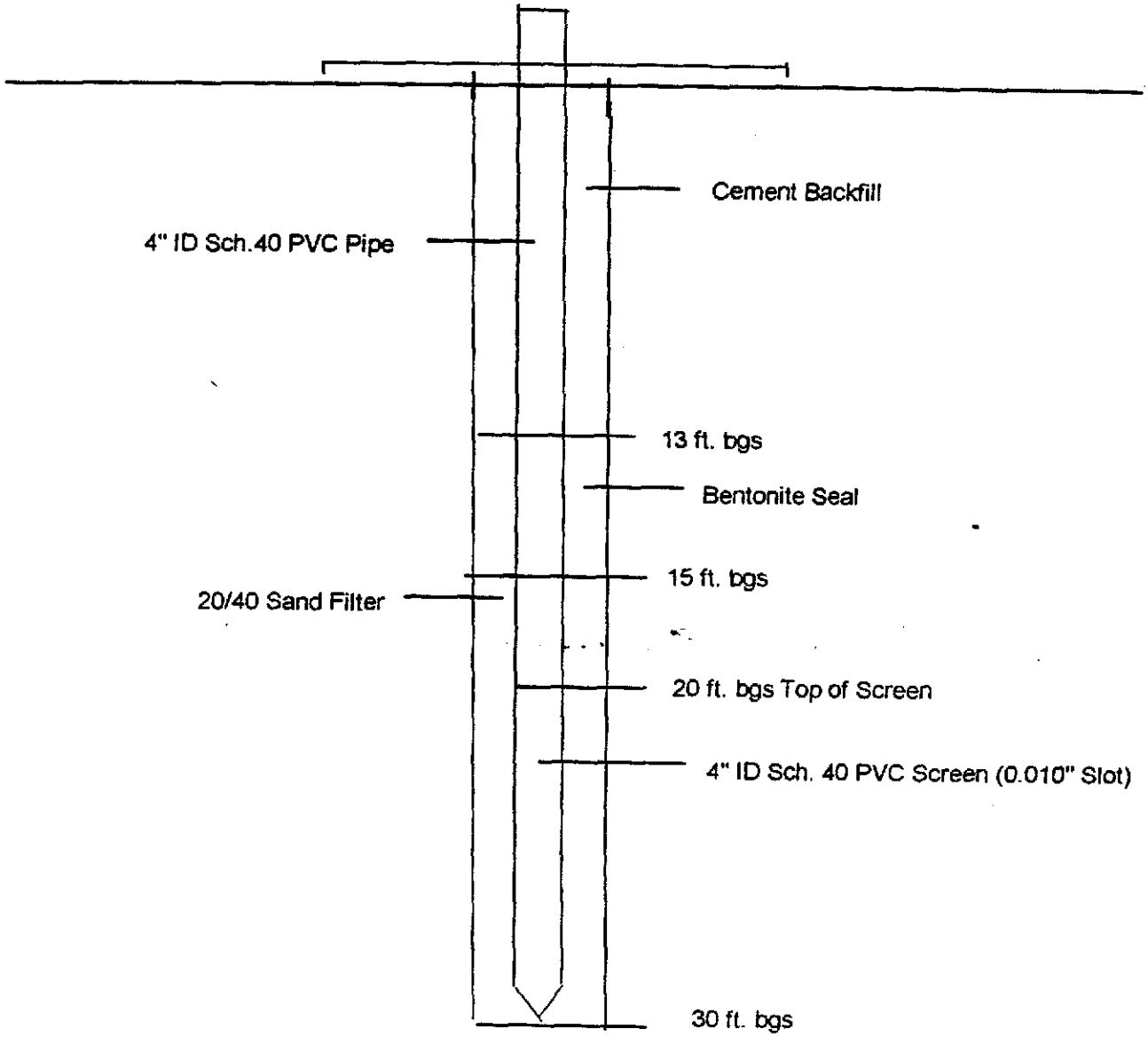
PZ-25B

WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI	Site Name: Vicksburg Chemical Plant
Location: Vicksburg, MS	Well Number: MW-1C
Date Installed: 05/14/01	Well Contractor: Universal Drilling Services, Inc.
Installation Method: HSA	Well Depth: 30 feet bgs
Development Method: Pumping	Development Time (hr/min): 1/15
Development Water Quantity (gal): 45	
Field Supervisor: H. Dean Lowe	



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number:	MW-1C		
Top of Casing Elevation:	Not Available	Project Name:	Vicksburg Chemical Phase II RFI
Initial Water Level:	3.2 ft.	Project Number:	PE01-0412
Water Level Elevation:	Not Available	Project Location:	Vicksburg, MS
Logged By:	H. Dean Lowe	Drilled By:	Universal Drilling Services, Inc.
Date Started:	05/14/01	Drilling Method:	CME-75 HSA
Date Completed:	05/14/01	Air Monitoring Method:	N/A

Depth (Feet)	Sample Type	Sample Number	Sample Description	USCS Symbol	Remarks
- - - - -5	Cuttings	NA	Tan fine Silt (wea. loess), dry to 3 ft. Grades to very moist at 8 ft.	ML	
- - -8.0	Cuttings	NA	8 ft.		
- -10	Cuttings	NA	Lt. Gray fine slightly clayey Silt (wea. loess), Wet but not saturated Grades to dk. Gray at 10 ft., very moist	ML	
- - - - -15	Cuttings	NA	Red-Tan at 12 ft. and wet Same as above	ML	
- - - - -20	Cuttings	NA	Same as above Wet at 19 ft.	ML	Well set at 30 ft. 4" ID PVC pipe and screen (sch. 40) See Well Construction Form for construction details
- - - - -25	Cuttings	NA	Same as above Saturated at 25 ft.	ML	
- - - - -30	Cuttings	NA	Same as above	ML	
- - - - - -36			Boring Terminated and Well Set at 30 ft.		

Comments: _____

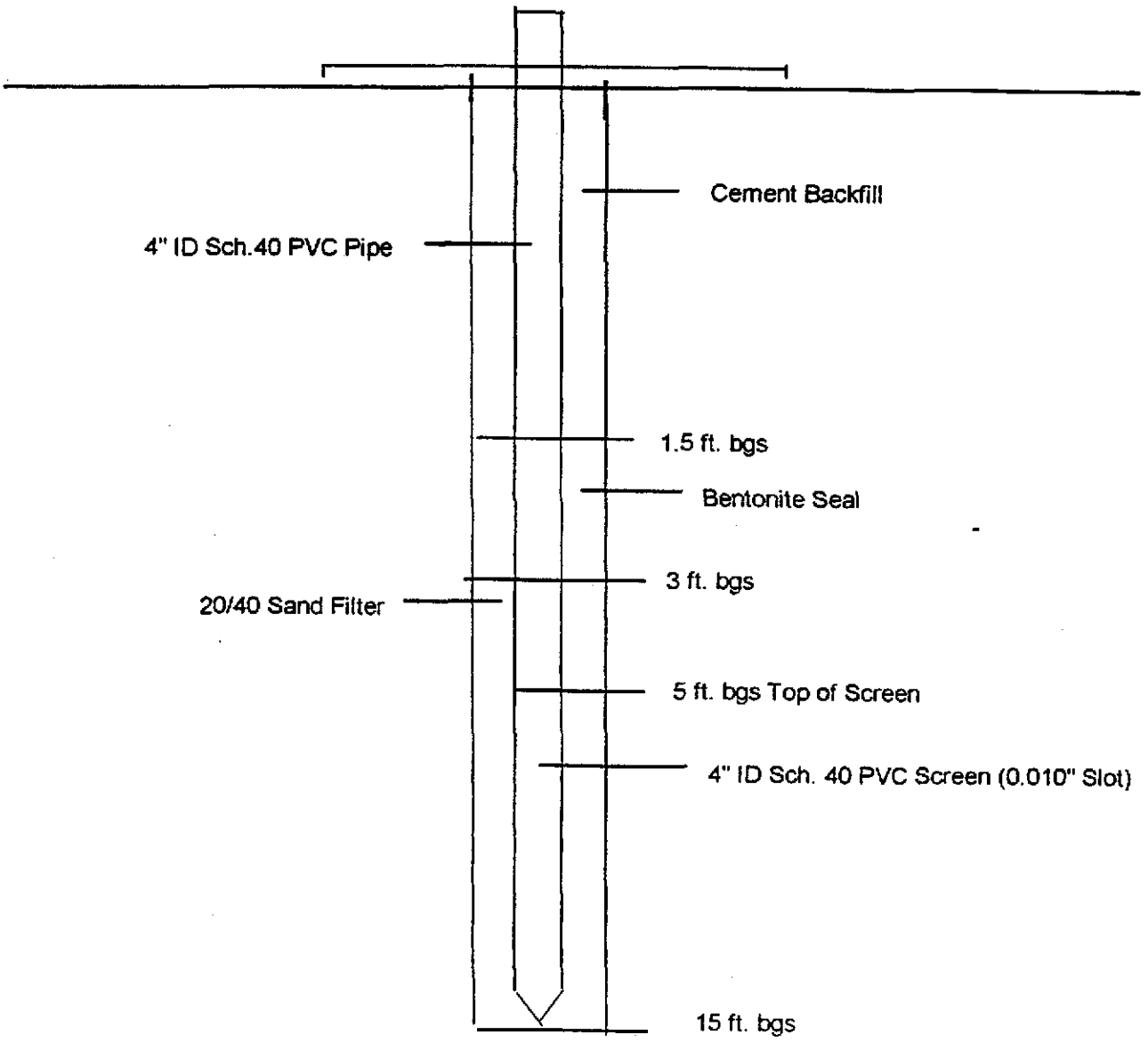
Logger Signature: H. Dean Lowe

WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI	Site Name: Vicksburg Chemical Plant
Location: Vicksburg, MS	Well Number: MW-10C
Date Installed: 05/14/01	Well Contractor: Universal Drilling Services, Inc.
Installation Method: HSA	Well Depth: 15 feet bgs
Development Method: Pumping	Development Time (hr/min): 0/35
Development Water Quantity (gal): 30	
Field Supervisor: H. Dean Lowe	



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number:	MW-10C		
Top of Casing Elevation:	Not Available	*Project Name:*	*Vicksburg Chemical Phase II RFI*
Initial Water Level:	10 ft.	Project Number:	PE01-0412
Water Level Elevation:	Not Available	Project Location:	Vicksburg , MS
Logged By:	H. Dean Lowe	Drilled By:	Universal Drilling Services, Inc.
Date Started:	05/14/01	Drilling Method:	CME-75 HSA
Date Completed:	05/14/01	Air Monitoring Method:	N/A

Depth (Feet)	Sample Type	Sample Number	Sample Description	USCS Symbol	Remarks
- - - - -5	Cuttings	NA	Tan fine slightly clayey Silt (wea. loess), Moist grading to wet Wet at 5 ft.	ML	
- - - - -10	Cuttings	NA	Same as above Saturated at 10 ft.	ML	Well set at 15 ft. 4" ID PVC pipe and screen (sch. 40) See Well Construction Form for construction details
- - - - -15	Cuttings	NA	Same as above, saturated	ML	
- - - - -20 - - - - -25 - - - - -30 - - - - -36			Boring Terminated and Well Set at 15 ft.		

Comments: _____

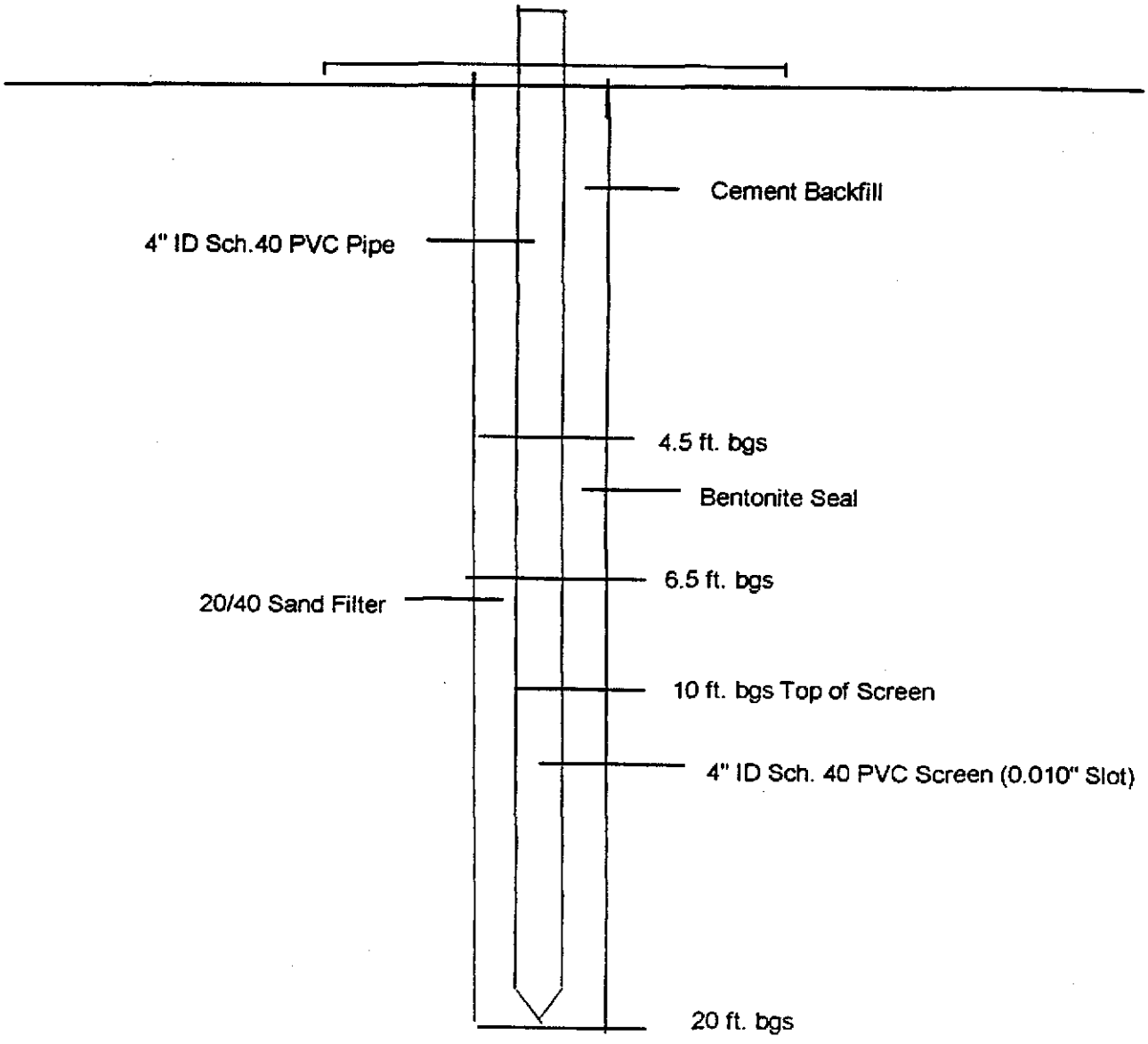
Logger Signature: H. Dean Lowe

WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI	Site Name: Vicksburg Chemical Plant
Location: Vicksburg, MS	Well Number: MW-12C
Date Installed: 05/16/01	Well Contractor: Universal Drilling Services, Inc.
Installation Method: HSA	Well Depth: 20 feet bgs
Development Method: Pumping	Development Time (hr/min): 0/35
Development Water Quantity (gal): 35	
Field Supervisor: H. Dean Lowe	



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number:	MW-12C		
Top of Casing Elevation:	Not Available	Project Name:	Vicksburg Chemical Phase II RFI
Initial Water Level:	4.2 ft	Project Number:	PE01-0412
Water Level Elevation:	Not Available	Project Location:	Vicksburg , MS
Logged By:	H. Dean Lowe	Drilled By:	Universal Drilling Services, Inc.
Date Started:	05/15/01	Drilling Method:	CME-75 HSA
Date Completed:	05/15/01	Air Monitoring Method:	N/A

Depth (Feet)	Sample Type	Sample Number	Sample Description	USCS Symbol	Remarks
- - - - -5	Cuttings	NA	Brown silt, sand and rock gravel	NA	Fill
- - - - -10	Cuttings	NA	Tan fine Silt (wea. loess), moist Wet at 9 ft.	ML	
- - - - -15	Cuttings	NA	Same as above, saturated	ML	
- - - - -20	Cuttings	NA	Same as above	ML	Well set at 20 ft. 4" ID PVC pipe and screen (sch. 40) See Well Construction Form for construction details
- - - - -25 - - - -30 - - - - -36			Boring Terminated and Well Set at 20 ft.		

Comments:

Logger Signature: H. Dean Lowe

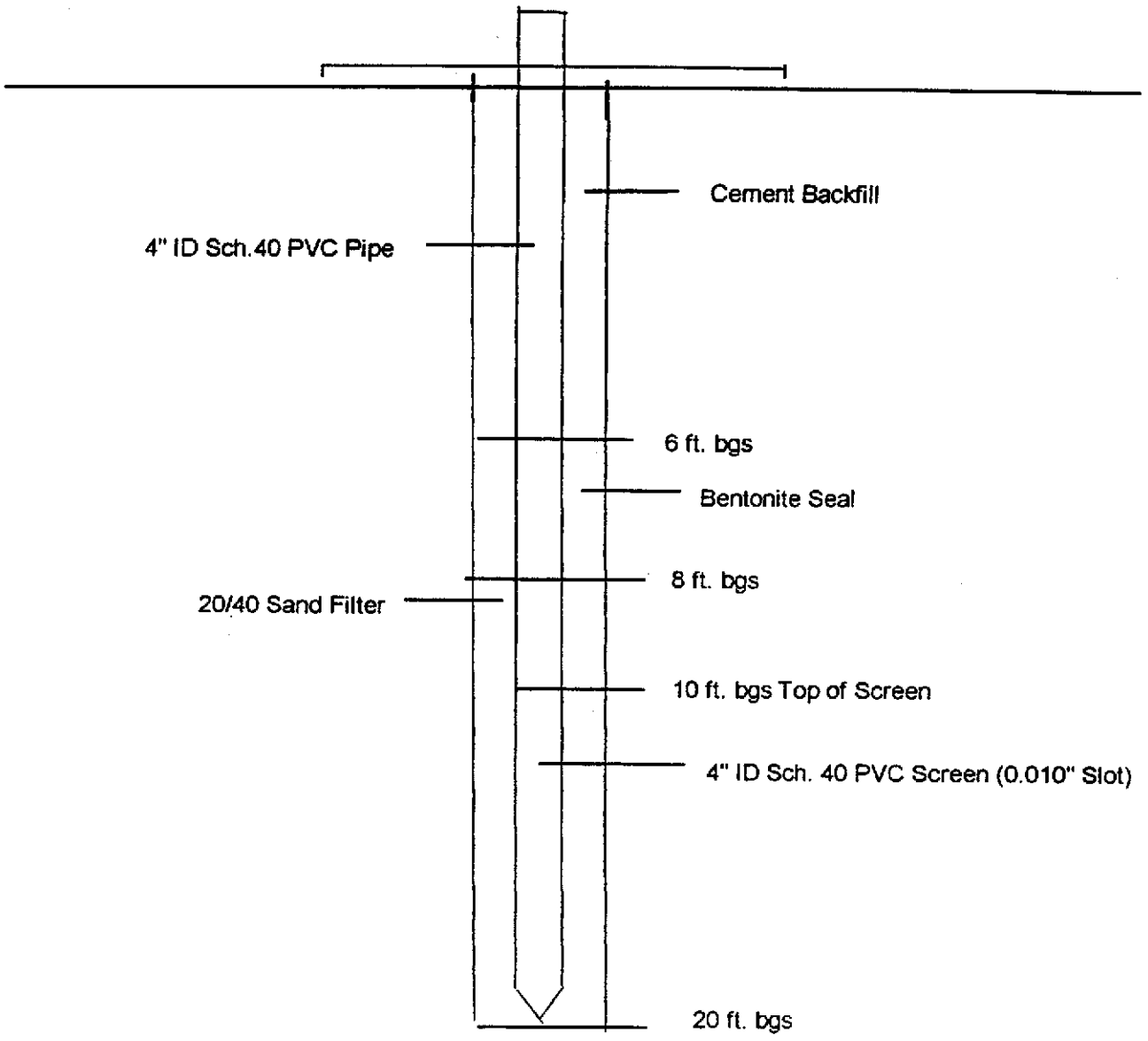
D-71

WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI	Site Name: Vicksburg Chemical Plant
Location: Vicksburg, MS	Well Number: MW-17B
Date Installed: 05/16/01	Well Contractor: Universal Drilling Services, Inc.
Installation Method: HSA	Well Depth: 20 feet bgs
Development Method: Test Pumping	Development Time (hr/min): 0/20
Development Water Quantity (gal): NM	
Field Supervisor: H. Dean Lowe	



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number: MW-17B
Top of Casing Elevation: Not Available
Initial Water Level: 12.6 ft.
Water Level Elevation: Not Available
Logged By: H. Dean Lowe
Date Started: 05/16/01
Date Completed: 05/16/01

Project Name: Vicksburg Chemical Phase II RFI
Project Number: PE01-0412
Project Location: Vicksburg, MS
Drilled By: Universal Drilling Services, Inc.
Drilling Method: CME-75 HSA
Air Monitoring Method: N/A

Depth (Feet)	Sample Type	Sample Number	Sample Description	USCS Symbol	Remarks
-	Cuttings	NA	1.3 Crushed rock and gravel	NA	Fill
- - - - -5			Tan fine Silt (wea. loess), moist	ML	
- - - - -10	Cuttings	NA	Saturated at 6 ft. Same as above	ML	
- - - - -15	Cuttings	NA	Same as above	ML	Well set at 20 ft. 4" ID PVC pipe and screen (sch. 40) See Well Construction Form for construction details
- - - - -20	Cuttings	NA	Same as above	ML	
- - - - -25 - - - - -30 - - - - -36			Boring Terminated and Well Set at 20 ft.		

Comments:

Logger Signature: H. Dean Lowe

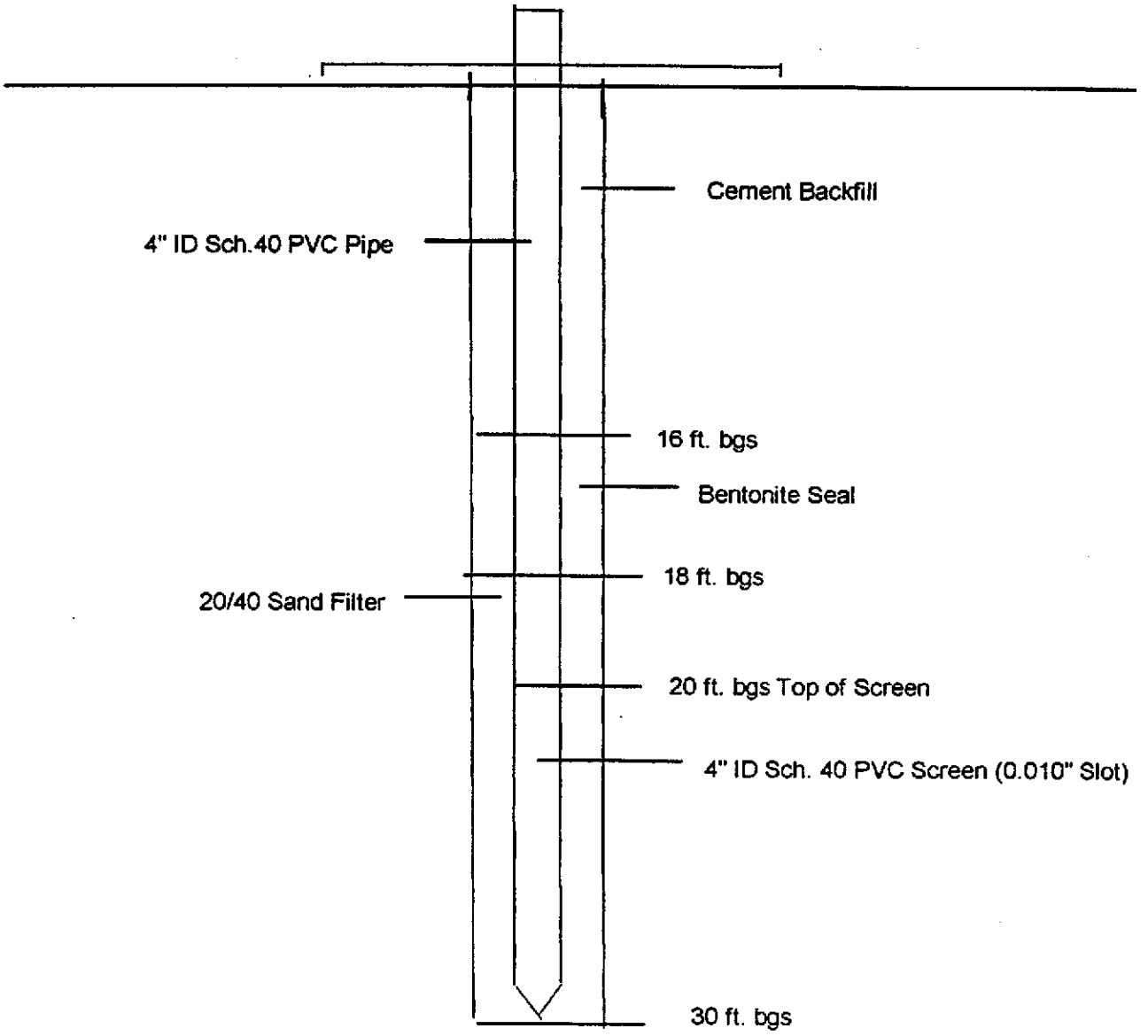
D-73

WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI	Site Name: Vicksburg Chemical Plant
Location: Vicksburg, MS	Well Number: MW-17A
Date Installed: 05/16/01	Well Contractor: Universal Drilling Services, Inc.
Installation Method: HSA	Well Depth: 30 feet bgs
Development Method: Test Pumping	Development Time (hr/min): 1/15
Development Water Quantity (gal): NM	
Field Supervisor: H. Dean Lowe	



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number: MW-17A
Top of Casing Elevation: Not Available
Initial Water Level: 14.2 ft.
Water Level Elevation: Not Available
Logged By: H. Dean Lowe
Date Started: 05/16/01
Date Completed: 05/16/01

Project Name: Vicksburg Chemical Phase II RFI
Project Number: PE01-0412
Project Location: Vicksburg , MS
Drilled By: Universal Drilling Services, Inc.
Drilling Method: CME-75 HSA
Air Monitoring Method: N/A

Depth (Feet)	Sample Type	Sample Number	Sample Description	USCS Symbol	Remarks
- - - - -5	Cuttings	NA	1.3 Crushed rock and gravel Tan fine Silt (wea. loess), moist	NA ML	Fill
- - - - -10	Cuttings	NA	Saturated at 6 ft. Same as above	 ML	
- - - - -15	Cuttings	NA	Same as above	ML	
- - - - -20	Cuttings	NA	Same as above	ML	
- - - - -25	Cuttings	NA	Same as above	ML	Well set at 30 ft. 4" ID PVC pipe and screen (sch. 40) See Well Construction Form for construction details
- - - - -30	Cuttings	NA	Same as above Lt. Gray at 28 ft. (unwea. Loess)	ML	
- - - - -36			Boring Terminated and Well Set at 30 ft.		

Comments:

Logger Signature: H. Dean Lowe

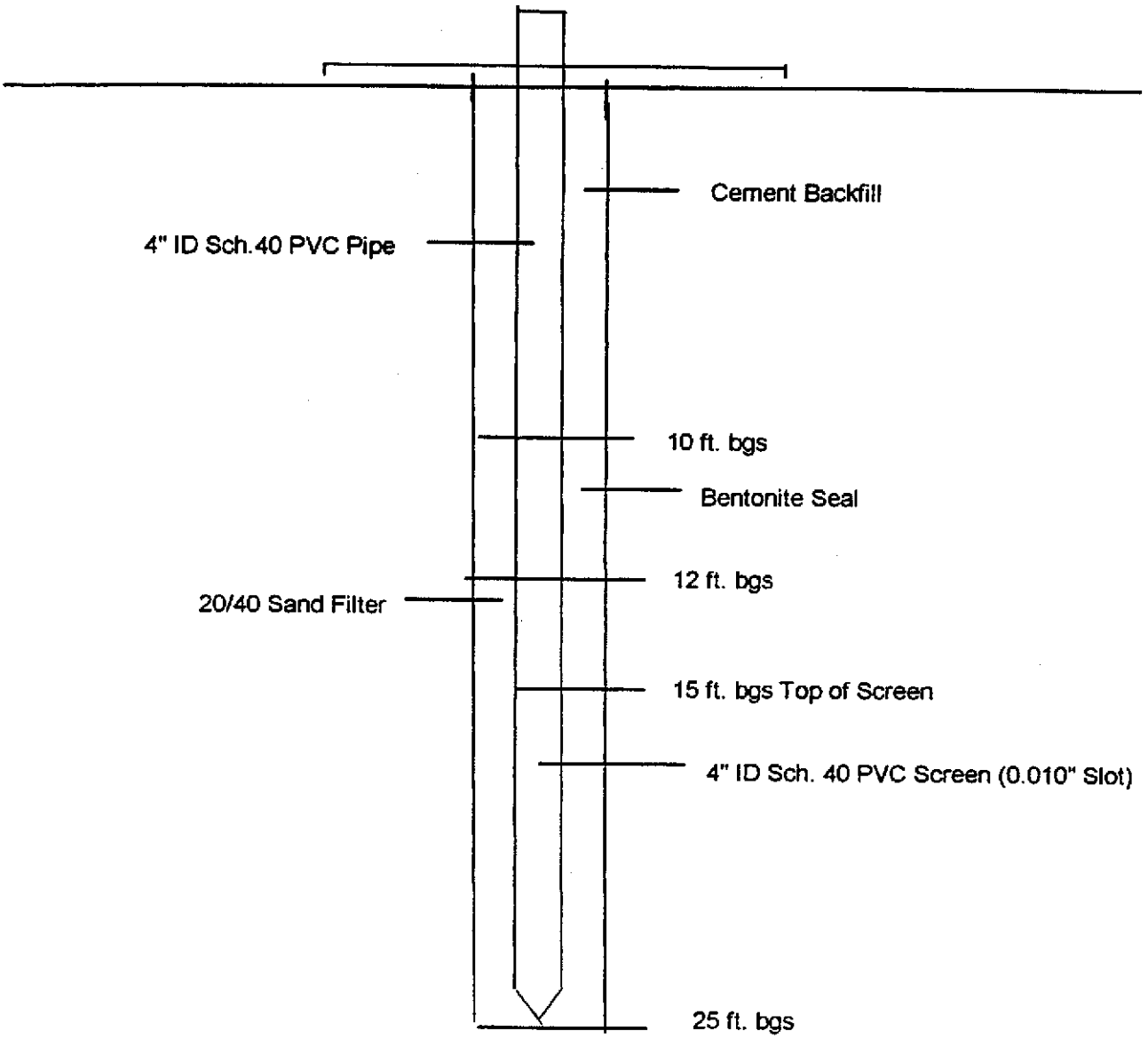
D-75

WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI	Site Name: Vicksburg Chemical Plant
Location: Vicksburg, MS	Well Number: MW-18B
Date Installed: 05/16/01	Well Contractor: Universal Drilling Services, Inc.
Installation Method: HSA	Well Depth: 25 feet bgs
Development Method: Pumping	Development Time (hr/min): 0/30
Development Water Quantity (gal): 30	
Field Supervisor: H. Dean Lowe	



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number: MW-18B
Top of Casing Elevation: Not Available
Initial Water Level: 11.5 ft.
Water Level Elevation: Not Available
Logged By: H. Dean Lowe
Date Started: 05/16/01
Date Completed: 05/16/01

Project Name: Vicksburg Chemical Phase II RFI
Project Number: PE01-0412
Project Location: Vicksburg, MS
Drilled By: Universal Drilling Services, Inc.
Drilling Method: CME-75 HSA
Air Monitoring Method: N/A

Depth (Feet)	Sample Type	Sample Number	Sample Description	USCS Symbol	Remarks
- - - - -5	Cuttings	NA	Sandy, gravelly Silt 2 ft. Tan fine Silt (wea. loess), moist Grades to very moist 7 ft.	NA ML	Fill
- - - - -10	Cuttings	NA	Lt. Gray clayey Silt (wea. loess), wet	ML	
- - - - -15	Cuttings	NA	Saturated at 11.5 ft. Same as above	ML	
- - - - -20	Cuttings	NA	Grades to Gray-Tan at 18 ft. Same as above	ML	
- - - - -25	Cuttings	NA	Same as above	ML	Well set at 25 ft. 4" ID PVC pipe and screen (sch. 40) See Well Construction Form for well construction details
- - - - -30 - - - - -35 -36			Boring Terminated and Well Set at 25 ft.		

Comments:

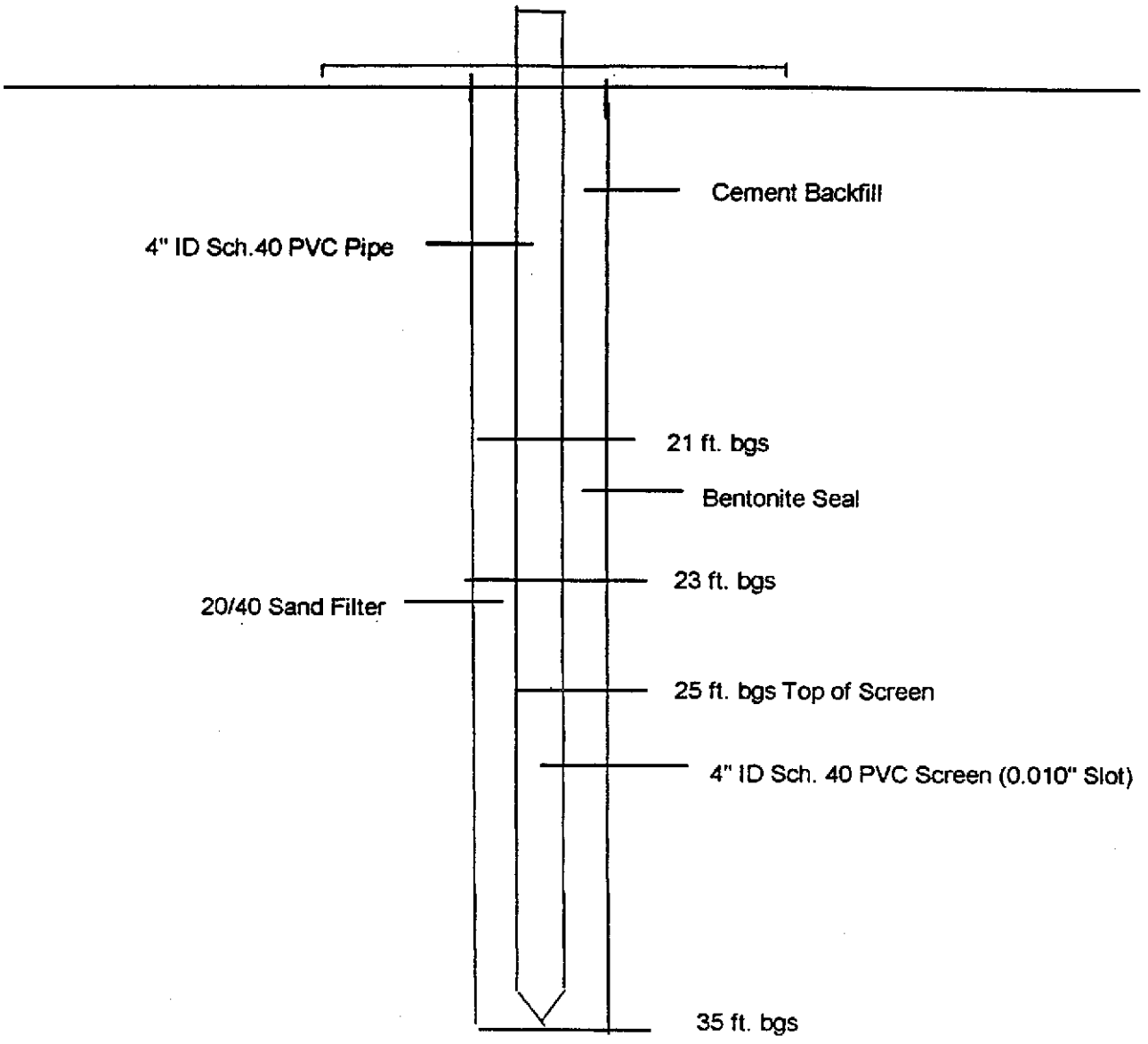
Logger Signature: H. Dean Lowe

WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI	Site Name: Vicksburg Chemical Plant
Location: Vicksburg, MS	Well Number: MW-18A
Date Installed: 05/16/01	Well Contractor: Universal Drilling Services, Inc.
Installation Method: HSA	Well Depth: 35 feet bgs
Development Method: Pumping	Development Time (hr/min): 0/45
Development Water Quantity (gal): 45	
Field Supervisor: H. Dean Lowe	



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number: MW-18A
Top of Casing Elevation: Not Available
Initial Water Level: 12.5 ft.
Water Level Elevation: Not Available
Logged By: H. Dean Lowe
Date Started: 05/16/01
Date Completed: 05/16/01

Project Name: Vicksburg Chemical Phase II RFI
Project Number: PE01-0412
Project Location: Vicksburg, MS
Drilled By: Universal Drilling Services, Inc.
Drilling Method: CME-75 HSA
Air Monitoring Method: N/A

Depth (Feet)	Sample Type	Sample Number	Sample Description	USCS Symbol	Remarks
- - - - -5	Cuttings	NA	Sandy, gravelly Silt 2 ft. Tan fine Silt (wea. loess), moist Grades to very moist 7 ft.	NA ML	Fill
- - - - -10	Cuttings	NA	Lt. Gray clayey Silt (wea. loess), wet	ML	
- - - - -15	Cuttings	NA	Saturated at 12.5 ft. Same as above	ML	
- - - - -20	Cuttings	NA	Grades to Gray-Tan at 18 ft. Same as above	ML	
- - - - -25	Cuttings	NA	Same as above	ML	
- - - - -30	Cuttings	NA	Same as above	ML	Well set at 35 ft. 4" ID PVC pipe and screen (sch. 40) See Well Construction Form for well construction details
- - - - -35	Cuttings	NA	Same as above	ML	
-36			Boring Terminated and Well Set at 35 ft.		

Comments:

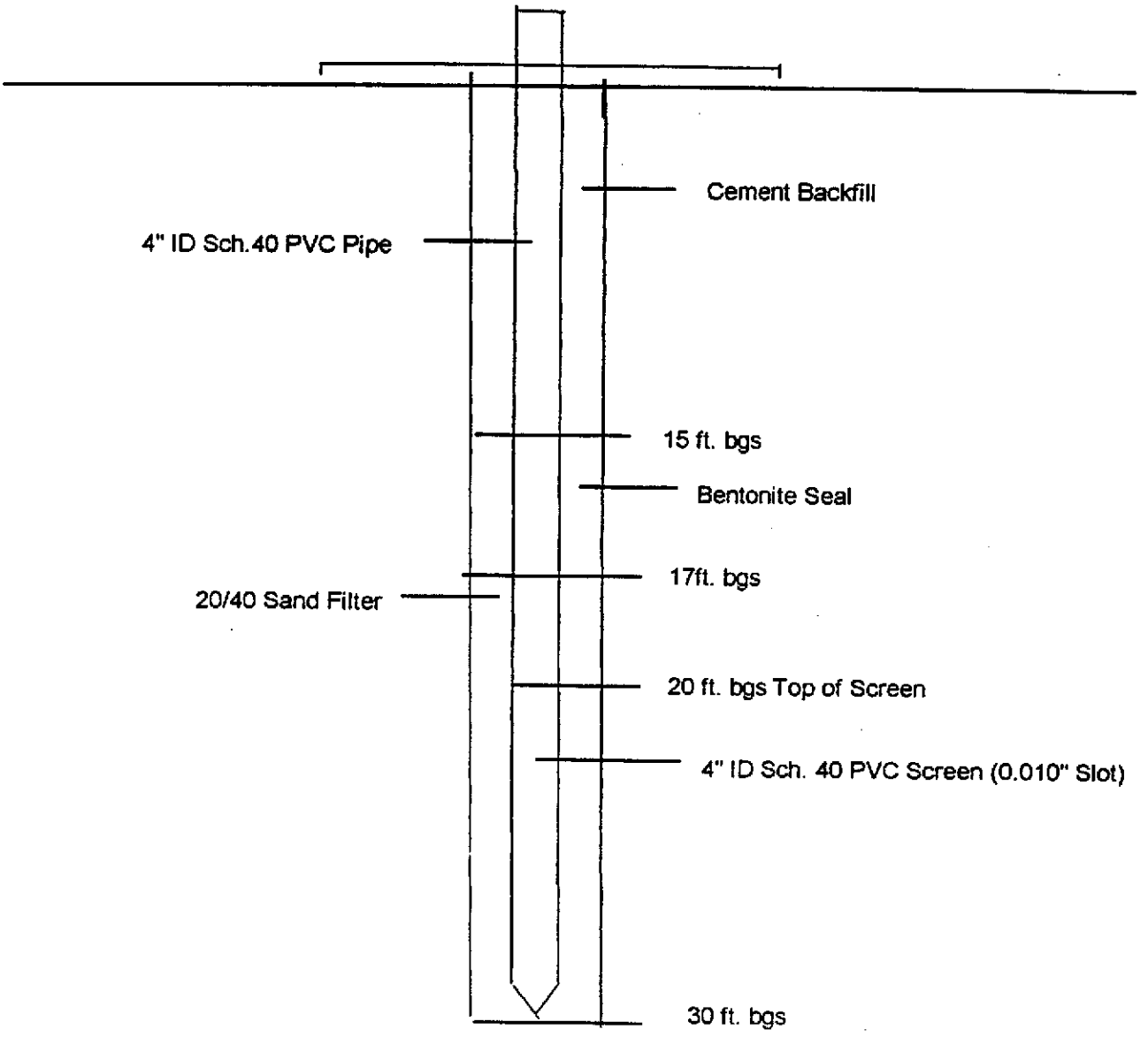
Logger Signature: H. Dean Lowe

WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI	Site Name: Vicksburg Chemical Plant
Location: Vicksburg, MS	Well Number: PZ-26B
Date Installed: 05/16/01	Well Contractor: Universal Drilling Services, Inc.
Installation Method: HSA	Well Depth: 30 feet bgs
Development Method: Pumping	Development Time (hr/min): 1/10
Development Water Quantity (gal): 50	
Field Supervisor: H. Dean Lowe	



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number:	PZ-26B		
Top of Casing Elevation:	Not Available	Project Name:	Vicksburg Chemical Phase II RFI
Initial Water Level:	9.6 ft.	Project Number:	PE01-0412
Water Level Elevation:	Not Available	Project Location:	Vicksburg , MS
Logged By:	H. Dean Lowe	Drilled By:	Universal Drilling Services, Inc.
Date Started:	05/15/01	Drilling Method:	CME-75 HSA
Date Completed:	05/15/01	Air Monitoring Method:	N/A

Depth (Feet)	Sample Type	Sample Number	Sample Description	USCS Symbol	Remarks
- - - - -5	Cuttings	NA	Tan fine Silt (wea. loess), dry to moist	ML	
- - - - -10	Cuttings	NA	7 ft. Lt. Gray slightly clayey Silt (wea. loess), very moist to wet	ML	
- - - - -15	Cuttings	NA	wet at 12 ft. Same as above Very wet at 15 ft.	ML	
- - - - -20	Cuttings	NA	Same as above	ML	
- - - - -25	Cuttings	NA	Same as above	ML	
- - - - -30			Same as above, free water in borehole	ML	Well set at 30 ft. 4" ID PVC pipe and screen (sch. 40) See Well Construction Form for well construction details
- - - - -35			Boring Terminated and Well Set at 30 ft.		

Comments: _____

Logger Signature: H. Dean Lowe

D-01

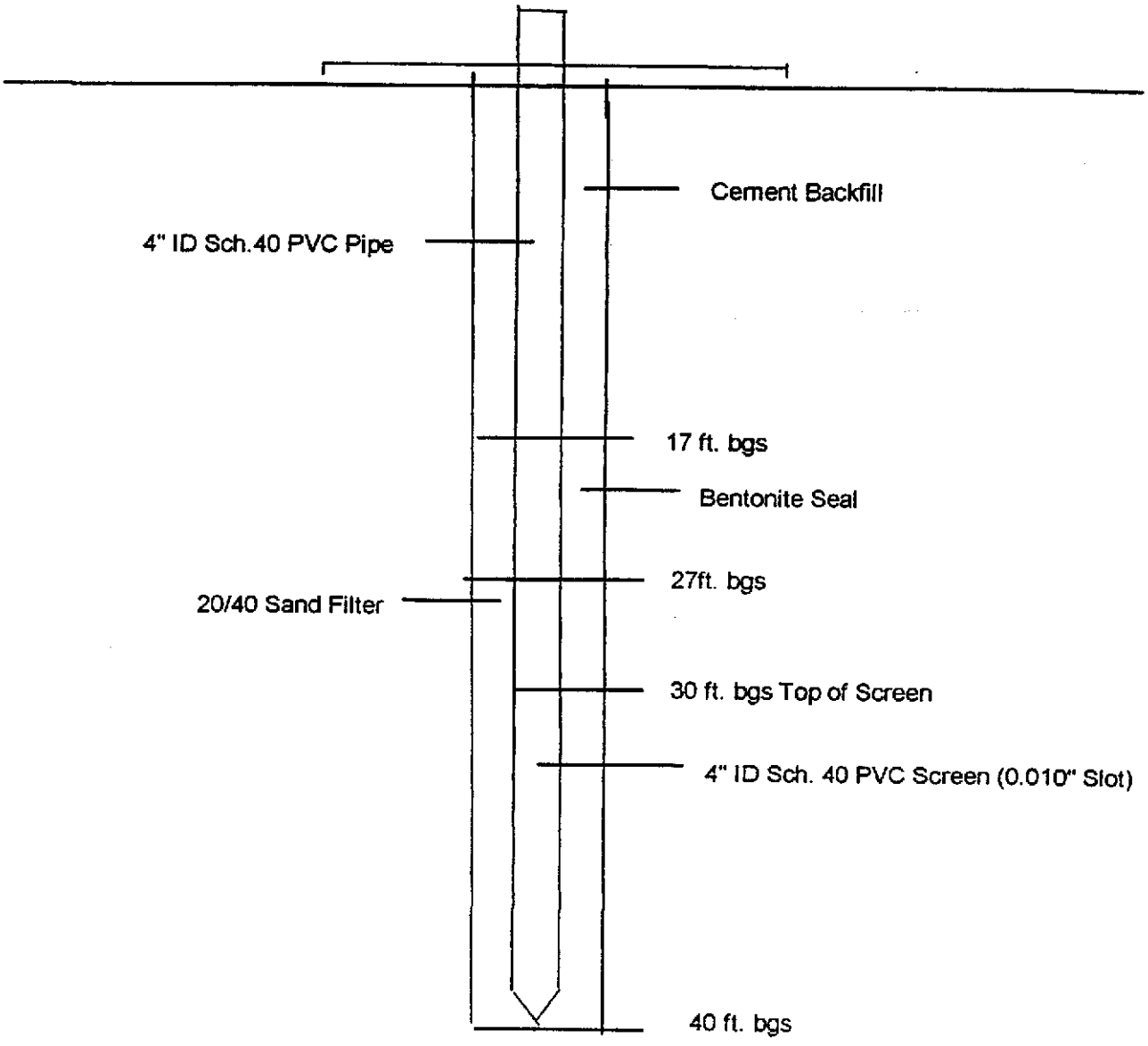
WELL CONSTRUCTION DETAILS

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chem. Phase II RFI
Location: Vicksburg, MS
Date Installed: 05/16/01
Installation Method: HSA
Development Method: Pumping
Development Water Quantity (gal): 60
Field Supervisor: H. Dean Lowe

Site Name: Vicksburg Chemical Plant
Well Number: PZ-26A
Well Contractor: Universal Drilling Services, Inc.
Well Depth: 40 feet bgs
Development Time (hr/min): 1/30



RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number: PZ-26 A
Top of Casing Elevation: Not Available
Initial Water Level: 10.5 ft.
Water Level Elevation: Not Available
Logged By: H. Dean Lowe
Date Started: 05/15/01
Date Completed: 05/15/01

Project Name: Vicksburg Chemical Phase II RFI
Project Number: PE01-0412
Project Location: Vicksburg, MS
Drilled By: Universal Drilling Services, Inc.
Drilling Method: CME-75 HSA and 5-foot core sampler
Air Monitoring Method: N/A

Depth (Feet)	Sample Type	Recovery (in)	Sample Number	Sample Description	USCS Symbol	Remarks
- - -3	Core	26	NA	Tan fine Silt (wea. loess), moist Very moist at 3 ft.	ML	
- -5	Core	24	NA	Wet at 5 ft.		
- - - - -10	Core	46	NA	8.3 ft.	ML	
				Gray mottled moderately plastic silty Clay, very moist	CL	
- - -15	Core	60	NA	Saturated at 10.5 ft. Same as above, saturated	CL	
- - - - -20	Core	36	NA	Same as above, saturated	CL	
- - - - -25	Cuttings	NA	NA	Same as above, saturated	CL	
- - - - -30	Cuttings	NA	NA	Same as above, saturated	CL	
- - - - -35	Cuttings	NA	NA	Same as above, saturated 35 ft.	CL	

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RECORD OF SUBSURFACE EXPLORATION

Borehole/Well Number: PZ-26A
Top of Casing Elevation: Not Available
Initial Water Level: 10.5 ft.
Water Level Elevation: Not Available
Logged By: H. Dean Lowe
Date Started: 05/15/01
Date Completed: 05/15/01

Project Name: Vicksburg Chemical Phase II RFI
Project Number: PE01-0412
Project Location: Vicksburg, MS
Drilled By: Universal Drilling Services, Inc.
Drilling Method: CME-75 HSA
Air Monitoring Method: N/A

Depth (Feet)	Sample Type	Recovery (in)	Sample Number	Sample Description	USCS Symbol	Remarks
-35	Cuttings	NA	NA	Brown fine clayey Silt (wea. loess), saturated	ML	
-						
-						
-						Well set at 40 ft.
-						4" ID PVC pipe and screen (sch. 40)
-40						See Well Construction Form for well construction details
-				Boring Terminated and Well Set at 40 ft.		
-						
-						
-						
-45						
-						
-						
-						
-50						
-						
-						
-						
-55						
-						
-						
-						
-60						
-						
-						
-						
-65						
-						
-						
-						
-70						

Comments:

Logger Signature: H. Dean Lowe

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APPENDIX E

GWA/RFI DATA COLLECTION QUALITY ASSURANCE PLAN

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The Vicksburg Chemical Corporation manufacturing facility (VCC) is located in Vicksburg, Mississippi. The facility is a manufacturer of chemicals. An U.S. Environmental Protection Agency (EPA) Determination of Release was issued for the facility in December, 1989. Negotiations for a Consent Decree began in January, 1990.

VCC has retained URS Corporation (URS) to perform a RCRA Facility Investigation (RFI) and Groundwater Assessment (GWA) at the Vicksburg facility. URS has conducted the investigation in compliance with the guidelines of the Consent Decree. Among the requirements and/or guidelines included in the decree are procedures to control the quality of data acquired in during the investigation. This document presents the overall approach that URS has undertaken to verify that the information, data, and procured results meet the quality objectives. A discussion of sampling procedures and methodologies for specific media is also given. Information on the description and background of the RFI and GWA for the entire facility is presented in the introduction of the GWA report.

2.1 DATA OBJECTIVES

The primary objectives of the RFI and GWA are as follows:

- Identify or verify the contaminants of concern for each SWMU requiring further investigation.
- Determine whether or not the SWMU's in question are releasing hazardous constituents into the environment.
- Identify the source of contamination
- Determine vertical and horizontal extent of contamination.
- Collect data to be used in determining the necessity and feasibility of corrective action measures.
- Establish a long-term groundwater monitoring program.

To meet the overall objectives of the investigation, URS will collect subsurface soil and groundwater samples. The following sections present the data requirements and strategy for collection of samples from each media.

2.2 QUALITY ASSURANCE OBJECTIVES

The objectives of the Quality Assurance/Quality Control (QA/QC) procedures are to produce data that meet the requirements of standard analytical methods and satisfies the project requirements. The objectives of the QA efforts for this project are as follows:

- To provide the mechanism for ongoing control and evaluation of the quality of data measurement throughout the project.
- Utilizing quality control data to define data quality for various measurement parameters in terms of precision and accuracy.
- To verify that all chemical samples are accurately and precisely collected, analyzed and documented.
- To verify compliance with regulatory agency requirements.
- To verify that samples are properly collected, analyzed and documented to provide data as part of the H&S Plan.

DEFINITIONS OF QUALITY ASSURANCE TERMS

Definitions of precision, accuracy, completeness, representativeness, and comparability are presented in Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-0050/80, Office of Monitoring Systems and Quality Assurance and Office of research and Development, U.S. Environmental Protection Agency, Washington, D.C. 20460, December 29, 1980).

Precision

Precision is "a measure of mutual agreement among individual measurements of the same property. It is a measure of variability of individual sample measurements. Precision will be assessed from the laboratory duplicate analyses of field samples and from the set of duplicate matrix spiked samples. Precision will be measured as the percent difference in the duplicate measurements.

Accuracy

Accuracy is "the degree of agreement of a measurement with an accepted reference or true value" and is a measure of a system bias. Bias is the difference between the mean of the true sample values and the mean of the laboratory analysis. Accuracy will be assessed using laboratory spiked standard matrix samples in conjunction with field and trip blank samples and laboratory method and reagent blanks. Average accuracy and its standard deviation of the concentration data will be used if sufficient data are collected for a specific sampling activity.

Completeness

Completeness is "a measure of the amount of the valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions." The completeness of data objectives reflect the degree to which required samples specified in the appropriate sampling plan have been collected and the necessary analysis performed, in order to create a sufficient data base to meet the objectives. If the completeness objective is not met, an evaluation will be undertaken to determine if resampling is required to provide adequate data to meet specific task objectives.

Representativeness

Representativeness "expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition." Representativeness is a function of the sample site selection and sample collection and analysis techniques. The objective of this program is to obtain samples which are representative of the media to be measured.

Comparability

Comparability "expresses the confidence with which one set of data can be compared with another." Comparability can be related to precision and accuracy since these quantities are measures of data reliability. Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable than data obtained from another project or previous study. To maintain comparability, the sampling method used, chain-of-custody procedures, EPA analytical methods and qualified laboratories and establishment of strict QA procedures and sampling guidelines provide the basis for uniformity in all data collection and analysis activities.

ACCURACY, PRECISION, AND SENSITIVITY OF LABORATORY ANALYSIS

The QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

The following tables are lists of the samples first proposed as the initial sampling effort for the RFI and GWA.

FIRST RFI SAMPLING PROPOSAL

SWMU Number	Sample Points	Samples (Soil or Concrete)	Analyte List
1/17	12	34	A
2 – Landfill	10	23	B
4 – Activated Carbon Treatment	6	6	B
5 – South Plant Drainage	16	16	C
7/20 – Former Dinoseb Production Area/Railroad Car Loading/Unloading Station	21	42	A
8 – Dinoseb Loading/Unloading Area	2	6	A
11/12/15 MSMA – Methyl Production Area	5	13	D

FIRST RFI SAMPLING PROPOSAL (Continued)			
SWMU Number	Sample Points	Samples (Soil or Concrete)	Analyte List
13 – West Drainage	9	9	C
14 – Toxaphene	3	6	C
16 – Atrazine	5	13	C
18 – Blue Tank	3	3	C
30 – Waste Oil	3	3	E
34 - Junkyard	6	6	F

FIRST GWA SAMPLING PROPOSAL			
SWMU Number	Sample Points	Samples (Groundwater)	Analyte List
1, 17, 2, 4, 5, 7, 20, 8, 11, 12, 15, 13, 14, 16, and 18	3	3	Z

LEGEND:

- A Atrazine, cyanazine, arsenic, dinoseb, toxaphene, toluene
- B TCL, TAL, atrazine, cyanazine, dinoseb
- C Atrazine, cyanazine, arsenic, dinoseb, toxaphene
- D TCI, dioxin, TAL, atrazine, cyanazine, dinoseb
- E BTEX, TPH
- F BTEX, TPH, atrazine, cyanazine, arsenic, dinoseb, toxaphene
- Z TCL, TAL, dioxin, atrazine, cyanazine, dinoseb

The field investigations evolved into a much more extensive sampling program. The sampling programs are described in the introduction sections of the RFI Final Report and the GWA Report.

What has evolved as the constituents of concern for continued monitoring are arsenic, atrazine, cyanazine, dinoseb, toxaphene, and VOCs.

A summary of the parameter and possible methods to be employed by the offsite laboratory are as follows:

Parameter	Protocol
Toxaphene, Atrazine and Cyanazine	EPA SW-846, Method 8080
Dinotrobytyl Phenol (Dinoseb)	EPA SW-846, Preparation Method 3550, Analysis Method 8015
Arsenic	EPA SW-846, Method 7060

Parameter	Protocol
Toluene	EPA SW-846, Method 8020
TAL, Dioxin	Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revision 9/88, 4/89, and 5/89, Office of Solid Waste and Emergency Response, U.S. EPA, Washington, D.C., May 1989 or equivalent SW-846 methods
TAL	Statement of Work for Inorganic Analysis Multi-Media Multi-Concentration, Sow No 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency Response, U.S. EPA, Washington, D.C., June 1989 or equivalent SW-846 methods

QUALITY OF FIELD SAMPLES

Field duplicates, rinsate blanks, trip blanks, and matrix spikes/matrix spike duplicates will be taken in the field and submitted to the analytical laboratory to provide a means to assess the quality of the data resulting from field investigation tasks. Field duplicate samples will be analyzed to check for sampling and analytical reproducibility. Field and trip blank samples will be analyzed to check for procedural contamination and cross-contamination during shipment and storage of samples. Matrix spike/matrix spike duplicate samples will be analyzed to verify that recoveries falling outside acceptance windows are attributable to sample matrix interferences and not to laboratory analytical errors.

Field duplicates for groundwater will consist of obtaining a duplicate sample set for analysis from the sample. Rinsate samples will be prepared by rinsing decontaminated equipment with deionized water and collecting the rinsate sample. Matrix spike and matrix spike duplicates will be collected in the field but they will be spiked in the laboratory. Trip blanks will be prepared by the laboratory and shipped with the sample containers. The trip blanks will be kept with collected samples and shipped back to the laboratory for analysis.

ACCURACY OF FIELD MEASUREMENTS

Measurement data will be generated in many field activities that are incidental to collecting samples for analytical testing or unrelated to sampling. These activities include, but are not limited to, the following:

- Documenting time and weather conditions
- Determining depths in a borehole or piezometer and static water levels
- Measuring pH and conductivity of ground water samples

- Screening samples with an organic vapor analyzer (OVA) or photoionization detector (PID)

The general QA objective for such measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of such data through the documented use of standard procedures.

The QC level of effort for the field measurement of pH consists of pre-measurement calibration and post-measurement verification using two standard reference solutions each time to sample pH. This procedure will be performed for each sample tested. The QC effort for field conductivity measurements will include daily calibration of the instrument using standard solutions of known conductivity.

The accuracy of field measurements of pH will be assessed through pre-measurement calibrations and pH-measurements verifications using at least two standard buffer solutions. The two measurements must each be within $\pm$ 0.1 standard unit of buffer solution values. If measurements not within $\pm$ 0.1, the problem will be evaluated. A fresh portion of buffer solution will be utilized. If the problem persists, a different (new) buffer solution will be used. Precision will be assessed through replicate measurements. (The electrode will be withdrawn, rinsed and de-ionized water and re-immersed between each replicate). The instrument used will be capable of providing measurements to 0.1 standard unit. A total of four replicates for pH and conductivity will be performed.

The accuracy of measuring depths (for boreholes and static water levels) will be assessed by using a measuring device (weighted tape or electronic water level indicator such as an M-scope) that has been calibrated before use by measuring two known lengths. Any measurements taken with the device will be adjusted by the difference (if any) in length over the appropriate depth interval. At least three replicate depth measurements will be made and the average depth measurement will be used.

The data from the OVA or PID is used for screening only to select samples for analysis. After receiving laboratory data the OVA or PID and lab data will be evaluated for comparability.

The specific objectives of the collection of the data are further discussed in the subsequent paragraphs.

3.1 GROUNDWATER SAMPLING DATA OBJECTIVES

Water-bearing zones have been identified in previous investigations and groundwater data obtained to characterize these zones. Groundwater data included:

- Approximate vertical boundaries of zones and stratigraphic relationships.
- Basic flow characteristics of each zone (direction, lateral flow rate, hydraulic conductivity, transmissivity and storage capacity).
- Effect of stratigraphic variations within each zone on contaminant transport.
- Nature and extent of contamination in each zone (approximate boundaries of contaminant accumulation).

Identification of water-bearing zone boundaries and relevant soil strata will required a detailed description of soil features (such as color, lithology, bedding, identifying features and relative degree of water saturation) to a depth sufficient to identify the base of the deepest contaminated water-bearing zone. The description will require accuracy to the nearest foot and professional geologic judgment to recognize and describe pertinent features.

The zones to be monitored will require sufficient screening intervals to characterize each zone. For low density immiscible contaminants (floaters), the screen will extend approximately two feet above the top of the zone to provide for fluctuations in water levels. If dense non aqueous phase contaminants are the concern (sinkers) the screen will cover the base of the upper pervious zones and extend slightly below the base of the zone ($\pm$ 6 inches). If dissolved constituents are the concern, the screened interval will correspond to that portion of the zone which is judged to have the highest hydraulic conductivity. If required, deeper zones will be monitored utilizing similar approaches as describe above.

Determination of groundwater flow direction will require measurement of elevations of the top of the piezometric surface of each zone. A sufficient number and spacing of measurement stations will be installed to construct idealized contours of the piezometric surface elevations. The locations of measuring stations will be established such that they can be plotted on a site location map. Locations should be to the nearest 0.1 foot. Water level

measurements should be made to the nearest 0.01 foot accuracy and reported in feet mean sea level (MSL). This data will be evaluated to verify the designated upgradient shallow well location and to identify upgradient background wells. As additional samplings are performed, the data will be reevaluated to verify results of previous sampling.

Determination of the nature and extent of groundwater contamination will require sampling and chemical analysis of groundwater from each water-bearing zone. A sufficient number of samples will be required to identify approximate lateral limits of contamination and establish and nature and concentrations of contaminants. Investigation of zones below the upper pervious zone will be performed if data does not define the vertical extent of groundwater contamination.

3.2 AQUIFER TESTING OBJECTIVES

Determination of lateral and vertical flow rates, hydraulic conductivities, transmissivities, storage capacities and vertical interconnection will require in situ flow testing data. Lateral hydraulic conductivity/transmissivity data should be collected by at least two different methods in order to evaluate the credibility of the data and subsequent calculations. Storage capacity calculations and vertical interconnection determinations should be based on field pumping test data. Aquifer testing will be done in conjunction with detailed design of corrective action, if required.

3.3 SURFACE SOIL SAMPLING DATA OBJECTIVES

The primary purpose of collecting surface soil data is to aid in determining potential for contamination of site runoff-water, potential for off-site migration of contaminated sediments (water transported) and/or potential for human/animal contact and/or ingestion. Consequently, sampling need not extend beyond about 12 inches below the natural ground surface. Background samples at 0 to 12 inches to 12 to 36 inches will be obtained in the site vicinity. The background sample locations are selected based upon the lack of hazardous waste activities in those areas.

3.4 SUBSURFACE SOIL SAMPLING DATA OBJECTIVES

The primary purpose of collecting subsurface soil (vadose zone) and soil structure data is to aid in determining the potential for downward percolation of contaminants into the shallow

groundwater. Consequently sampling must be of sufficient quantity to identify lateral limits of contamination and must extent to a sufficient depth of identify and quantify accumulation of contaminants above and within the first occurring water-bearing zone. The data shall consist of laboratory analyses of the contaminated soil.

3.5 SAMPLING ACTIVITIES

The sampling activities occurred during the RFI and GWA to address the data objectives for the media of concern identified above. The field investigation tasks to obtain the data generally consisted of the following:

- Obtaining sampling location characteristic information from topographic and information surveys.
- Obtaining background and current groundwater quality data from the existing site monitor wells.
- Subsurface soil sampling to evaluate the vertical and horizontal extent of contamination and constituents if released.
- Groundwater assessment and sampling.

The sampling locations, depths, type (grab vs. composite), number of samples, and analytical parameters are discussed in the RFI Final Report and GWA Report. The procedures and equipment to perform the sampling were discussed in general terms and are presented in more detail herein. In addition, procedures for piezometer or monitor well installation and aquifer testing are presented. The sampling procedures presented below were implemented as appropriate. Additional specifications with respect to documentation, equipment, and procedures as required by VCC standard policies and manuals which do not affect data quality objectives may be incorporated into the work plan as appropriate.

4.1 SUBSURFACE SOIL SAMPLING

Subsurface soil sampling will be performed to characterize the wastes and to evaluate the extent of subsurface soil contamination, if any. The equipment and methods are discussed below.

EQUIPMENT

Subsurface sampling will be performed by rotary auger or hollow-stem drilling methods or use of "Geoprobe" soil boring equipment. The drilling apparatus will consist of a truck-mounted drilling rig. Samples will be obtained by drilling using a 3-inch diameter Shelby tube, or 2-inch diameter split spoon sampler.

"Geoprobe" soil boring equipment is typically mounted on the rear of a pickup truck or on the rear of an all terrain vehicle. The "Geoprobe" system uses the direct-push method to hydraulically advance small diameter hollow steel probe rods to the desired sampling depth. The probe rods are typically one or three feet in length and 1 to 2 inches in diameter. The soil boring can be sampled continuously or can be advanced to a desired depth to collect discrete soil and/or groundwater samples. The working depth for the system is dependent upon subsurface conditions and is typically about 40 feet below ground surface (bgs).

Only petroleum jelly, teflon tape, lithium grease, or vegetable-based lubricants shall be used on the threads of downhole drilling equipment. Additives containing lead or copper shall not be used. Any hydraulic or other fluids used in the drilling rig, pumps, or other field equipment/vehicles shall not contain any polychlorinated biphenyls (PCBs).

If antifreeze is added to any pump, hose, etc., in an area in contact with drilling fluids, this antifreeze shall be completely purged prior to the equipment's use in drilling, mud mixing, or any other part of the overall drilling operation. Only antifreeze without rust inhibitors and/or sealants may be used.

Drilling equipment that has a visible loss of grease, hydraulic fluids, oils, fuels and/or transmission oil to drilling fluids to the borehole will not be allowed for borings and/or well installation until the problem is corrected.

PROCEDURE

The borings shall be continuously sampled with a thin-walled Shelby tube sampler or split-spoon sampler, extruded in the field and described or logged, following the guidelines of the appropriate and most current American Society for Testing and Materials (ASTM) Standards:

- D 1452 Practice for Soil Investigation and Sampling by Auger Borings,
- D 1586 Method for Penetration Test and Split-Barrel Sampling of Soils,
- D 1587 Practice for Thin-Walled Tube Sampling of Soils,
- D 2487 Test Method for Classification of Soils for Engineering Purposes, and
- D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure).

All borings shall be sampled and described by a qualified URS representative. The qualified URS representative is to be on-site during all boring and sampling operations. Samples taken from borings will be handled as described later in this section.

All soil borings will be advanced with "Geoprobe" sampler or hollow-stem drilling techniques with continuous soil sampling techniques unless it is determined to be unnecessary for strata identification and sample collection by the qualified URS representative based on consistent site conditions. If the borehole becomes unstable and caving or sloughing of the walls develop, temporary surface casing may be used in the drilling operations.

The samples obtained from the borings may be screened in the field for head-space analysis using an on-site OVA or PID. Immediately upon removal of the soil sample from the Shelby

tube or split spoon, the field geologist will visually log it. The visual logging will describe soil type and secondary color, penetration resistance and inclusions as described above. A portion of the sample will then be shaved with a clean knife or spatula to remove at a minimum the outer approximately one-fourth inch which may have come in contact with the downhole fluids. This shaved sample will then be divided into two parts, each of which will be labeled based on boring number and sample depth. One portion of the sample will be placed in a glass jar, labeled, and placed on ice. The other portion will be placed in a wide mouth glass jar covered with aluminum foil and capped. The headspace will be sampled by inserting the probe of the OVA into a predrilled hole in the cap through the aluminum foil. The OVA or PID reading will be made immediately and the reading recorded on the boring log.

The qualified URS representative will select samples for chemical analysis. Samples will be retained on ice or refrigerated until delivery to the laboratory. One sample in 20 will be split to provide field duplicate samples for analysis.

Subsurface soil samples may be collected from discrete intervals or continuously by soil probe sampling with a "Geoprobe" sampler. The sample tools are stainless steel thin wall sample tubes or split spoon samplers. The sampling tools are typically 1- to 2-foot in length and 1 1/2 to 2 inches in diameter. Different types of "Geoprobe" samplers are also available.

The soil probe uses a direct-push method that consists of a small diameter hollow steel rod with a stainless steel sampling tool fitted to the base of the rod. The borehole can be continuously sampled or a discrete sample can be collected at a desired sample interval. Soil samples are collected by pushing or driving the sampler to the desired sampling depth. The drive tip is then mechanically released and the thin wall sample tube or split spoon sampler is pushed into the soil at the base of the borehole. The sampler uses a plastic polybutyrate liner which is extruded upon retrieval of the sampler from the borehole.

The soil samples will be handled in the same manner as described previously. The sampling devices and probe rods will be decontaminated prior to each use.

DOCUMENTATION

Subsurface soil sampling will be documented in the filed log book as well as on a boring log form for each boring drilled. Pertinent information will, at a minimum, include boring number, date, logger, lithologic description, core recover, OVA or HNu readings, depth of water table and boring completion data.

The following information shall be routinely entered or attached to the soil boring log:

- Depths/heights shall be recorded in feet and fractions thereof (tenths).
- Soil classifications shall be in accordance with the Unified Soil Classification System (equivalent to ASTM D 2487 and 2488).

Each soil sample taken shall be described in the log. The descriptions of intact samples shall include the following parameters:

- Lithologic Classification and Unified Soil Classification
- Color
- Plasticity
- Consistency (cohesive soil)
- Density (noncohesive soil)
- Relative moisture content.

Other information to be placed on the soil boring logs, as appropriate, include:

- The drilling equipment used will be generally described either on each log or in a general legend.
- Each log will record the drilling sequence.
- All special problems and their resolution will be recorded on the log; e.g., hole caving, recurring problems at a particular depth, sudden tool drops, excessive grout takes, unrecovered tools in hole, lost casing, etc.
- The dates for the start and completion of borings shall be recorded on the log.

- Each sequential boundary between the various soils and individual lithologies shall be noted on the log by depth. When depths are estimated, the estimated range shall be noted along the boundary.
- The depth of first encountered free water shall be indicated along with the method of determination. In addition, when free water is first encountered the following procedure will be followed; Allow the first encountered water to partially stabilize (10 to 15 minutes) and record this secondary level and time between measurements before proceeding.
- The estimated depth interval for each soil sample taken, classified, and/or retained shall be noted on the log. For each driven (split spoon), thin wall (shelby), and cored sample, the length of sample recovery and the sampler type and size (diameter and length) will be recorded.
- For thin wall samplers it should be indicated whether the sampler was pushed or driven.
- Special abbreviations used on a soil boring log and/or well diagram will be defined either in the log/diagram where used, or in a general legend.

4.2 SURFACE SOIL

Soil samples will be obtained from areas that are potential pathways for surficial contaminant migration.

EQUIPMENT

Sampling equipment will consist of hand sampling tools such as trowels, shovels, a drive tube sampler or a hand auger. Stainless steel or PVC sampling tools will be used.

PROCEDURE

The sample locations will be referenced to site coordinates. The sampling area will be first cleared of vegetation and/or debris. The sample will be collected to a depth of 12 inches such that minimal volatilization is allowed and then transferred in the appropriate container. The hole will be backfilled with native soils and vegetation.

DOCUMENTATION

As previously stated, the sampling point will be referenced to the site coordinate system and ,if taken with an areal grid, the node number will be recorded. Visual classification and other observations will also be noted in the field log book along with sample number, time, date, and other pertinent information.

4.3 GROUNDWATER SAMPLING

WATER LEVEL MEASUREMENT

Water Level Determination

The elevation at the top of the casing (TOC) should be established at each piezometer. This information will be used to determine the water level elevation. To calculate the water level elevation, the distance to the water level from the TOC needs to be measured. This can be achieved by either of the following procedures:

Weighted Tape Procedure. A weighted tape must be decontaminated prior to use and between wells. The weight should consist of an inert, open-ended object that will create a distinct sound when tapped on the water's surface. The weight should be lowered gently into the well until it is heard to have touched the water. The water level measurement from top of casing to water level should be determined to the 0.01 foot and recorded in a logbook. A measurement of well depth from the top of the casing to the bottom of the well should also be made. This measurement can be used to determine if a significant silt build-up has occurred at the bottom of the well or that the well casing is not blocked. NOTE: When using a weighted tape, be sure that the weight is not secured using an adhesive tape (duct tape, strapping tape, etc.) as the adhesive may contain organic compounds which could contaminate the well.

Electronic Water Level Indicator Procedure. An electronic water level indicator must also be decontaminated prior to use and between wells. The indicator probe, connected to a graduated wire is lowered down the well casing. A light turning on or a meter deflection occurs when the electrical circuit is closed indicating that the probe tip has touched the water. The reading should be taken to the nearest 0.01 foot by recording the length of graduated wire between the TOC and the water level (probe tip) in a logbook. Additionally, a measurement of well depth should be made from TOC to the bottom of the well using the probe.

Cross-Contamination Minimization

In areas of known contamination, the sequence of water level measurement should be done, whenever possible, from the well least likely to be contaminated to the well most likely contaminated to reduce the potential for cross-contamination. If this information is not available, an attempt should be made to sample upgradient wells first and then downgradient wells.

Calculation of the Volume of Standing Water

The water level measurement is used to calculate the volume of standing water in the well from the linear feet of standing water and the well diameter. This calculation is then used to determine the volume of water to be purged from the well prior to sampling. To calculate the linear feet of water in the well, subtract the depth to the water from the total depth of the well. Form the table below determine the appropriate factor for the specific well inside diameter; multiply the linear feet by the appropriate factor listed on the table below to get the gallons of water present in the well.

Casing Diameter	Casing Volume
2 inches	0.163 gallons/foot
3 inches	0.367 gallons/foot
4 inches	0.653 gallons/foot

For example, if depth to water is 7.5 feet, and the total depth of the 2-inch diameter well is 20 feet, then 12.5 feet of standing water is in the well. Volumetrically, 0.163 x 12.5 (2-inch well), or 2.04 gallons of standing water are in the well.

Free-Phase Immiscible Contamination

If contamination of groundwater by free-phase immiscible chemicals is suspected, procedures for the detection of immiscible, or nonaqueous phase liquids (NAPL) should be employed. The presence of dense NAPL (heavier than water) or light NAPL (less dense than water) can be determined by the use of an electrical interface probe. The probe should be carefully and slowly lowered into the well. A deflection of the needle on the scale of the probe will indicate the air/light NAPL interface, light NAPL/water interface, and water/dense NAPL interface, respectively. The thickness of immiscible contaminants is to be recorded in a logbook.

WELL EVACUATION – PURGING

Well evacuation allows fresh or formation groundwater to enter the well. The optimum method to ensure that formation water is sampled, is to monitor the water being purged by field measurements of pH, temperature and conductivity. For each volume of standing water purged from the well (as calculated earlier) a measurement of these three indicator parameters should be taken. When the subsequent sample are observed to have less that 10 percent variation in these parameters, the well is presumed to be adequately flushed. At a minimum, three standing water volumes as should be removed; however, in wells with very low recoveries this goal may not be practical. When full recovery exceeds two hours, the well should be purged to dryness. If the well is evacuated to dryness, samples of the groundwater should be collected within 24 hours of evacuation.

Evacuation rates should be kept well below 10 gallons per minute and in most cases should be below 5 gallons per minute. At no time should a well be pumped to dryness if recharge rates cause groundwater to vigorously cascade down the sides of the screen which can potentially cause an accelerated loss of volatiles. If at all possible, the water should be drawn down from above the screen in the uppermost part of the water column in high yield formation to ensure that fresh water from the formation will move upward in the screen. In low yield formations, water should be purged so that it is removed from the bottom of the screen.

Evacuation of a well can be accomplished in several different ways. In any instance it is paramount to ensure that the evacuation procedure does not cause cross-contamination from one well to the next. The selection of an evacuation method often relies on the depth of the water in the well, as discussed below. The following are potential evacuation methods:

Bailer Purging

Bailers can be used to evacuate shallow wells. Historically, monitor wells are purged of 3 casing volumes prior to sample collection to evacuate the standing well water and access the adjacent formation water. A common result of such purging practice is highly turbid samples from excessive downhole disturbance due to high pump rates or the continual plunger action of bailers. The excessive turbidity may adversely affect sample quality. Considering the uniformity of aquifer soil media and other site hydrogeologic characteristics and the primary

purpose for monitoring at the site (primarily attenuation monitoring), problems associated with purging with bailers have not significantly affected the quality of monitoring at this site.

The preferable materials of bailer construction are teflon, stainless steel, polypropylene, polyethylene, vitron, and polyvinyl chloride (PVC). The bailer should be lowered into the well using a nonporous rope made out of material such as polypropylene or teflon-coated cord. Caution should be used when lowering the bailer into the water so as to avoid aeration of the well water. Retrieve the bailer after it is filled and pour water into a graduated container to measure the amount of water removed from the well. Care should be taken to keep the rope and bailer from touching the ground or other potentially contaminated surfaces. When the first standing water volume has been removed, a groundwater sample should be collected from the bailer for field measurements of pH, temperature, and conductivity. These field measurements should be repeated for each subsequent standing water volume removed.

Mechanical Pump Purging

Suction lift pumps such as centrifugal, diaphragm, or peristaltic pumps can be used to evacuate wells if the static water level is within 25 feet of ground surface. These pumps are utilized at ground surface with the intake line connected to dedicated teflon or high-density polyethylene tubing inserted into the well. The tubing should be equipped with a foot valve to avoid having aerated water from the pump fall back in the well. The outlet tubing should be placed so that the purge water is collected in a graduated container, and can be measured. Deionized water should be used if priming is necessary. Measurements of pH, conductivity, and temperature should be taken for each standing water volume evacuated from the well. If the well is pumped dry and the recharge rate is sufficiently rapid to cause water to cascade into the well, the well should be allowed to recover. Then the pumping rate should be adjusted to a slower rate and the well re-evacuated of two standing water volumes before sampling.

Submersible Pump Purging

Portable submersible pumps are an option for evacuating wells with water levels greater than 25 feet below land surface. One such pump is an electrically powered (110 or 230 V AC) centrifugal pump with an isolated motor. Another is an air displacement pump in which a stainless steel reservoir with check valves at each end alternately fills from the bottom with water from the well, and evacuates when air or compressed gas (nitrogen) is discharged into

the reservoir from the top. The decontaminated pump should be carefully lowered into the well, trailing a discharge hose, electrical cables or air liens, and a stainless steel security cable (which should bear most of the weight). If these items are to be bundled, use plastic ties and not electrical tape or duct tape.

If the pump is connected to a portable gasoline generator or air compressor, the generator should be placed some distance away from the well where fumes can not affect sample quality. An inline air filtration system at the discharge line should be used when an air compressor is used in conjunction with an air displacement pump. The submersible pump provides the advantage of high flow rates, however, care should be taken when operating to keep the flow rate within an acceptable limit for the particular well yield (recharge capacity). As with the suction lift pumps, these pumps should be equipped with a foot valve and fitted with dedicated tubing.

To evacuate, simply turn the pump on, prime with de-ionized water if needed, and measure the outlet water quantities. As with all other evacuation methods, pH, temperature, and conductivity should be measured for each standing water volume removed. These pumps need to be decontaminated prior to sampling and between sampling points.

Bladder Pump Purging

A bladder pump or gas squeeze pump consists of a housing that encloses a flexible membrane (bladder) that has check valves above and below. The pump is connected to either bottled gas or an air compressor. When in operation, water enters the membrane/bladder through the bottom check valve; compressed gas is injected into cavity between the housing and the bladder, squeezing the bladder and forcing the water through the top check valve and ultimately out of the well. Another type of bladder pump is also available that works on the same principle except that the water enters the chamber between the membrane and the casing, and the gas is injected into bladder. Similar to the submersible pumps, the bladder pump should be carefully lowered into the well by a security cable. In low-yielding wells (i.e., wells incapable of producing three well volumes), the bladder pump should be placed at the bottom of the well screen so that water is removed from the bottom of the well screen.

The outlet tubing from the bladder pump should be placed so that purge water can be collected into a graduated container. Field measurements of temperature, pH, and conductivity should be taken for each standing water volume evacuated from the well.

Inertial Pump Purging

An inertia pump consists of a PTFE footing which is essentially a reservoir with check valves at the bottom inlet and top outlet, and a tube rising to the wellhead. An up-and-down movement of the tube pumps water through inertia derived from the upward movement of water with each stroke. The whole system is dedicated and can be pumped by hand, by the use of a hand-operated lever, or by using an electrically powered (110 V AC) motor. An optional bellows attachment provides suction to the tubing and greatly increases the pumping capacity.

To evacuate, simply pump by hand, or connect the motor. If a portable generator is used, take care to place it some distance away from the well where fumes cannot affect sample quality. Field measurements of pH, temperature, and specific conductivity should be taken for each standing water volume removed.

WELL SAMPLING

Sampling of the piezometer or well should occur as soon as possible after evacuation, preferably immediately and must occur within 24 hours of completion of purging activities. Of the methodologies used for monitor well evacuation it is recommended that samples be collected only by using either the bailer, inertia pump, or the bladder pump. Due to the manner in which the other pumps (suction lift and submersible pumps) operate and the potential effect on the quality of the samples, it is not advisable to collect samples for volatile organic analysis with them.

Sample Collection

Site monitoring well sampling and purging normally can be accomplished by means other than bailing, where possible wells with suitable yields will be purged using a low flow rate pump and maintaining the water level in the well above the top of the well screen (preferably little or no drawdown at all).

Wells Capable of Sustaining Suitable Purging Rates

Purging will be monitored using field measurements of pumping water levels and water quality parameters, such as pH, temperature, conductance and turbidity, as the primary basis

for determining when samples can be collected. While the volume of water discharged during the purging operation is of interest in evaluating the overall well performance, well volumes will not be used as a criteria for determining when samples can be collected. Samples will be collected using the following generalized protocol:

- Samples for volatile organic analysis will be collected first, followed by semivolatile, inorganic and metals samples;
- Volatile organic samples will be collected using the ball check and tubing method for diaphragm pump operation (tubing check valve and ball will not be used for peristaltic pump operation) according to the following protocol:
    1. Fill the tubing used to purge the well by pumping water to the surface until a bubble-free stream of water is discharged from the tubing;
    2. Stop the pump and carefully remove the tubing from the well being careful to keep the tubing from contacting anything outside the well except the gloved hands of the sample collector;
    3. Carefully fill the sample vials by releasing the ball check valve and allowing water to slowly flow into the vials (diaphragm pump system) or reversing the flow of the pump so that water slowly discharges from the tubing intake into the vials (peristaltic pump system);
    4. Take care to use only the lower two-thirds of the column of water in the tubing for filling the vials (the remaining one-third will be discarded);
    5. If there is not enough water in the tubing to completely fill all sample vials without violating the two-thirds limit specified above, place the tubing back into the well to the depth that the tubing intake was located in Step 1 and repeat Steps 1 through 5;
    6. Continue this protocol until all volatile sample vials required for the individual well are satisfactorily filled.
- Collect samples for semivolatile organics, inorganics and metals (in this order) using the purge pump and tubing placed back into the well with the tubing intake at the same depth that volatile organic samples were collected; and
- Fill sample jars using the pump system surface discharge.

All pumping for sample collection, including filling tubing for volatile sample collection, will be performed at the purging rate (i.e., the rate at which the water level in the well does not draw down below the top of the screen).

Wells Not Capable of Sustaining Suitable Purging Rates

Wells with yields that cannot sustain pumping without drawing the water level down below the top of the screen and/or to dryness, will be purged according to the following generalized protocols:

- Measure static water level and bottom depth prior to beginning the purging process;
- Pump the well to dryness with the pumping system described above;
- Allow the well to recharge until sufficient water has entered the well to collect volatile organic samples as described above (Steps 1 through 7);
- Collect semivolatile organic samples, inorganics and metals by discharging pumped water directly into the sample containers as described above, except sample collection at these wells will consist of one or more cycles of pumping and well recharging until a sufficient volume of sample has been collected to satisfy laboratory analytical requirements;
- Depending on the recharge rate of the well, sampling according to this protocol could require one or more days to complete sample collection. If so, sample collection will be performed on subsequent days (in sequence) after purging.

4.4 QUALITY CONTROL SAMPLES

To attain the project quality assurance objectives discussed in this document, certain Quality Control (QC) samples need to be collected and sent to the laboratory. The following is a discussion of those samples:

TRIP BLANKS

These samples consist of laboratory-prepared VOA vials, filled with volatile organic-free water which are shipped with the sample containers. These vials remain in the sample cooler and are not to be opened. They will be analyzed in the same manner as the collected samples, and are used to monitor volatile organic compounds due to container contributions or contamination during shipment. A trip blank shall accompany each sampling event (defined as the duration of the sampling of the wells in the plant) for which sample for volatile organic analysis are being collected.

RINSATE BLANKS

These samples are used to monitor contamination resulting from the sampling equipment and also to monitor the effectiveness of equipment decontamination procedures. Rinsate samples are collected by pouring reagent grade water over decontaminated sampling equipment, in such a manner as to contact the same surfaces as the samples and collecting that water for analysis. Rinsate blanks will be collected at a minimum of one per sampling event. If there is more than one type of parameter being monitored in that sampling event, the rinsate blank will be analyzed for only the organic constituents (volatile and semivolatile, if applicable).

SAMPLE PRESERVATION AND SHIPMENT

The appropriate preservative will be added to each sample bottle by the laboratory prior to being taken into the field.

Once the sample is placed in the bottle, a label should be affixed to the bottle. The label shall contain the following information: plant area, sample number (monitor well number), date, time of sample collection, parameter for analysis, preservative (if any), and the collector's name. The samples shall be placed in an ice chest containing an adequate volume of ice to maintain samples at 4°C. The ice chest should be sealed for shipment.
All samples will be continuously tracked in the field and while in transit. A chain-of-custody form shall accompany the samples at all times.

4.5 GROUTING

Following completion of each borehole, the borehole will be grouted with a cement/bentonite grout (4 to 8 percent bentonite by dry weight). The grout shall consist of Portland cement and powdered sodium bentonite. The grout mix will consist of a pumpable cement/bentonite slurry. The grout shall be mixed in clean, above ground, rigid containers with an appropriate quantity of water. The mixing of each component will be achieved by a mechanical paddle device or recirculation with a grout pump. Mixing activities will continue until a smooth, lump free consistency is achieved.

The grout mixture shall be pumped through a rigid, side discharge tremie pipe placed approximately 6 inches above the bentonite seal for monitor well installation or on the bottom of the hole for plugging and abandonment of soil borings. The grout mixture shall be pumped until undiluted grout flows from the annulus at the ground surface. The tremie pipe may be slowly withdrawn during grouting operations. The estimated volume of grout will be computed for each boring or well, based upon borehole dimensions and well dimensions. If actual grout placed is less than or exceeds 50 percent of the computed volume, the grouting for that boring or well will be evaluated to determine if grouting problems are present (i.e. caving or excessive grout takes).

After a minimum 24-hour period, the boring or well will be inspected for settlement of the grout and more grout will be added as needed. This process shall be repeated until firm grout is at or within one foot of the ground surface.

The specifications for the materials making up the grout are:

- Bentonite will be powdered, granular, or chipped sodium montmorillonite furnished in moisture resistant sacks and without additives.

- Cement will be a low-alkaline Portland Cement, Type I in conformance with ASTM C-150 and without additives.

4.6 AQUIFER TESTING (To be implemented prior to detailed design of corrective action, if necessary to supplement existing information)

Single well tests are referred to as slug tests. These tests are performed by suddenly adding or removing a slug (known volume) of water from a monitor well and observing the recovery of the water surface to its original level. In systems where the entire depth of the aquifer formation is screened, such tests provide information on the horizontal component of hydraulic conductivity. When only a portion of the aquifer depth is screened, the slug test results give a hydraulic conductivity containing both horizontal and vertical components. Most of the pressure loss (head loss) is dissipated in a horizontal direction, therefore, the value of hydraulic conductivity evaluated is assumed to be most horizontal. Bower (1978) discusses a slug-test procedure applicable to fully or partially penetrating wells in unconfined aquifers. He discusses the use of dimensionless solutions of the Thiem equation to determine the hydraulic conductivity from observed values of water level and elapsed time.

EQUIPMENT

Slug testing equipment will consist of:

- Pressure transducer(s)
- Suspended weight of known volume (slug).
- Electric water level probe and/or steel tape.
- Data logger (recorder)
- Field data printer.

Since the pumping test program will be developed as needed after performing the slug testing, it is not possible to identify equipment to be used in conducting the pumping test(s) at this time. A listing of such equipment will be compiled when the pumping test program has been developed.

PROCEDURE

The specific slug test performed will be a falling head test followed by a rising head test. Measurements of the behavior of the piezometer system as it returns to equilibrium are then made and used for analysis. The test will be run until the system has achieved 90 percent equalization. Field procedures for slug testing are as follows:

- The magnitude of instantaneous head change resulting from introduction or removal of the slug shall not cause water to overflow the casing. To assure meeting these requirements, magnitude of head change shall be determined prior to introduction of the slug. The magnitude determination shall be based on the calculated volume of the slug and the inside diameter of the casing. The test shall proceed only when these requirement are met.

- All equipment shall be decontaminated prior to placing into the piezometer. Decontamination shall consist of triple rinsing with deionized water.

- The static water level shall be measured using an electronic water level sensor or weighted tape.

- When the transducer is lowered into the piezometer and in place, the slug shall be introduced as rapidly as possible without causing undue splashing or turbulence so as to produce an instantaneous head increase. The instant the slug is set in place, the reference time will be time zero.

- Water levels shall be measured continuously (millisecond intervals) with the transducer and recorded with the data logger unit. Measurements shall be terminated when the water level stabilizes or when the water level has reached a level within 10 percent of static level.

- Water level measurements recorded shall be checked for credibility before proceeding to the next testing stage (removal of the slug).

- When checking of data has been completed and the previous testing has been determined to be acceptable, the slug shall be removed as rapidly as possible to produce an instantaneous head reduction. The instant the slug is removed from the water, the reference time will be time zero.

- Water levels shall be measured continuously (as in the previous testing stage) using the transducer and shall be recorded using the data logger unit. Measurements shall be terminated when the water level stabilizes or reaches a level within 10 percent of initial static water level.

- When measurements are terminated, the transducer shall be removed.
- Water level measurements recorded shall be checked for credibility before proceeding.
- Any test or test stage shall be repeated if review of the recorded data indicates questionable validity.

The data from the slug test will be reduced to evaluated time versus change in water level using the methods of Cooper, et al. (1967) or Bower and Rice (1976). Upon evaluating the results of the slug test, a pumping test plan may be developed.

DOCUMENTATION

Water level data shall be recorded with the data logger and preserved for offloading at the URS Corporation office in Baton Rouge, Louisiana. To the extent possible, print outs shall be obtained for each set of tests during the data checking phase of testing. Printouts obtained shall be properly labeled to indicated the following and shall be preserved as raw field data:

- Piezometer location
- Piezometer number
- Date of Test
- Elevation of Base of Test Section
- Elevation of Top of Test Section
- Testing Stage (i.e., slug-in or slug-out)

If a printout cannot be obtained, the data shall be hand recorded in the field log book, if possible or the piezometer will be retested.

5.1 EQUIPMENT

In addition to drilling and sampling equipment described previously, the material required for installation will consist of:

- A screen to allow entry of ground water.
- A bentonite pellet seal above the filter pack to prevent downward migration into the filter media.
- A filter pack to fill the space between the borehole and the screen with a stable material and to limit entry of fine materials into the well.
- Blank pipe or casing connecting the screen to the ground surface.
- A low permeability grout seal between the casing and the borehole to isolate the screened interval from the ground surface.
- Intermediate casings to seal off permeable zones above the target stratum, as needed.
- A protective casing at the surface.
- A surface slab.
- Protective posts.

PROCEDURE

The construction for well involves drilling of borehole to the total depth and backfilling the hole in succession with the screen (with a cap and sump on the bottom), the blank pipe above the screen, a filter pack around the screen, a bentonite pellet layer and cement bentonite grout to the surface.

In the event that it is necessary to "case off" contamination from being carried further subsurface, the following procedure may be followed. Such wells will be constructed by drilling a borehole through the base of the upper permeable zone and one to three feet, at the discretion of the qualified URS representative, into the underlying clay. A Schedule 40 PVC casing is lowered into the borehole and pushed about one foot into the clay at the base of the boring. The casing is then grouted in place by pumping a cement bentonite grout through a tremie pipe into the borehole between the outer casing wall and borehole wall. At completion

of the grouting, the grout is allowed to cure for 24 hours and the downhole drilling equipment is decontaminated. During the grout set period the casing will be capped to prevent tampering until well installation is resumed. After the grout has set, the inside of the 12 inch casing is thoroughly flushed with clean water. The borehole and installation are then completed through the casing. Wells will be surveyed upon completion prior to sampling.

Screen

Screens will be Schedule 40 PVC with No. 10 slot size. Connections between the screen and the casing will be threaded. No glues, solvents, epoxies, thermal processes (except welding) or rivets will be used.

A direct measurement of borehole depth by the use of a clean, chemically inert, weighted measuring tape shall be made before screen placement. The depth, to the nearest tenth of a foot shall be recorded on the construction log.

The borehole shall be purged or flushed with water, to the extent practical of drill cuttings and any bentonite drilling mud used during construction. If during construction unstable soils or other factors resulting in side wall caving or "blow-in", were encountered, the use of temporary casing will be required. The temporary casing shall be steam cleaned and free of coatings and rinsed with water prior to use.

The screen shall be new, commercially fabricated continuously wound or slotted screen with a four-inch nominal diameter. No fittings shall obstruct the inside diameter. The screen will be free of foreign matter and steam cleaned prior to use.

Screens shall be 0.01 inch slot and no longer than 10 feet in length nor shorter than five feet. Screens will be placed based on the qualified representative's description of formation materials.

Filter Pack

After the screen is placed in the borehole the filter pack will be placed around it. The filter pack material will consist of a clean graded sand (typically 20-40 mesh sand).

None of the filter pack aggregate is to come in contact with the ground surface. Any aggregate that comes in contact with the ground surface or is otherwise contaminated shall not be introduced into the well. Filter aggregate may be placed directly from the bag; however, care will be exercised not to include the dust and fines from the bottom of the sack.

The filter pack is to be placed by either tremie pipe or poured down and around the annulus in such a manner as to be distributed around the screen at a uniform height and density.

If temporary casing is used, the filter pack will be placed first and then the casing partially withdrawn to allow the filter pack to slump against the side walls of the boring. Additional filter aggregate will be added to allow for the slight increase in volume.

The filter pack will extend 1 to 2 feet above the top of the screen unless this height prevents proper placement of the bentonite seal. Placement of an adequate bentonite seal shall override the filter pack thickness except that the filter pack will come at least one foot over the top of screen. In no case shall the filter pack extend such that separate permeable zones are connected.

Pipe and Casing

Blank pipe or casing made of Schedule 40 PVC will extend from the top of the screen to between three and four feet above ground surface. This blank pipe will be attached to the screen by a threaded connection. The casing will be capped with a vented top cap.

Grout Seals

A bentonite pellet seal shall be 2 or 3 feet in thickness and will be placed in such a manner as to be uniform in thickness around the casing. In placing the bentonite pellets, care will be exercised so as not to incorporate any of the accumulated bentonite fines from the bottom of the packaging container into the annulus.

However, if the soils in this area are unstable to the degree that slumping or collapse of these soils against the permanent wall casing is highly probable, then the bentonite pellet seal shall be placed first and the temporary casing withdrawn as expeditiously as practical. After placement of the bentonite seal, the seal will be given adequate time to hydrate as determined by the qualified URS representative. After the hydration period, the top of the bentonite seal shall be determined by direct measurement and recorded on the construction log.

The annular space above the bentonite seal will be grouted. All grout materials shall be placed by pumping through rigid, side discharge tremie pipe.

Protective Casing

A 8-inch locking protective casing shall be placed around the PVC riser pipe as soon as possible after grout inspection has been completed. The protective casing shall be provided with a threaded, 1/4-inch hole and drain plug at a base of the exposed portion of the protective casing. The protective casing shall fit such that there is sufficient clearance for cap accessibility.

The inside of the locking cover of the protective casing shall have the following inscribed, stamped or otherwise permanently affixed:

- Identification number
- Top of casing elevation
- Depth
- Screen length
- Date of well installation
- Construction contractor's name

The locking protective casing, at a minimum, shall be five feet in length and extend just over the riser pipe, and be manufactured of new black iron, steel, or stainless steel pipe or will be protective covers commercially manufactured for that purpose. Prior to placement, the casing shall be steam cleaned and free of any asphaltic or resinous coatings except paint or primer applied by the manufacturer. The casing shall be provided with a locking cap that telescopes or in some similar manner extends over and down the casing to prevent the entrance of rainwater, wind-blown dust particles, or insects into the casing. All protective casings shall be provided with a padlock, which shall be locked until the time of sampling.

Surface Slab

A concrete slab will be poured at the ground surface around each well after installation. The slab will be at least four inches thick and five feet square and sloped gently away from the well in all directions.

Protective Posts

Wells located in areas of traffic will be further protected by the erection of four steel posts, or approved alternate, each radially located 4 feet from each well, placed 2 to 3 feet below ground surface, having 3 feet minimally above ground surface. Guard posts shall not be made a part of any protective slab constructed around the well.

DOCUMENTATION

Each installed well shall be depicted in an installation report. This report shall be attached to the boring log for that installation and shall graphically denote, by depth from ground surface (unless otherwise specified):

- The bottom of the boring (that part of the boring most deeply penetrated by drilling and/or sampling) and borehole diameter;
- Screen location;
- Granular filter pack;
- Bentonite pellet seal;
- Grout;
- Cave-in(s);
- Height of riser (without cap/plug) above ground surface;
- Protective casing detail;
  - height of protective casing without cap/cover
  - base of protective casing
  - drainage port location and size
  - guard post configuration

The construction report will include:

- The actual quantity and composition of the grout, seals, and granular filter pack used for each well.
- The screen slot size (in inches), outside diameter, schedule/thickness, composition, and manufacturer.
- The outside diameter, schedule/thickness, composition, and manufacturer of the well casing.

- The joint design and composition.
- Location of placement of bentonite pellet seal.
- Location of placement of annular grout.
- Protective casing composition and nominal inside diameter.
- Special problems and their resolutions; e.g., grout in wells, lost casing and/or screens, bridging, etc.
- Dates and times for the start and completion of well installation.

All abbreviations used on the boring logs/well diagrams shall be designated on the log-diagram or in an attached general legend.

For documentation purposes, all information pertinent to field observations and sampling will be recorded in a field logbook with consecutively numbered pages. Entries in the log book will include at least the following:

- Location and sampling activity and address,
- Purpose of sampling,
- Number and approximate volume of samples taken,
- Description of sampling point,
- Date and time of collection,
- Collector's sample identification number(s),
- Sample distribution (e.g., chemical laboratory, geotechnical laboratory, etc.),
- Sample preservation,
- Field observations,
- Any field measurements made, such as pH, temperature, specific conductivity, or other field parameters,
- Weather conditions.

The documentation in the log book will be sufficient to reconstruct the sampling situation without relying on the collector's memory.

6.1 BORING LOGS

Field boring logs will include at a minimum the following information for each boring location:

- Project name and number
- Boring number
- Location of boring (including measured offset and reason for offset)
- Drilling method
- Name of URS representative

Each log will also include:

- Sample location number and depth
- Water levels and the respective times of each reading

- Description of subsurface materials using the Unified Soil Classification System (USCS) including classification, consistency, texture, plasticity, moisture content, color, stratification, etc.
- Sample recovery in inches
- Results of organic vapor monitoring, if required
- Sample interval

6.2 MONITOR WELL / PIEZOMETER INSTALLATION / DEVELOPMENT REPORTS

A monitor well/piezometer installation report will be completed for each newly installed monitor well/piezometer at the site. Information on these reports shall include the screening interval, depth to sand pack and bentonite seal, and grout backfill.

6.3 GROUNDWATER SAMPLING REPORT

A sample collection log specific to groundwater sampling will be completed for each monitor well sampled at the site. These reports shall include static groundwater elevation, volumes purged, weather conditions, etc.

6.4 SAMPLE CUSTODY DOCUMENTATION

Chain-of-custody will be maintained for each sample collected. The chain-of-custody will provide an accurate written record which can be used to trace the possession and holding of samples from the time of collection through data analysis and reporting. The following information will be specified for each sample on the chain-of-custody form:

- Sample number
- Sample date
- Sample time
- Sample location and depth where appropriate
- Analyses to be performed

The chain-of-custody form will be signed by the sample custodian. It will be placed in a water-tight plastic bag and taped to the underside of the lid of the cooler containing the samples designated on the form. The lid of the cooler will be securely taped shut and signed

custody seals will be placed on the opening of the cooler lid to allow detection of any possible tampering. Upon arrival in the laboratory, samples will be received by the analytical laboratory representative. Samples contained in the shipment will be compared of the chain-of-custody form to verify that all samples designated have been received. Sample custody within the laboratory will be maintained on internal tracking forms.

The chain-of-custody procedures document sample possession from the time of collection to final disposition. A Sample Analysis Request Form will accompany the Chain-of-Custody form and will document the requested sample analysis.

For the purpose of these procedures, a sample is considered in custody if it is:

- In one's actual possession
- In view, after being in physical possession
- Locked so that no one can tamper with it, after having been in physical custody
- In a secured area, restricted to authorized personnel

A chain-of-custody record will be initiated in the field, and the original will accompany the samples with copies retained at intermediate steps.

Each time responsibility for custody of the sample changes, the new custodian will sign the record and denote the date. A copy of the signed record will be made and retained by the immediately previous custodian to allow tracking of sample possession. All changes of custody of samples must be a person-to-person change of physical possession.

6.5 ANALYSIS REQUEST

Analysis of the samples collected shall be in accordance with the EPA protocol. All samples shipped for analytical testing shall be accompanied by a Chain-of-Custody form containing information on the requested analyses.

Personnel will wear appropriate protective clothing during decontamination as required by the Health and Safety Plan. All protective equipment (gloves, boots, etc.) will be decontaminated after use or they will be disposed in drums, labeled, dated, and stored until disposed at an approved facility.

7.1 CROSS-CONTAMINATION CONTROL PROCEDURES

In order to minimize the possibility of cross-contamination, strict cross-contamination control procedures should be followed. These procedures include:

- Sample jars should be kept in limited access areas until used.
- Clean equipment should be wrapped in aluminum foil or plastic sheeting prior to use.
- Clean plastic sheeting shall be placed at the sampling area and all equipment should be placed on the sheets. This plastic shall be discarded after each use.
- Equipment refueling shall be performed in designated areas. These areas should be at a distance from any sampling points, to minimize the potential that vapors from fuel will affect sample quality.
- All purge water, decontamination water, and discarded gloves should be containerized for disposal.

To prevent contamination prior to drilling operations, the following will be applied:

- Only new materials will be used. Only bagged cement, powdered bentonite in bags or bentonite pellets in well protectors will be used.
- PVC pipe for riser and well screen will be cured and free of plasticizers and oils.
- Workers will wear clean cotton or surgical gloves when handling riser and well screen.
- Electrical tape will not be used to band pumps.

7.2 SAMPLING EQUIPMENT DECONTAMINATION

All equipment used to collect groundwater samples should be decontaminated prior to the collection of the samples and in between sample locations. Decontamination of this equipment will be accomplished by the following procedures:

- Wash equipment thoroughly with laboratory, phosphate free detergent (i.e., Alconox) and de-ionized water using a brush to remove any particular matter or surface film.
- Triple rinse equipment thoroughly with clean deionized water.
- Rinse equipment thoroughly with methanol.
- Triple rinse with clean deionized water.

In the event that metals become a primary concern, sampling equipment will be rinsed with HCl prior to the methanol rinse. The sampling equipment will be wrapped in aluminum foil or visqueen after decontamination until reuse. This equipment will be decontaminated in areas established near the perimeter of the sampling area.

7.3 PUMP DECONTAMINATION

If a monitor well has been purged or sampled using any of the pumps as discussed, the pumps used need to be decontaminated between sample points. Decontamination of the pumps includes washing with soap and rinsing the outside portion of the pumps (especially those pumps that are placed inside the wells) as well as running water through the pump. It is recommended that a sufficient volume of distilled water or de-ionized water be run through the pumps to clean them out.

7.4 DOWNHOLE EQUIPMENT DECONTAMINATION

The drilling rig with associated tools and all sampling equipment will be decontaminated before entering the site and leaving the site. Downhole equipment (i.e., augers, bits, samplers, etc.) will be cleaned between boring or other sampling locations at a decontamination/washdown pad. Wash water will be containerized or transported to the wastewater treatment facility.

The equipment will be cleaned as described below:

- The drill rig, all auger flights, auger bits, drilling rods, drill bits, core barrel samplers, Shelby tubes, or other parts of the drilling and well development equipment that will contact the soil or groundwater should be cleaned with a steam cleaner or hand washed with a brush and detergent to remove oil, grease, and any contamination that has accumulated on the equipment.
- Any sampling equipment which can be safely steam cleaned shall be decontaminated as described above.
- These units should then be rinsed thoroughly with potable water.

8.1 ANALYTICAL PROCEDURES

During the RFI field work there will be analyses performed for constituents of concern form the following list:

List:	Parameter or Group of Parameters:
A	Atrazine, cyanazine, arsenic, dinoseb, toxaphene, toluene
B	TCL, TAL, atrazine, cyanazine, dinoseb
C	Atrazine, cyanazine, arsenic, dinoseb, toxaphene
D	TCL, dioxin, TAL, atrazine, cyanazine, dinoseb
E	BTEX, TPH
F	BTEX, TPH, atrazine, cyanazine, arsenic, dinoseb, toxaphene
Z	TCL, TAL, dioxin, atrazine, cyanazine, dinoseb

A table listing the SWMU Number, number of samples to be taken and the analytes and parameter or group of parameters is presented as Table 1 for the RFI Workplan and Table 2 for the Groundwater Assessment Workplan.

A summary of the parameter and possible methods to be employed by the offsite laboratory are as follows:

Parameter:	Protocol
Toxaphene, Atrazine and Cyanazine	EPA SW-846, Method 8080
Dinitrobytyl Phenol (Dinoseb)	EPA SW-846, Preparation Method 3550, Analysis Method 8015
Arsenic	EPA SW-846, Method 7060
Toluene	EPA SW-846, Method 8020
TCL, Dioxin	Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW 2/88, Revision 9/88, 4/89, and 5/89, Office of Solid Waste and Emergency Response, U.S. EPA, Washington, D.C., May 1989 or equivalent SW-846 methods
TAL	Statement of Work for Organic Analysis Multi-Media Multi-Concentration, SOW No. 788, Revisions 2/89 and 6/89, Office of Solid Waste and Emergency Response, U.S. EPA, Washington, D.C., June 1989 or equivalent SW-846 methods

8.2 CALIBRATION PROCEDURES AND FREQUENCY

Measuring and test equipment used in the field and laboratory shall be controlled by a formal calibration program. The program shall provide equipment of the proper type, range,

accuracy, and precision to provide data compatible with the specified requirements and desired results. Calibration of measuring and test equipment may be performed internally using in-house reference standards, or externally by agencies or manufacturers.

CALIBRATION PROCEDURES

Documented and approved procedures shall be used for calibrating measuring and test equipment. Whenever possible, widely accepted procedures, such as those published by the ASTI or U.S. EPA, or procedures provided by manufacturers in equipment manuals, shall be adopted.

Calibrated equipment shall be uniquely identified by using either the manufacturer's serial number, an equipment identification number, or other means. This identification, along with a label indicating when the next calibration is due (only for equipment not requiring daily calibration), shall be attached to the equipment. If this is not possible, records traceable to the equipment shall be readily available for reference. It is the responsibility of all personnel to check the calibration status from the due date labels or records prior to using the equipment.

Measuring and test equipment shall be calibrated at prescribed intervals and/or as part of operational use. Frequency shall be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience. Equipment shall be calibrated, whenever possible, using reference standards having known relationships to nationally recognized standards (e.g., National Bureau of Standards) or accepted values of physical constants. If national standards do not exist, the basis for calibration shall be documented.

Reference standards (physical and chemical) shall be used only for calibration. Physical standards shall be stored separately from working measuring and test equipment. Equipment that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use and shall be tagged to indicate it is out of calibration. Records shall be prepared and maintained for each piece of calibrated measuring and test equipment to indicate that established calibration procedures have been followed. Laboratory calibration records shall be maintained by the laboratory.

FIELD EQUIPMENT CALIBRATION

Field calibration procedures will be performed on field instrumentation as follows:

- pH Meter - Premeasurement calibration and post-measurement verification using at least two standard buffer solutions for each sample tested. The buffer solutions should bracket the sample pH. The two measurements must be within ± 0.05 standard unit of buffer solution values.

- Conductivity Meter - Daily calibration using potassium chloride (KCl) standard solution. The meter measurement must read ± 10 percent of the standard to be considered in control.

- Temperature - Temperature is measured using a thermostat built into the conductivity meter. The readings will be checked at least once at the start of the field use of the instrument using a quality grade thermometer.

- OVA - The instrument will be calibrated daily to a methane in air standard.

- Calibration of field equipment shall be documented in the field log book for reference and maintained in the project files.

LABORATORY EQUIPMENT CALIBRATION

Laboratory calibration procedures for analytical testing will be performed in accordance with SW-846 and EPA CLP protocols, as appropriate.

To ensure that the analytical DQOs for the project are met and to evaluate the overall acceptability of the analytical data, a review of the laboratory analytical report may be conducted. This review will consist of a check of "external" and "internal" laboratory QA/QC results.

The external quality assurance review will include a check of contaminants in the field-collected QA samples (trip blank, rinsates and duplicate samples) submitted with the environmental samples. Evidence of contaminants in these QA samples will be compared against the environmental sample results to evaluate whether detected constituents are related to field or laboratory artifacts.

The internal quality assurance review will include a review of the laboratory QA/QC results to determine if holding times, initial and/or continuing calibration curves, surrogate recoveries, matrix spikes and matrix spike duplicates and blank contamination objectives have been met according to the laboratory's internal quality assurance program.

9.1 DATA REDUCTION

All concentration associated with samples or prepared sample extracts or digestates will be taken directly from multiplied quantitation reports. Multiplied quantitation reports relate the instrumentally measured extract or digestate concentrations to those of the original sample. GC/MS concentration data will be taken, to the extent possible, directly from the data systems following an internal standard calibration for both the volatile and semivolatile base/neutral/acid compounds and following an external calibration for both the pesticide and herbicide compounds.

9.2 DATA REPORTING

The intention of these sampling data reporting procedures is to maintain accurate records of all samples taken and to follow the status of the sample location and analytical results, while minimizing the duplication of record keeping activities and the possibilities for errors.

The tabulation and flow of all data reporting information can be broken down into the following activities:

- Assignment of sample numbers, sample label preparation, and initial permanent record keeping,
- Preparation and labeling of all sample bottles,
- Sampling and in-the-field record keeping, and
- Sample receiving and preparation for shipping.

SAMPLING RECORD KEEPING

Sample numbers will be assigned to all divisions of the original sample, all of which have the same identification number with letters denoting subset containers. The sample number and corresponding description will be written onto the appropriate sample label. When written, the sample labels will be applied to the sample bottles.

The individual(s) doing the sampling is (are) responsible for verifying that each sample is put in the appropriate sample bottle. At the time of sampling this person must fill in the time sampled, the date sampled, and sign and complete the sample's label. By the end of the sampling day, the sampler must return all samples and oversee preparation of the samples for shipment.

SAMPLE CUSTODY AND SHIPMENT

When the samples are ready to be sent to the laboratory, the sample coordinator will examine the samples and note their condition. At the time the samples are shipped, the sample coordinator will have a copy of the pages that include information on the sample numbers and the corresponding information on the date sampled, time sampled, and the date shipped.

The chain-of-custody record will document the fact that the evidentiary integrity of the samples was maintained.

LABORATORY RESPONSE

The laboratory will be responsible for reviewing all sample analyses according to their internal QA/QC procedures. Data validation will be completed by the laboratory prior to the delivery of the data package. Any problems should be resolved before the data are reported.

The quality control data and sample data results will be presented in a concise and convenient tabulated summary. The calibration data, raw quality control data, and raw sample data will be sufficient to permit reproduction of the calculation of any of the reported values. In addition, routine laboratory reports will include the following:

- Chain-of-Custody Records
- Quality Control Summary
- Sample Data Results

When generated, each hard copy data package will provide thorough coverage according to the following areas:

- Case Narrative
- Chain-of-Custody
- Quality Control Summary
- Sample Data Results
- Calibration Data
- Raw Quality Control Data
- Raw Sample Data

9.3 DATA VALIDATION

Data validation, according to Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-0050/80, Office of Monitoring System and Quality Assurance and Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 20460, December 29, 1980), is "a systematic process for reviewing a body of data against a set of criteria to provide assurance that data are suitable for their intended use", and entails editing, screening, checking, auditing, verification, certification, and review.

The purpose of data validation is to determine if the data conform to specifications and are suitable for the intended project usage. Therefore, all data will be potentially subjected to screening in terms of conformance to project specifications and suitability for use. After completing a sampling program, the field data package (calibration records, chain-of-custody, field logs, etc), will be reviewed for completeness and accuracy. Data will be reviewed with respect to holding times, initial and continuing calibrations, method blanks, laboratory control samples, samples, matrix spikes and matrix spike duplicates or duplicates.

If problems occur which would reject data, the following outline of procedures should detect these problems and the problem data will not be reported. However, rejected data will be addressed in a validation report.

10.1 DATA TRANSCRIPTION

All data transcriptions for final reports will be reviewed before reporting. Data transcription requirements may vary, but should be monitored in accordance with requirements for accuracy and legibility.

10.2 FIELD SAMPLING QUALITY CONTROL

Quality control for field sampling includes duplicate samples, field blanks and rinsate blanks. Steps and checks used to validate precision and accuracy of the measured parameters and to support the representativeness, comparability, and completeness of the work include:

- Description of the calibration of methods and instruments,
- Description of routine instrument checks (noise levels, drift, linearity, etc).,
- Documentation of traceability of instrument standards, samples and data,
- Documentation on analytical methodology and QC methodology,
- Description of applicable performance audits with appropriate audit materials,
- Description of controls for interference contaminants in analytical methods (use of reference blanks and check standards for method accuracy and precision),
- Description of levels of routine maintenance to verify analytical reliability, and
- Documentation of sample preservation and transport.

10.3 VERIFICATION AND REVIEW

The laboratory analyst should review data to verify that where appropriate, the laboratory:

- Calculates the recoveries of surrogate spikes,
- Verifies that there are no contaminants in all associated blanks,
- Compares samples and duplicates for matches in data results,
- Reviews surrogate and spike recovery data to make sure they are within quality acceptance limits,

- Verifies calibration performance for acceptability,
- Reviews and verifies instrument tuning,
- Reviews internal areas of response for acceptability.
- Makes sure the surrogate recovery section has been completed
- Makes sure that all analyzed compounds have been properly recorded
- Confirms identified sample spectra with standard spectra
- Verifies accuracy of calculations on compound quantities.

The supervisor examines the entire sample folder to verify that all data transcriptions and documentation included meets URS and VCC requirements. The supervisor also reviews all data enclosed to verify that the data transcriptions are error free and that all documents are legible and in contractual order.

Audits may help to verify that the integrity of the data and related information is maintained.

11.1 FIELD ACTIVITY AUDITS

Senior project personnel may periodically conduct an audit of the collection activities to verify that proper sampling protocol is being followed. Some of the items to evaluate include: sampling operations, sampling labeling, sample handling, field notes, decontamination procedures, and chain-of-custody. The auditor will prepare a summary audit report containing the result of the evaluation and recommendations for any corrective actions. The auditor may check the following items to determine the completeness and accuracy of field activities:

- Sample Labels: A selected number of sample labels will be examined to determine if they were filled out properly and completely.

- Chain-of-Custody Procedures: Several chain-of-custody records will be examined to determine if they were properly filled out; if parameters for analysis were properly identified; all custody transfers were documented; and date and time of transfer were recorded.

- Field Notebooks: The notebooks will be examined to determine if proper recording format is being followed; if all in situ measurements and field observations are being documented suitably to explain and reconstruct field activities.

11.2 LABORATORY PERFORMANCE AUDITS

An on-site laboratory evaluation helps to verify that all the necessary quality control is being applied by the laboratory in order to deliver a high quality product. A laboratory audit of the laboratory used for sample analysis may be performed during the program.

Quality assurance evaluations allow the evaluators to determine that:

- The organization and personnel are qualified to perform assigned tasks.
- Adequate facilities and equipment are available.

- Complete documentation, including chain-of-custody of samples, is being implemented
- Required analytical methodology is being used.
- Adequate analytical quality control, calibration including reference samples, control charts, and documented corrective action measures, is being provided.
- Acceptable data handling, documentation techniques, and data review are being used.

In order to timely and effectively complete a measurement effort, an attempt should be made to minimize downtime of all instrumentation. This is achieved by regular inspections of equipment and the availability of spare parts or supplemental instrumentation should the equipment fail.

URS' preventative maintenance program is designed to minimize the down time of crucial sampling and/or analytical equipment due to expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas:

- Establishment of maintenance responsibilities
- Establishment of maintenance schedules for major and/or critical instrumentation and apparatus, and documentation of maintenance activities in equipment logs.
- Establishment of an adequate inventory of critical spare parts and equipment.

12.1 FIELD INSTRUMENTATION

All instrumentation to be used in collecting or testing the groundwater samples will be regularly serviced and at a minimum, inspected prior to going out in the field to collect samples.

When laboratory or field equipment is damaged or it cannot be verified that it will produce acceptable data, the equipment will be removed from service to be repaired or replaced. The equipment will not be returned to service until it has been verified that it is capable of producing acceptable data. Acceptable data as referenced here is data which meets quality assurance criteria for precision, accuracy, and representativeness. Equipment leased or purchased to replace damage equipment shall be capable of producing equivalent data.

If nonanalytical type field equipment is damaged, it will be repaired immediately such that work may progress, or be replaced with similar or equivalent equipment such that the project objectives and the approved work plan will be met.

12.2 ANALYTICAL INSTRUMENTATION

The laboratory is expected to maintain and inspect their equipment. Instrument redundance, to the extent possible, coupled with an extensive stock of spare parts and expendable materials on-site will serve to minimize downtime.

Subcontract laboratories may be inspected to verify that similar preventive maintenance programs are in operation, and are properly documented including the following:

- Accepting data with an acknowledged level of uncertainty.
- Resampling and analyzing.
- Recalibration of instruments using freshly prepared calibration standards.
- Replacement of solvent or other reagents that give unacceptable blank values.
- Additional training of laboratory personnel in correct implementation of sample preparation and analysis methods.

The laboratory manager will be responsible for the repair and/or replacement of damaged laboratory equipment.

During the course of this investigation, it will be the responsibility of the sampling team members to see that all measurement and sampling procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. In the event a problem is discovered, it is imperative that prompt and prescribed action to be taken to correct the problem. Corrective action will be initiated, for instance, if QC data are found to exceed acceptability limits.

Whenever corrective action is necessary to eliminate the cause of nonconformance, a closed-loop corrective action system will be used:

- The problem will be defined,
- Responsibility for investigating the problem will be assigned,
- The cause of the problem will be investigated and determined,
- A corrective action to eliminate the problem will be determined,
- Responsibility for implementing the corrective action will be assigned and accepted,
- The effectiveness of the corrective action will be established, and
- The fact that the corrective action has eliminated the problem will be verified.

13.1 CORRECTIVE ACTION FOR FIELD SITUATIONS

If problems become apparent that are identified as originating in the field, corrective action will take place. If corrective action does not resolve the problem, appropriate personnel will be assigned to investigate and evaluate the cause of the problem. Once a corrective action is implemented, the effectiveness of the action will be verified.

13.2 CORRECTIVE ACTION FOR LABORATORY SITUATIONS

The need for corrective action will be initiated in consultation with the environmental lab personnel. Corrective Action may include, but is not limited to :

- Accepting data with an acknowledged level of uncertainty,
- Resampling and analyzing,

- Recalibration of instruments using freshly prepared calibration standards,
- Replacement of solvent or other reagents that give unacceptable blank values,
- Additional training of laboratory personnel in correct implementation of sample preparation and analysis methods.

APPENDIX F

RFI/GWA DATA MANAGEMENT PLAN

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1.1 INTRODUCTION

During the RCRA Facility Investigation (RFI) and the Groundwater Assessment (GWA), various types of data will be generated. At a minimum, data gathered will consist of field data sheets, field log books, boring logs, chemical data from analysis of soil and groundwater, field parameter measurements, maps and drawings. This Data Management Plan describes procedures that will be used to physically manage project related information. The Data Management Plan addresses:

- Project organization and responsibilities
- Technical approach to data management
- Flow of data (tracking)
- Data validation and reduction

A description of primary project personnel and their responsibilities is presented below. Changes in procedures presented below will be documented.

2.1 AUTHORITY AND RESPONSIBILITIES

Project Manager

Richard D. Karkkainen, Principal Environmental Engineer with URS Corporation (URS), will serve as Project Manager. The Project Manager will be the prime contact with Mr. Steve Boswell, the Vicksburg Chemical Company (VCC) Project Director and official representative for VCC, concerning all the work that is done by URS. Project organization and management procedures will be established by the Project Manager, including reviews and approval of work scope, budget, schedules and reports. The Project Manager will also direct financial reporting and subcontractor recommendations for VCC's approval.

Site Coordinator

The Site Coordinator's primary responsibility is to oversee all field phases of the RFI activities under the direction of the Project Manager. Additionally, the Site Coordinator will monitor quality assurance in the field. The Site Coordinator may be the Project Manager.

Task Leaders

The task leader for data management validation and analytical services is Rodney Culpeper. He is an employee of Magnolia Scientific.

2.2 PROJECT COMMUNICATIONS

Record Control

The control of records provides for the flow of information both internal and external to URS.

Following receipt of information from external sources, completion of analyses, and issuance of reports or other transmittals; associated records shall be submitted to the URS office project files. This shall include any records generated for URS by subcontractors. Records shall be

legible and easily identifiable. In addition, field records and records transmitted between URS and contractor offices shall be adequately protected from damage and loss during transfer (e.g., hand carrying or making copies prior to shipment).

Field records, laboratory data summaries, numerical calculations, reports and other data transmittals, copies of proposals, purchase orders, contracts, correspondence, memorandums, telephone records, photographs, and reference material shall be transferred to the project central file.

Records submitted to the project central file, with the exception of correspondence, should be bound, placed in folders or binders, or otherwise secured for filing.

Record Status

All individuals on the Project Staff shall be responsible for reporting obsolete or superseded project-related information to the Project Manager on a periodic basis. In turn, the Project Manager shall notify the Project, Laboratory Staff, and Quality Assurance personnel of the resulting status change in project documents, such as drawings and project procedures. Notification of personnel of status changes in quality assurance procedures shall be the responsibility of the Project Manager.

In general, outdated drawings and other documents shall be marked "void." Any copy of void documents maintained for the project files shall state the reasons for and date of voiding.

To denote that calculations, drawings, and other material which have not been formally checked are preliminary, they shall be marked "preliminary".

Record Retention

Information associated with the project shall be retained in the URS office project files. These files will include the following:

- Project file (project material except drawing originals, and records related to laboratory analysis)

- Original drawing file
- Generic quality assurance file

Project records shall be received at the various storage areas by the Project Manager who shall check that incoming records have proper identification for filing, are legible, and are in suitable condition for storage. Indexing and filing of records shall be performed only by the personnel designated by the Project Manager.

For the project file, the individual file folders shall be divided into appropriate categories based on content and numbered and filed sequentially within each category.

A numbered index for the project file shall list the individual file folders and identify the records therein to facilitate locating the records. The index shall be kept in a separate folder at the front of the project file. If appropriate, information on project material not stored in the project central file should be included with the index.

For the original drawing and quality assurance files, all material shall be filed only by project number.

The record storage in the files shall utilize facilities that provide a suitable environment to minimize deterioration or damage and that prevent loss. The facilities shall, where possible, have controlled access and shall provide protection from excess moisture and temperature extremes. Records shall be secured in binders, placed in folders or envelopes, or otherwise secured for storage in containers (e.g., file cabinets).

Storage systems shall provide for the prompt retrieval of information for reference or use outside the storage areas. For the project file, sign out sheets shall be maintained so that a record of files removed is available.

Onsite Records

Appropriate requirements for the field control and retention of records generated as a result of site investigation, sampling, and testing shall be followed. Upon completion of the field program or program phase, onsite files will be transferred to, and integrated with, the URS office project files.

Change Control

It is imperative that the status of work items be up-to-date. A status system includes:

- Formal document and design drawing revision
- Nonconformance identification, documentation, and reporting
- Change documentation and approval

Change from original design documents, procedures, and specifications must be expected. Change does not imply a nonconformance to the work, but simply means that original plans must be altered because of information or events that occur during the work.

Change must be documented, evaluated, and reported as necessary. It is necessary to manage change so that the actual course of the project, not the original plan, can be demonstrated and justified. Changes must be documented so that the actual course of work is known and the effect of the change upon the course of work can be evaluated.

It is the responsibility of project personnel to appropriately record the change and to make the documentation available as appropriate to project or laboratory management. The effect of the change upon the project shall be evaluated by the project or laboratory management, quality assurance personnel, and/or subcontractor management.

Review and written approval for changes which affect the project activities should be provided by the Project Manager. Following the review and approval process, notification of the change should be made to appropriate personnel and affected documents revised as necessary to reflect the work as actually performed.

Project documents and design drawings must be reviewed, approved, distributed, and revised as necessary. This control will provide approved, up-to-date information and drawings.

3.1 GENERAL PRINCIPLES

Three major approaches to database design are the Network, the Hierarchial and the Relational approaches. These three approaches have their respective strengths and weaknesses and in some applications, one approach is more suited than the others. Of the three methods, the relational approach is gaining momentum in the database market and is used in various applications. Because of its popularity, versatility, ease of use and the availability of many commercial relational database packages, URS has chosen the relational approach for its design of the VCC database.

In the relational approach, the information is stored in tables and columns. A table is called a relation and columns are the attributes of the relation. A good relational design of a database management system minimizes data redundancy, maintains data consistency and ensures data integrity. Data redundancy refers to the storing of the same information in multiple tables. Redundancy can rarely be totally eliminated but can be reduced. Data consistency refers to maintaining redundant data in the same form at all locations in the system. That is, if data is changed at one location, the system should propagate similar changes in that data in other related tables. This action ensures the integrity of the data in the database.

3.2 OBJECTIVES OF THE SYSTEM

The data management, as defined herein for this project, refers to the actual management of the data. URS has identified the following objectives for effectively managing the field data and the laboratory results data from the VCC site:

- Store and organize all field, analytical and other data.
- Track the samples for extraction and analysis holding time deadlines.
- Validate the analytical results pursuant to the RFI and GWA Data Collection Quality Assurance Plan.
- Make provisions for transmission of data.

4.1 DATA MANAGEMENT

The task leader is responsible for the following:

- Utilize a system to store and organize all field and analytical data.
- Establish procedures to follow as the data arrives from the field and the laboratory.
- Produce tables for reports.
- Maintain and administer the system utilized.

The need to use an organized system which facilitates easy and instant access to the information desired, is obvious because a large volume of data is generated by this project. Establishment of procedures streamline the operation of data collection, organization and presentation.

4.2 DATA VALIDATION

The task leader is responsible for the following:

- Review the QA/QC information for the samples.
- Validate the analytical results pursuant to the RFI and GWA Data Collection Quality Assurance Plan.
- Interface with the data management system.
- Maintain records.

APPENDIX G

RFI HEALTH AND SAFETY PLAN

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1.0
HEALTH AND SAFETY PLAN

Client:	Vickburg Chemical Corporation
Project:	RFI Field Investigation, Groundwater Assessment, and Interim Measures
Project Manager:	Richard D. Karkkainen
Project Number:	92B007C
Date of Plan:	Revised October 22, 1993
Estimated Dates of Work:	North Pond, October 25, 1993 through November 5, 1993, Additional Pending EPA and MSDEQ
Expiration Date:	Pending EPA and MSDEQ

1.1 HEALTH AND SAFETY PLAN APPROVALS

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10/22/93
Date

Tanya Pawley
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10/22/93

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10/22/93
Date

2.0 INTRODUCTION

This Health and Safety Plan establishes guidelines and requirements for the safety of field personnel during the conduct of the field activities associated with the referenced project. The specific activities addressed by this plan are defined in Section 3.0. All employees of Woodward-Clyde Consultants (WCC) involved in this project are required to abide by the provisions of this plan. They are required to read this plan and sign the attached Compliance Agreement.

The health and safety guidelines and requirements presented are based on a review of available information and an evaluation of potential hazards. This plan outlines the health and safety procedures and equipment required for activities at this site to minimize the potential for exposures of field personnel. This plan may be modified by the project manager, the corporate health and safety officer, and the Baton Rouge health and safety officer in response to additional information obtained regarding the potential hazards to field investigative personnel. This plan has been prepared for the exclusive use of WCC Personnel and WCC subcontractors. WCC liability is extended to WCC Personnel and WCC Subcontractors only.

2.1 KEY PERSONNEL

Project management will be handled out of the Baton Rouge Operating Unit of WCC. The following is a description of job responsibilities and authorities:

Project Manager: Richard D. Karkkainen

For this project, the Project Manager has the following responsibilities:

- To see that the project is performed in a manner consistent with the WCC Health and Safety Program.

- To have an approved Health and Safety Plan prepared and properly implemented for this project.

- To provide the Business Unit Health and Safety Officer with project information related to health and safety matters and development of the Health and Safety Plan.

- To implement the Health and Safety Plan.

- To insure compliance with the Health and Safety Plan by WCC and contractor personnel.

- To coordinate with the Business Unit Health and Safety Officer on health and safety matters.

The Project Manager has the authority to take the following actions:

- To determine matters relating to schedule, cost, and personnel assignments on hazardous waste management projects.

- To temporarily suspend field activities, if the health and safety of personnel are endangered, pending further consideration by the Business Unit Health and Safety Officer.

- To temporarily suspend an individual from field activities for infractions of Health and Safety Plan, pending further consideration by the Business Unit Health and Safety Officer.

Health and Safety Officer: Charles Self

The Health and Safety Officer has the following responsibilities:

- To interface with the Project Manager as may be required in matters of health and safety.

- To approve a Health and Safety Plan for the project.

- To appoint or approve a Site Safety Officer to assist in implementing the Health and Safety Plan.

- To monitor compliance with the approved Health and Safety Plan.

- To assist the Project Manager in seeing that proper health and safety equipment is available for the project.

- To approve personnel to work on this site with regard to medical examinations and health and safety training.

The Health and Safety Officer has the authority to take the following actions:

- To suspend work or otherwise limit exposures to personnel, if a Health and Safety Plan appears to be unsuitable or inadequate.

- To direct personnel to change work practices, if they are deemed to be hazardous to health and safety of personnel.

- To remove personnel from the project, if their actions or condition endangers their health and safety or the health and safety of co-workers.

WCC Site Safety Officer:

The Site Safety Officer (SSO) has the following responsibilities:

- To direct health and safety activities on-site.

- To report safety-related incidents or accidents to the Project Manager and Business Unit Health and Safety Officer.

- To assist the Project Manager in all aspects of implementing the Health and Safety Plan.

- To maintain health and safety equipment on-site, as specified in Health and Safety Plan.

- To perform health and safety activities on-site, as specified in the Health and Safety Plan, and report results to the Project Manager and the Business Unit Health and Safety Officer.

The SSO has the authority to take the following actions:

- To temporarily suspend field activities, if the health and safety of personnel are endangered, pending further consideration by the Business Unit Health and Safety Officer.

- To temporarily suspend an individual from field activities for infractions of the Health and Safety Plan, pending further consideration by the Business Unit Health and Safety Officer.

WCC Corporate Health and Safety Officer: Charles Self

The WCC CHSO has the following responsibilities:

- Direct the implementation of the Health and Safety Program of the operating group and provide recommendations for improvement of the program.

- Coordinate health and safety activities of the operating units in the operating group.

- Determine need for project Health and Safety Plans.

- Review and approve Health and Safety Plans.

- Monitor implementation of Health and Safety Plans.
- Investigation reports of incidents or accidents and report accidents or incidents to the CHSA and EVPP.
- Assist CHSA with employee health and safety training in the operating group.
- Determine whether an accidental exposure or injury merits a change in the affected individual's work assignments and whether changes in work practices are required.
- Coordinate business units with regard to health and safety equipment needs.

The WCC CHSO has the authority to take the following actions:

- Approve or disapprove Health and Safety Plans.
- Direct operating unit HSO to prepare project Health and Safety Plans.
- Access project files.
- Direct changes in personnel work practices to improve health and safety of employees involved in hazardous waste management projects.
- Remove individuals from projects, if their conduct jeopardized their health and safety or that of co-workers.
- Suspend work on any project that jeopardizes the health and safety of personnel involved.

2.2 SITE LOCATION

Vicksburg Chemical Corporation (VCC) is located less than a mile south of Interstate 20 bordering the City of Vicksburg, Mississippi. To the north and west of the site is light residential properties. To the East of the site is light industrial properties including the Vicksburg water treatment facility and an asphalt mixing and gravel drying operation. To the South of the site is light residential to rural properties.

2.3 SITE DESCRIPTION

VCC is located off Highway 61 on Rifle Range Road. The facility is comprised of a North Plant and a South Plant and occupies approximately 640 acres. Currently, the only active areas of the plant include the nitric acid, potassium carbonate and potassium nitrate plants. All other portion of the plant are no longer in operation. Resources such as a potable water supply, electricity, and telephone service are available at the plant office located at the facility entrance on Rifle Range Road. Chemical on-site relative to the aforementioned active plants include anhydrous ammonia, nitric acid, potassium chloride, chlorine, nitrogen tetroxide, and nitrogen dioxide. Chemical on-site related to past production activities include atrazine, dinoseb, methyl parathion, monosodium methane arsenate (MSMA), and toxaphene. Other chemicals that have been detected on-site include carbon tetrachloride, chloroform, 1,1-dichloroethylene, ethylbenzene, methylene chloride, toluene, and xylene.

The work sites concerning this plan are associated with the South and North Plants (Figure 1) and include several Solid Waste Management Units (SWMUs) and Other Areas of Concern (OACs).

2.4 SITE HISTORY

In the past, VCC produced various types of pesticides and herbicides such as dinoseb, toxaphene, atrazine, and monosodium methane arsenate. All of these chemicals have been detected in the soil and water by VCC and the state of Mississippi. Concentrations range from non-detected on hazardous wastes to an average of about 5 part per million (ppm). Chlorinated solvents have been detected in sludge sediments in the ppm range for carbon tetrachloride, methylene chloride, chloroform, and 1,1,-dichloroethylene. The source of the chlorinated

solvents is unknown as well as the source of xylene toluene, and ethylbenzene, which have been detected in the range of 2-15 ppm. During the investigation of the site of the former MSMA plant (RFI Expedited Report SWMUs 12, 11 and 15, April 1998) the concentration of arsenic found in sludge/sediment samples in the drainage system was as high as 2,870 ppm and the concentration of arsenic found in concrete, asphalt or soil was as high as 322 ppm.

3.0
PURPOSE AND SCOPE OF PROPOSED WORK

WCC will perform work as required in a Consent Decree effective April 17, 1992. This Consent Decree requires Interim Measures activities, a Groundwater Assessment Program, and a RCRA Facility Investigation be conducted at the facility. These three workplans require geophysical borings, monitor well sampling and installation, subsurface soil sampling, and surface soil sampling. Construction in conjunction with closures may be included in the Interim Measures activities.

4.0
HAZARD ASSESSMENT

The following hazards have been identified and will be protected against:

- Heat stress.
- Biological hazardous.
- Physical hazards.
- Skin contact with contaminants.

4.1 BIOLOGICAL HAZARDS

If clearing has not been conducted or if biological hazards develop during work activities, practical guidelines for prevention of exposure to pests should be implemented.

4.2 HEAT STRESS HAZARDS

If heat stress becomes a concern, the heat stress casualty prevention plan, presented in Appendix A shall be implemented.

4.3 PHYSICAL HAZARDS

Personnel should be cognizant of the fact that when protective equipment such as respirators, gloves, and protective clothing are worn, visibility and manual dexterity are impaired. In addition, personnel should be alert to physical hazards such as slipping/tripping/falling potentially associated with dismantled process equipment and piping remnants/ladders/stairways in various stages of disrepair, and uneven ground surface due to foundation fragments distributed throughout the site. Drilling personnel should abide by standard safety guidelines applicable to drilling operation presented in Appendix B.

4.4 CHEMICAL HAZARDS

Due to past production activities at the facility, pesticides, herbicides, chlorinated solvents, and volatile organic solvents have been detected on-site during site characterization efforts conducted by VCC and the state of Mississippi. The constituents detected included arsenic, dinoseb, toxaphene, atrazine, carbon tetrachloride, methylene chloride, chloroform, 1,1-dichloroethylene, xylene, toluene, and ethylbenzene at concentration report in the parts per million range. Of the constituents detected on-site, arsenic, carbon tetrachloride, methylene chloride, and chloroform are classified by OSHA and/or ACGIH as known or suspected human carcinogens.

The constituents detected on-site are present in low concentrations. However, exposure to these chemicals may potentially occur through inhalation, ingestion, and/or direct contact. Chemical exposure via multiple exposure pathways is cumulative, therefore it is important to recognize potential exposure situations and to take precautions to minimize exposure to chemical hazards by all routes.

The following potential exposure routes and associated health hazards have been identified:

Inhalation: Chemical hazards associated with inhalation exposures may include irritation of the mucous membranes and respiratory tract or with more sever exposures, may include systemic effects. Table 1 presents recommended exposure limits for potential airborne constituents.

Ingestion. Ingestion of chemical will be controlled on-site by prohibiting eating, smoking, or drinking in the Exclusion Zone and by requiring all field personnel to conduct decontamination procedures prior to leaving the Exclusion Zone.

Direct Contact: Skin and eye contact with chemical hazards may potentially result in irritation, rashes, or burns. If a person should exhibit symptoms of eye or skin irritation, he/she should report to the SSO for immediate medical attention.

Potential hazards may be minimized by utilizing appropriate personal equipment designed to protect the body against contact with known or anticipated chemical hazards. Personal

protective equipment is classified by the EPA by the level of protection afforded and is divided into four categories designated as Level A, B, C, and D with Level A providing the most extensive level of protection.

The levels of protection required for the field activities specified by the work scope are presented in Section 5.1

Chemical information sheets for each constituent known to be present at the site are presented in Appendix C of this Health and Safety Plan. These sheets provide important information concerning physical/chemical properties, chemical/reactive hazards, exposure potentials, health hazards and symptoms of exposures, and appropriate treatment following exposure.

Table 1
Exposure Limits for Potential Airborne Contaminants

Constituent	ACGIH TWA	OSHA PEL-TWA	STEL	IDLH
+Toxaphene	0.5 mg/m^3	0.5 mg/m^3	1 mg/m^3	200 mg/m^3
Atrazine	5 mg/m^3	5 mg/m^3	--	--
+Carbon Tetrachloride	5 ppm	2 ppm	--	Ca
Methylene Chloride	50 ppm	500 ppm	--	Ca
Chloroform	10 ppm	2 ppm	--	Ca
Xylene	100 ppm	100 ppm	150 ppm	1000 ppm
Toluene	100 ppm	100 ppm	150 ppm	2000 ppm
Ethylbenzene	100 ppm	100 ppm	125 ppm	2000 ppm
Lime Kiln Dust	10 mg/m^3	10 mg/m^3	--	--
Ammonia	25 ppm	50 ppm	35 ppm	500 ppm
Arsenic	0.2 mg/m^3	0.01 mg/m^3	--	Ca

\+ Potential Skin Irritant
Ca Potential Human Carcinogen (Cancer Causing);
-- No IDLH level established.

5.0
GENERAL HEALTH AND SAFETY REQUIREMENTS

5.1 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) required to prevent contact with known or anticipated chemical hazards has been divided into four categories by the USEPA, Levels A, B, C and D, according to the degree of protection afforded. The following personnel protective equipment will be provided to personnel involved in site characterization work at the site.

Mobilization - Level D Protection

- Boots, steel toe and shank
- Hard hat
- safety glasses with side shields

Modified Level D Protection

- Coveralls, chemical resistant; tyvek (polycoated tyvek if splash hazard exists)
- Gloves (outer), chemical resistant, Polyvinyl Alcohol (PVAL)
- Gloves (inner), chemical-resistant, latex
- Boots, chemical-resistant (or bootie covers), steel toe and shank
- Safety glasses with side shields
- Hard hat (with faceshield if splash hazard exists)

Modified Level C Protection

- To include Modified Level D; PPE mentioned above
- Full-face air purifying respirators with organic vapor/pesticide/HEPA combination filter cartridges.

Tyvek coveralls will be discarded after each use or when they become worn or punctured. Suit materials are resistant to all known or anticipated chemicals at the site. If the disposable protective suits appear to be deteriorating under chemical action, the Site Safety Officer should be notified.

In addition to the personal protective equipment listed above, general safety equipment available for use will include a first aid kit, portable eye wash and fire extinguisher.

5.2 WORK ZONES

During activities conducted in Modified Level D PPE, management of this project shall be conducted in such a manner which will restrict access to the job site by unauthorized personnel. If Level D action levels established in Table 2 are exceeded resulting in an upgrade to Level C PPE, work zones as described in the following paragraphs shall be implemented.

To minimize the movement of contaminants from the site to uncontaminated areas, three work zones will be set up during activities conducted under Level C PPE. The three work zones will include the following:

Zone 1: Exclusion Zone
Zone 2: Contamination Reduction Zone
Zone 3: Support Zone

The exclusion zone is the zone where contamination does or could occur. Observations by the site safety officer will determine the extent of the zones. All persons entering this zone must wear at a minimum the level of protection set forth in Section 5.1 (Level C PPE).

Between the exclusion zone and support zone is the personnel contamination reduction zone (CRZ) which provides a transition zone between the contaminated and clean areas of the site. This zone will be located directly outside of the exclusion zone and will be defined as 10-foot zone directly outside the exclusion zone.

The support zone will be an uncontaminated area from which operations will be directed. It is essential that contamination from the site be kept out of this area. Included in this area will be a storage area for decontaminated clothing, additional personal protective equipment, etc.

One additional work zone will be set up for decontaminating equipment.

5.3 DECONTAMINATION PROCEDURES

VCC will have a minimum of one personnel decontamination station, strategically located or in the contamination reduction zone (CRZ) if applicable. The decontamination station will have at least the following items:

- An adequate-sized plastic sheet for flooring
- Boot wash equipment
  - Water/alconox solution container
  - Rinse water container
  - Long-handled plastic brush
- Waste container (disposable PPE, tape, etc.)
- Hand wash equipment
  - Water/alconox solution container
  - Rinse water container
  - Paper towels

5.3.1 Equipment Decontamination

Decontamination of sample collection equipment will be accomplished by the following procedure:

- Washing in a detergent solution (Alconox)
- Triple rinsing with clean deionized water
- Rinsing with methanol
- Triple rinsing with clean deionized water

Decontamination of equipment shall be conducted in Modified Level D PPE as listed in Section 5.1. While utilizing methanol for deconning equipment, personnel shall position themselves upwind of decontamination operations to minimize inhalation exposures to methanol vapors. If this is not feasible, respiratory protection as listed under level C PPE is Section 5.1 shall be worn during methanol use.

5.3.2 Personnel Decontamination

Decontamination of personnel will be performed at a designated location at the perimeter of the work area. Decontamination will consists primarily of soap and water washings and water rinse of exterior protective gear to remove contaminants, followed by doffing of the gear.

Coveralls should be removed by turning the clothing inside out. A general sequence of doffing procedures is outlined below. The extent of washing required, or modifications to the sequence, may be specified as appropriate.

Personnel will be decontaminated by the following procedure:

- Wash and rinse outer protective coverall
- Wash work gloves and boots
- Remove outer protective clothing
- Rinse respirator if worn
- Wash hands and face

Contaminated disposable PPE and all decontamination fluids shall be containerized on-site for subsequent disposal by the direction of VCC.

5.4 MEDICAL EXAMINATION

Before commencing any of the field or laboratory activities defined in Section 3.0, all WCC personnel and all WCC subcontractors must take an annual WCC-approved medical examination as part of WCC's medical surveillance program.

5.5 SAFETY TRAINING DOCUMENTATION

Prior to commencing any of the field activities defined in Section 3.0, all WCC personnel working on-site will supply certificate or equivalent, attesting to completing 40 hours of training as required by OSHA, in 29 CFR 1910.120, to the SSO. Site supervisors will be required to supply documentation indicating that an additional 8 hours of training has been completed. Escorted visitors may be allowed in a defined area without 40 hours training at the discretion of the WCC SSO and the WCC site coordinator.

Documentation concerning respirator fit testing, in accordance with OSHA, 29 CFR 1910.134 shall be required of any WCC employee wearing a respirator.

5.6 COMPLIANCE AGREEMENT

The Project Manager and the Baton Rouge Health and Safety Officer shall hold meetings with all WCC field personnel before work commences. During the meeting, all personnel shall be provided with a copy of this safety plan; the plan shall be reviewed and discussed and questions answered. Signed Compliance Agreement Forms shall be collected by the Project Manager and filed by the Baton Rouge Health and Safety Officer. Individuals refusing to sign the form will not be allowed to work on the site.

5.7 PROJECT MANAGER NOTIFICATION

All field personnel must inform the Project Manager or his designated representative before entering the site. The "buddy system" will be employed during all project work. This means that at least two members of the field crew must be on-site whenever work is performed. Personnel must be in visual contact with each other or carry two-way radios at all times.

5.8 PROJECT SAFETY LOG

A project safety log will be used to record the names, entry and exit dates and times of all WCC and subcontractor personnel and of project site visitors; accidents, injuries, and illnesses; incidence of safety infractions by field personnel; air quality and personal exposure monitoring data; and other information related to safety matters. All accidents, illnesses or other incidence

shall be reported immediately to the WCC Project Manager, and the WCC Baton Rouge Health and Safety Officer and subsequently documented for filing on the HS-502 Incident Report Form.

5.9 PROHIBITIONS

- Smoking, eating, drinking, chewing gum or tobacco, storing food or food containers shall not be permitted on the work site. Good personal hygiene should be practiced by field personnel to avoid ingestion of contaminants or spread of contaminated materials.

- Ignition of flammable liquids within, on, or through improvised heating devises or space heaters.

- Approach or entry into areas or spaces where toxic of explosive concentrations of gases or dust may exist without proper equipment available to enable safety entry.

- Conduct of on-site operations without off-site back up personnel.

5.10 SITE SAFETY MEETINGS

During all site characterization activities, daily safety meetings will be held by the site safety officer to review and plan the specific health and safety aspects of scheduled work for that day.

6.0
LABORATORY CONSIDERATIONS

The laboratory director must be informed of any contaminant level in the samples that would require special handling procedures to prevent risk to the health and safety of laboratory personnel.

7.0 PERSONAL PROTECTIVE EQUIPMENT

This section outlines the general usage guidelines for personal protective equipment.

7.1 HEAD PROTECTION

Hard hats must be worn by all personnel working on-site.

7.2 EYE PROTECTION

Safety glasses with side shields or goggles must be worn by all personnel performing activities where potential for eye or face exposure exists due to splash, dust, or vapor, etc. An eyewash station will be set up by the site safety officer prior to commencing field activities and should be placed so that it could be used quickly in an emergency.

7.3 SKIN PROTECTION

Due to the potential for skin absorption and carcinogenic properties chemical resistant gloves and coveralls shall be worn by all personnel during subsurface and sample handling activities. These will be disposed of in a designated sealable drum after each use of when they become worn or punctured.

7.4 FOOTWEAR

Chemical-resistant boots with steel toes and shanks will be worn by field personnel engaged in the field activities at the site. Chemical-resistant booties can be substituted for chemical resistant boots, although work boots to be covered must always maintain steel toes and shanks.

7.5 RESPIRATORY PROTECTION

For respiratory protection against possible volatile organics, full-face air purifying respirators (APR) will be required if Level D air monitoring action levels are exceeded. Specific cartridges to be utilized with the APRs will be combination organic vapor/ammonia filter cartridges. All personnel must be properly fit-tested for the specific brand and size respirator to be used. Documentation of fit testing is to be provided to WCC SSO prior to commencement of work. A respirator which has not been successfully fit-tested cannot be used by an individual on the project. To ensure a proper fit, no facial hair will be allowed that will interfere with mask operation. The site safety officer will determine if facial hair represents such an interference. Air purifying respirators will only be used if the following conditions are met:

- The oxygen content of the air is greater than 19.5 percent.
- Concentration of air contaminants are known and monitored.
- The contaminants of concern all have good warning properties (i.e., odor threshold below PEL value).
- The protection factor is adequate and PELs are not exceeded.
- If concentrations of air contaminants exceed IDLH value, personnel must immediately evacuate.
- Cartridges are changed daily or whenever breakthrough occurs, which ever occurs first.
- Each person has been fit-tested for the specific brand and size of respirator used.
- The respirator is MSHA- and/or NIOSH-approved.

8.0
AIR QUALITY MONITORING

The primary goal of on-site air quality monitoring will be compliance with the specified contaminant action levels. The secondary goal will be documentation of personal exposures as required by OSHA 1920.120.

8.1 AIR QUALITY SURVEY

During modified Level D field activities related to organic contamination at the site, an air quality survey will be performed utilizing an HNu-photoionization detector (PID) equipped with an 11.7 ev probe, or equivalent instrument to characterize volatile organics and ammonia concentrations on-site. Standard operating procedures for this instrument are attached as Appendix E. During Level C filed activities, additional sampling utilizing colorimetric tubes specific for detecting chloroform, methylene chloride, and carbon tetrachloride will be used along with the HNu for total organic vapors. At least two sampling events utilizing each of these tubes will be conducted in the breathing zone of personnel closest to the subsurface activities at the site. Table 2 lists air monitoring action levels for Level D and C work.

During modified Level D field activities related to construction at former MSMA areas, a determination shall be made of airborne exposure levels that are representative of each workers exposure to inorganic arsenic over an eight (8) hour period. Samples will be taken using a personal sampling pump at a flow rate of 2 liters per minute. Samples will be collected on 0.8 micrometer pore size filter (37 mm diameter). At least two consecutive measurements, taken at least seven (7) days apart, will be conducted. Table 2 lists air monitoring action levels for Level D and C work.

Table 2
Air Monitoring Action Levels for Level C and D Work

Contaminant	Instrument	Reading	Action Taken
Volatile Organic	HNu or equivalent*	<5 ppm	Continued Work in Modified D Level
Volatile Organic	HNu or equivalent*	5 - 25 ppm	Upgrade to Level C and Expand Work Zones; Commence additional colorimetric tube sampling
Volatile Organic	HNu or equivalent*	>25 ppm	Evacuate Area
Arsenic	Personal sampling pump**	<5 micrograms per cubic meter of air	Continue to work in Modified D Level
Arsenic	Personal sampling pump**	5 - 10 $\mu g/m^3$	Upgrade to Level C
Arsenic	Personal sampling pump**	>10 $\mu g/m^3$	Evacuate area until construction procedures are revised.

* Sustained reading above background (for 15 minutes continuous) which shall not be exceeded within worker breathing zones or exclusion zones.

9.0
EMERGENCIES/ACCIDENTS

A site map and direction to Vicksburg Hospital are included in Figure 1. Illnesses, injuries, and accidents occurring on-site must be attended to immediately in the following manner:

- Remove the injured or exposed person(s) from immediate danger.
- Render FIRST AID if necessary. Decontaminate affected personnel, if necessary.
- Call ambulance for transport to local. This procedure should be followed even if there is no apparent serious injury. Emergency numbers are listed on the following section.
- Evacuate other personnel on-site to a safe place until the engineer (assisted by the Site Safety Officer) determines that it is safe for work to resume.
- Report the accident to the Health and Safety Officer immediately.
- Develop procedures, in accordance with the Health and Safety Officer, Site Safety Officer, and Project Manager to prevent a recurrence.

In the event that an emergency site evacuation should be necessary for any reason, the Site Safety Officer will render an alarm using a horn and all personnel shall leave the site. The assembly point will be designated in the filed. Personnel will not return to the site until an all-clear has been received from the Site Safety Officer

9.1 EMERGENCY NUMBERS

For any on-site Emergency dial 911.

Emergency Service	Telephone
Fire Department	636-1121
Ambulance	911
Sheriff	636-1761
Vicksburg Police Department	636-2511
National Response Center (NRC)	1-800-424-8802
Poison Control Center	1-800-535-0525
Vicksburg Medical Center	636-2611
Mercy Regional Medical Center	631-2250

10.0 PERSONNEL ASSIGNMENTS

WCC personnel and subcontractors authorized to work on this project and enter the site are:

Project Manager:	Richard D. Karkkainen
Baton Rouge Health and Safety Officer:	Charles Self
Site Safety Officer:	As Needed
Field Personnel:	As Needed
Subcontractor:	As Needed

10.1 PROJECT SAFETY PERSONNEL

Personnel responsible for implementing this Safety Plan are the Project Manager and Site Safety Officer. Their specific responsibilities and authorities for all accountable WCC personnel are listed in this plan as well as Table 2-1 of the WCC Health and Safety manual dated November 1990.

11.0
SAFETY PLAN COMPLIANCE AGREEMENT

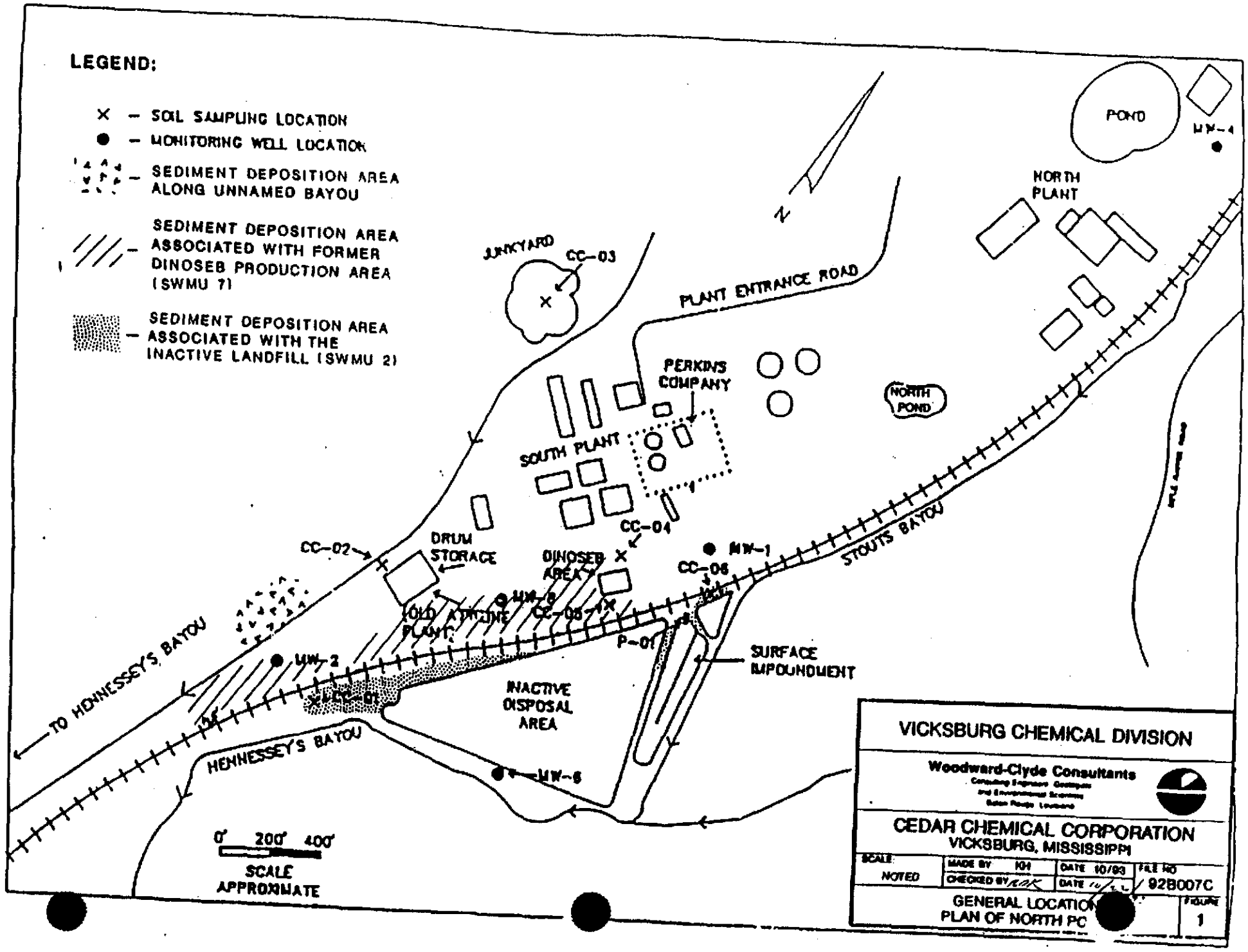
I, _____(print name), have received a copy of the Safety Plan for the Interim Measures, Groundwater Assessment, and RFI Field Investigation Workplans for VCC, Vicksburg, Mississippi and Corrective Measures Implementation Plans. I have read the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the safety requirements specified in the plan.

Signed:

_____ _____

Signature Date

Firm:_____


LEGEND:
× – SOIL SAMPLING LOCATION
● – MONITORING WELL LOCATION
– SEDIMENT DEPOSITION AREA ALONG UNNAMED BAYOU
– SEDIMENT DEPOSITION AREA ASSOCIATED WITH FORMER DINOSEB PRODUCTION AREA (SWMU 7)
– SEDIMENT DEPOSITION AREA ASSOCIATED WITH THE INACTIVE LANDFILL (SWMU 2)
N
POND
MW-4
NORTH PLANT
JUNKYARD
CC-03
PLANT ENTRANCE ROAD
PERKINS COMPANY
NORTH POND
SOUTH PLANT
CC-04
MW-1
CC-06
STOUTS BAYOU
CC-02
DRUM STORAGE
DINOSEB AREA
MW-8
CC-05
OLD ATRAZINE PLANT
P-01
SURFACE IMPOUNDMENT
MW-2
CC-01
INACTIVE DISPOSAL AREA
TO HENNESSEY'S BAYOU
HENNESSEY'S BAYOU
MW-6
0' 200' 400'
SCALE APPROXIMATE
VICKSBURG CHEMICAL DIVISION
Woodward-Clyde Consultants
CEDAR CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI
SCALE NOTED
MADE BY KH
DATE 10/93
CHECKED BY
DATE
FILE NO 92B007C
GENERAL LOCATION PLAN OF NORTH PC
FIGURE 1

APPENDIX A

HEAT STRESS CASUALTY PREVENTION PLAN

APPENDIX A

HEAT STRESS CASUALTY PREVENTION PLAN

Due to the increase in ambient air temperatures and the affects of protective outer wear decreasing body ventilation, there exists an increase in the potential for injury, specifically, heat casualties. Site personnel will be instructed in identification of a heat stress victim, the first-aid treatment procedures for the victim and the preventing of heat stress casualties.

A. IDENTIFICATION AND TREATMENT

1) Heat Exhaustion

a) Symptoms: Usually begins with muscular weakness, dizziness, nausea, and staggering gait. Vomiting is frequent. The bowels may move involuntarily. The victim is very pale, his skin is clammy skin, and he may perspire profusely. The pulse is weak and fast, his breathing is shallow. He may faint unless he lies down. This may pass, but sometimes it remains and death could occur.

b) First Aid: Immediately remove the victim to the Personnel Decontamination Reduction Zone in a shady or cool area with good air circulation. Remove all protective outer wear. Call a physician. Treat the victim for shock. (Make him lie down, raise his feet 6 to 12 inches and loosen all clothing.) Transport victim to a medical facility as soon as possible.

2) Heat Stroke

a) Symptoms: This is the most serious of heat casualties due to the fact that the body excessively overheats. Body temperatures often are between 107 degrees to 110 degrees Fahrenheit. First there is often pain in the head, dizziness, nausea, oppression, and the skin is dry, red and hot. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly.

b) First Aid: Immediately evacuate the victim to a cool and shady area in the Personnel Decontamination Reduction Zone. Remove all protective outer wear and all personal clothing. Lay him on his back with his head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels, ice bags, etc., to the head. Sponge off bare skin with cool water or place him in a tub of cool water. The main objective is to cool him without chilling him. Give no stimulants. Transport the victim to a medical facility as soon as possible.

B. PREVENTION OF HEAT STRESS

1) One of the major causes of heat casualties is the depletion of body fluids. On the site there will plenty of fluids available. Personnel should replace water and salts loss from sweating. Salts can be replaced by either 0.1 percent solution, more heavily salted foods, or commercial mixes such as Gatorade. The commercial mixes are advised for personnel on low sodium diets.

2) A work schedule should be established so that the majority of the work day will be during the morning hours of the day before ambient air temperature levels reach their highs.

3) A work/rest guideline will be implemented for personnel required to wear Level B or Level C protection. This guideline is as follows:

Ambient Temperatures	Maximum Working Time
Above 90°F	1/2 hour
80°-90°F	1 hour
70°-80°F	2 hours
60°-70°F	3 hours
50°-60°F	4 hours
40°-50°F	5 hours
30°-40°F	6 hours
Below 30°F	8 hours

A sufficient period will be allowed for personnel to "cool down". This may require shifts of workers during operations.

C. HEAT STRESS MONITORING

For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. Frequency of monitoring should increase as the ambient temperature increases or if slow recovery rates are indicated. When temperatures exceed 80 degrees Fahrenheit, workers must be monitored for heat stress after every work period.

Heart rate should be measured at the radial pulse for 30 seconds as early as possible in the resting period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the heart rate is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.

- Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. However, if the oral temperature exceeds 99.7 degrees Fahrenheit at the beginning of the next period, the following work cycle should be further shortened by 33 percent. Oral temperature should be measured again at the end of the rest period to make sure that it has dropped below 99 degrees Fahrenheit.

- Body water loss due to sweating should be measured by weighing the worker in the morning and in the evening. The clothing worn should be similar at both weighings; preferably, the worker should be weighed nude. The scale should be accurate to plus or minus one-quarter pound. Body water loss should not exceed 1.5 percent of the total body weight. If it does, workers should be instructed to increase their daily intake of fluids by the weight lost.

Ideally, body fluids should be maintained at a constant level during the work day. This requires replacement of salt lost in sweat as well.

Good hygiene standards must be maintained by frequent changes of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

APPENDIX B

SAFETY GUIDELINES FOR DRILLING

APPENDIX B

SAFETY GUIDELINES FOR DRILLING

Drill rig maintenance and safety is the responsibility of the drill rig operator. However, safety requires the attention and cooperation of every worker and visitor to the job. The following is provided as a general guideline for safe drilling practices onsite.

OFF-ROAD MOVEMENT OF DRILL RIGS

The following safety guidelines relate to off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, slumps, gullies, ruts and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven or hilly ground.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4x4, 6x6, etc., vehicles or carriers) when traveling off-highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill.
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is narrow.

- After the drill rig has been moved to a new drilling site, set all brakes and/or locks. When grades are steep, block the wheels.

- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

- Tie-down loads on the drill rig and support trucks during transport.

OVERHEAD AND BURIED UTILITIES

The use of a drill rig near electrical power lines and other utilities requires that special precautions be taken by both supervisors and members of the exploration crew. Electricity can shock, it can burn and it can cause death.

Overhead and buried utilities should be located, noted and emphasized on all boring location plans and boring assignment sheets.

Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine what the minimum distance from any point on the drill rig to the nearest power line will be when the mast is raised and/or being raised. Do not raise the mast or operate the drill rig if this distance is less than 20 feet.

Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.

CLEARING THE WORK AREA

Prior to drilling, adequate site cleaning and leveling should be performed to accommodate the drill rig and supplies and provide a safe working area. Drilling should not be commenced when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

NOTE: In coordination with the Drilling Crew, the Site Health and Safety Manager will review the precautions taken to insure that the drill rig is leveled and stabilized.

HOUSEKEEPING ON AND AROUND THE DRILL RIG

The first requirement for safe field operations is that the drilling crew safety supervisor understands and fulfills the responsibility for maintenance and "housekeeping" on and around the drill rig.

Suitable storage locations should be provided for all tools, materials and supplies so that they can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.

Avoid storing or transporting tools, materials or supplies within or on the mast (derrick) of the drill rig.

Pipe, drill rods, bits casing, augers and similar drilling tools should be orderly stacked on racks or sills to prevent spreading, rolling or sliding.

Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.

Work areas, platforms, walkways, scaffolding and other accessways should be kept free of materials, obstructions and substances such as ice, excess grease or oil that could cause a surface to become slick or otherwise hazardous.

Keep all controls, control linkages, warning and operation lights and lenses free of oil, grease and/or ice.

Do not store gasoline in any portable container other than a non-sparking, red container with a flame arrester in the fill spout and having the word "gasoline" easily visible.

SAFE USE OF HAND TOOLS

There are almost an infinite number of hand tools that can be used on or around a drill rig. "Use the tool for its intended purpose" is the most important rule. The following are a few specific and some general suggestions which apply to safe use of several hand tools that are often used on and around drill rigs.

- When a tool becomes damaged, either repair it before using it again or get rid of it.

- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others near you to wear safety glasses.

- When using a chisel, any kind of chisel, for any purpose, wear safety glasses and require all others around you to wear safety glasses.

- Keep all tools cleaned and orderly stored when not in use.

- Replace hook and heel jaws when they become visibly worn.

- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform, should the wrench slip or the joint suddenly let go.

SAFE USE OF WIRE LINE HOISTS, WIRE ROPE AND HOISTING HARDWARE

The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron and Steel Institute's Wire Rope Users Manual.

All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper weaving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting

hardware and any other feature that would lead to failure. Wire ropes should be replaced when inspection indicates excessive damage according to the wire rope users manual.

If a ball-bearing-type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to assure that the swivel freely rotates under load.

If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 foot (0.3m) of the drill rod column above the top of the mast (derrick), do not hoist a rod column with loose tool joints and do not make up, tighten or loosen tool joints while the rod column is being supported by a slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods with your hands.

Most sheaves on drill rigs are stationary with a single-part line. The number of parts of line should never be increased without first consulting with the manufacturer of the drill rig. Wire ropes must be properly matched with each sheave.

The following procedures and precautions must be understood and implemented for safe use of wire ropes and rigging hardware.

Use tool-handling hoists only for vertical lifting of tools (except when angle-hole drilling). Do not use tool-handling hoists to pull on objects away from the drill rig; however, drills may be moved using the main hoist as the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.

When attempting to free a mired vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle or drill rig carrier and stay as far away as possible from the wire rope. Do not attempt to use tool hoists to free a mired vehicle or drill rig carrier.

To minimize shock loading of a wire rope, always apply loads smoothly and steadily.

Some additional safety guidelines that should be followed are:

- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Replace damaged safety latches on safety hooks before use.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Periodically inspect and test clutches and brakes of hoists.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire ropes on hoist drums with your hands.
- After installation of a new wire rope, lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public or property are created.
- Never leave a load suspended when the hoist is unattended.

- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves and pinch points as slack is being taken up and when the load is being hoisted.

- Never hoist a load over members of the crew.

SAFE USE OF AUGERS

The following general procedures should be used when advancing a boring with continuous-flight or hollow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear and the engine running at low RPM.

- The operator and tool handler should establish a system of responsibility for the various activities required for auger drilling, such as connecting and disconnecting auger sections and inserting and removing the auger fork. The operator must assure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.

- Use only the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench or any other tools during rotation.

- Whenever possible, use tool hoists to handle auger sections.

- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- Never allow feet to get under the auger section that is being hoisted.

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatever.

- Never use your hands or feet to move cuttings away from the auger.

- When cleaning augers, be sure the drill rig is in neutral and the augers are stopped from rotating.

SAFETY DURING ROTARY AND CORE DRILLING

Rotary drilling tools should be safety-checked before use. In particular, check for the following:

- See that water swivels and hoisting plugs are lubricated and checked for frozen bearings before use.

- Check rod chuck jaws periodically and replace them when necessary.

- Check the capacities of hoists and sheaves against the anticipated weight on the drill rod string plus other expected hoisting loads. Inspect all cables daily.

These other special precautions should be taken for safe rotary or core drilling:

- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws.

- Drill rods should not be held or lowered into the hole with pipe wrenches.

- If a string of drill rods are accidently or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.

- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.

- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.

- If work must progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with a rough surface and fitted cover panels of adequate strength to hold drill rig personnel.

- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

- Inspect all hydraulic lines periodically and replace as needed.

START-UP

All drill rig personnel and visitors should be instructed to "stand-clear" of the drill rig immediately prior to and during starting of an engine.

Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the correct, non-actuating positions, and the cathead rope is not on the cathead before starting a drill rig engine.

SAFETY DURING DRILLING OPERATIONS

Safety requires the attention and cooperation of every worker and site visitor.

Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.

Before raising the mast (derrick) look up to check for overhead obstructions.

Before raising the mast (derrick), all drill rig personnel and visitors (with exception of the operator) should be cleared from the area immediately to the rear and the sides of the mast. All drill rig personnel and visitors should be informed that the mast is being raised prior to raising it.

Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig must be first leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after initial set up. Lower the mast (derrick) only when leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.

Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.

The operator of a drill rig should only operate a drill rig from the position of the controls. The operator should shut down the drill engine before leaving the vicinity of the drill.

Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a drill rig or while on the job.

Watch for slippery ground when mounting dismounting from the platform.

All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors or animals from stepping or falling into the hole. All open boreholes should be covered, protected, or backfilled adequately and according to local or state regulations on completion of the drilling project.

"Horsing around" within the vicinity of the drill rig and tool and supply storage areas should never be allowed, even when the drill rig is shut down.

Be careful when lifting heavy objects.

Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back.

Drilling operations should be terminated during an electrical storm.

APPENDIX C

CHEMICAL INFORMATION SHEETS

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Material Safety Data Sheet Collection

Anhydrous Ammonia **MSDS No.**

Date of Preparation: 8/85 Revision: [illegible]/9

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Anhydrous Ammonia
Chemical Formula: NH_3
CAS Number: 7664-41-7
Synonyms: am-fol; ammonia, anhydrous; ammonia, anhydrous, liquefied; ammonia gas; ammoniac; ammoniaca; ammoniak; amoniak; aqua ammonia; aqueous ammonia; nitro-sil; R 717; Spirit of Hartshorn
Derivation: Prepared by using atmospheric nitrogen and a hydrogen source at high temperatures (752 °F (400 °C) - 11,732 °F (6500 °C)) and pressures (100 to 900 atm) in the presence of an iron catalyst (modified Haber reduction process).
General Use: Used in the manufacture of nitric acid, explosives, hydrazine, pesticides, urea, ammonium nitrate, ammonium salts, nylon, detergents; as refrigerant, cotton defoliant, fertilizer, neutralizing agent in petroleum industry; in metal treating operations, *e.g.*, nitriding; for hydrogenation of fats and oils; source of pure nitrogen; in rubber industry for stabilization of raw latex; catalyst to make synthetic resin; in water treatment, against tastes and odors; on citrus fruit to control fungal growth; in veterinary medicine as an antacid and respiratory stimulant.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Anhydrous ammonia, ca 100 % vol

OSHA PELs
8-hr TWA: 50 ppm (35 mg/m^3)
Vacated 1989 final Rule Limit:
STEL: 35 ppm (27 mg/m^3)

ACGIH TLVs
TWA: 25 ppm (17 mg/m^3)
STEL: 35 ppm (24 mg/m^3)

NIOSH REL
10-hr TWA: 25 ppm (18 mg/m^3)
STEL: 35 ppm (27 mg/m^3)

IDLH Level
300 ppm

DFG (Germany) MAK
TWA*: 20 ppm (14 mg/m^3)
Category I: Local irritants

Peak Exposure Limit:
40 ppm (28 mg/m^3), 5 min, momentary value, 8/shift

*Embryo/Fetus Risk of Damage Classification C: There is no reason to fear risk of damage to the developing embryo or fetus when MAK and BAT values are observed.

Section 3 - Hazards Identification

ANSI Signal Word: Danger!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Anhydrous ammonia is an easily liquified colorless gas with a pungent, irritating odor. It is toxic by inhalation and ingestion. Due to its extreme alkalinity, it is corrosive and causes severe burns. Exposure may result in respiratory distress and, at high levels, may be fatal. This combustible gas can form explosive mixtures with air, and can violently react with many other chemicals. When heated to decomposition, anhydrous ammonia emits toxic fumes of ammonia and nitrogen oxides (NO_x).

Wilson Risk Scale
R 1
I 3
S 2*
K 4
*Skin absorption

HMIS
H 2*†
F 1
R 0
PPE‡
*Chronic effects
†3 (liquid)
‡Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption
Target Organs: Eyes, skin, respiratory system, brain
Acute Effects
Inhalation: Dyspnea, bronchospasms, laryngitis, chest pain, excessive salivation, pink frothy sputum, urine retention, elevated blood pressure, corrosion of nose, throat and respiratory tract, fluid in the lungs (can be delayed), inflammation of and fluid accumulation in the larynx, changes in brain energy metabolism, coma, convulsions, and even death from kidney failure or spasm can result from inhalation of anhydrous ammonia. Concentrations of 2500-4500 ppm for 30 minutes can be fatal. **Eye:** Contact with liquid or exposure to high gas concentrations (> 1700 ppm) causes tearing, eyelid redness and swelling, extreme irritation, permanent corneal damage, cataract formation, glaucoma-like symptoms, temporary/permanent blindness. **Skin:** Contact with liquid or exposure to high gas concentrations may cause blisters, burns, and frostbite (liquid only). Percutaneous absorption may take place through damaged tissue, and lead to systemic effects. **Ingestion:** Nausea, vomiting, swelling of the lips, mouth and larynx

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and systemic effects (see Inhalation) can result. **Carcinogenicity:** IARC, NTP, and OSHA do not list anhydrous ammonia as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Impaired lung or liver function, corneal disease, glaucoma.

Chronic Effects: Repeated inhalation may result in asthma, chronic bronchitis, dilation of and fiber formation in the bronchial tubes, headache and prolonged sleepiness. Repeated skin contact can result in dermatitis.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. **Eye Contact:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. **Skin Contact:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water or milk. *Do not* induce vomiting. ***After first aid, get appropriate in-plant, paramedic, or community medical support.*** **Note to Physicians:** Serum ammonia levels are not clinically useful in managing exposures; instead, monitor blood gases and evaluate clinically for pulmonary edema and respiratory distress, with treatment as appropriate. Consider esophagoscopy if patient has oral or pharyngeal burns. Gastric lavage is contraindicated. For eye exposure, irrigate until conjunctival sack pH is < 8.5. If ingestion is significant, observe for signs of esophageal stricture.

Section 5 - Fire-Fighting Measures

Flash Point: Not applicable, combustible gas **Burning Rate:** 1 mm/min

LEL: 16% v/v **UEL:** 25% v/v **Autoignition Temperature:** 1204 °F (651 °C)

Genium

Gas

NFPA

Liquid

Flammability Classification: Combustible gas. **Extinguishing Media:** Use carbon dioxide or dry chemical to extinguish flame at gas valve. **Unusual Fire or Explosion Hazards:** Containers may explode in heat of fire. Ammonia can form explosive mixture with air, and may decompose to flammable hydrogen and nitrogen gas at temperatures greater than 840 °F (450 °C); reacts exothermically with acids. Contact with many incompatibles (see Sec. 10) can generate explosive products. **Hazardous Combustion Products:** Heating anhydrous ammonia to decomposition can produce fumes of ammonia, and nitrogen oxides (NO_x). **Fire-Fighting Instructions:** *Do not* release runoff from fire control methods to sewers or waterways. Use water spray to protect personnel shutting off gas. Remove cylinders from fire. **Fire-Fighting Equipment:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Isolate spill for 330-660 ft (100-200 m) in all directions. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. *Do not* touch or walk through spilled material. Aerosol from leak of liquid ammonia may lower air temperature considerably. Use water spray to reduce vapors or divert vapor cloud drift, and then stop leak if possible. If possible, turn leaking containers so that gas escapes rather than liquid. Prevent entry into waterways, sewers, basements or confined areas. *Do not* direct water at spill or source of leak. Isolate area until gas has dispersed. **Small Spills:** Absorb liquid anhydrous ammonia with vermiculite, earth, sand or similar material.

Large Spills, Containment: For large spills, consider downwind evacuation of at least 1000 ft (300 m). *Do not* release into sewers or waterways. **Cleanup:** Spills can be neutralized with dilute acid. **Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves, goggles, and clothing (see Sec. 8). Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers. Liquid ammonia will attack some plastics, rubbers and coatings. **Storage Requirements:** Store outside, out of direct sunlight, away from drinking water wells, or in a tightly closed container in a cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect materials. Equip drums with appropriate pressure-relief devices. *Do not* use copper, brass, bronze or galvanized steel in contact with ammonia. **Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.101, 111) for combustible gases.

Section 8 - Exposure Controls / Personal Protection

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

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Section 8 - Exposure Controls / Personal Protection, *continued*

Engineering Controls: Consider installation of sprinklers protection for protection against vapors. **Administrative Controls:** *Implement medical surveillance procedures for workers, including chest x-ray, examination of eyes, skin and respiratory* **Respiratory Protection:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations ≤ 250 ppm, use chemical cartridge respirator with green cartridge, or supplied air (SA) respirator; ≤ 300 ppm, SA respirator in continuous flow mode, or *powered air-purifying respirator with green cartridge*, or chemical cartridge respirator with full facepiece and green cartridge, o air-purifying full-facepiece respirator with chin-style front- or back-mounted *green cartridge*, or SCBA *with full facepiece*, or SA respirator with full facepiece; > IDLH, or emergency, SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or SA respirator with full facepiece operated in pressure-demand or other positive-pressure mode combined with SCBA. For escape, use *air-purifying full facepiece respirator with green cartridge*, or escape-type SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Protective Clothing/ Equipment:** Wear chemically protective gloves, *boots, aprons, and gauntlets of butyl rubber*, Teflon™, Trellchem HPS™, or Responder™ (breakthrough time (BT) >8 hr), if possible, or alternatively, nitrile rubber (BT >4 hr), and *neoprene (BT >1 hr)*, to prevent skin contact. Polyvinyl chloride, polyethylene, polyvinyl alcohol, Barricade™ and Chemrel™ (BT <1 hr) may degrade after contact and are *not* recommended. Wear splash-proof chemical safety goggles and face shield (8-inch minimum), per OSHA eye- and face-protection regulations (29 CFR 1910.133). *Contact lenses* are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses. **Safety Stations:** Make emergency *eyewash stations*, safety/quick-drench showers, and washing facilities available in work area. **Contaminated Equipment:** Separate contaminated *work clothes from street clothes*. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. **Comments:** Never eat, drink, or smoke *in work areas*. *Practice good personal hygiene* after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: *Gas*
Appearance and Odor: Colorless; strong, pungent, and irritating odor
Odor Threshold Range: 0.32 - 46.8 ppm
Vapor Pressure: 7,510 *mm* Hg at 77 °F (25 °C)
Vapor Density (Air=1): 0.59
Formula Weight: 17.03
Density: 0.771 g/L at 760 mm Hg (gas)
pH: 11.6 (1.0 N aqueous solution)
Water Solubility: 31% at 77 °F (25 °C)
Other Solubilities: 10% in ethanol at 77 °F (25 °C); 16% in methanol at 77 °F (25 °C); *soluble in chloroform and ether.*
Boiling Point: -28 °F (-33.35 °C)
Freezing Point: -107.86 °F (-77.7 °C)
Viscosity: 0.255 centipoise at -28.3 °F (-33.5 °C)
Refractive Index: 1.325 at 61.7 °F (16.5 °C)/D
Surface Tension: 23.4 dynes/cm at 39.4 °F (4.1 °C)
Ionization Potential: 10.18 eV
Henry's Law Constant (H): 0.76 atm-m^3/mole
Octanol/Water Partition Coefficient: log K_{ow} = -1.14

Section 10 - Stability and Reactivity

Stability: Anhydrous ammonia is stable at room temperature in closed containers under normal storage and handling conditions. **Polymerization:** *Hazardous polymerization* cannot occur. **Chemical Incompatibilities:** Include acids; strong oxidants; interhalogens; chlorine or chlorine bleach; boron halides; 1,2-dichloroethane; *ethylene oxide*; *chloroformamidnium nitrate*; oxygen + platinum; magnesium perchlorate; nitrogen trichloride; heavy metals and their compounds; chlorine azide; bromine; iodine; iodine + potassium; tellurium halides; pentaborane; silver compounds; hypochlorites; air + hydrocarbons; germanium derivatives; stibine; *1-chloro-2,4-dinitrobenzene*; *ethanol + silver nitrate*; 2-, or 4-chloronitrobenzene; acetaldehyde; acrolein; boron; chlorosilane; hexachloromelamine; sulfur; hydrazine + alkali metals; potassium *ferricyanide*; *potassium mercuric* cyanide; nitrogen dioxide; phosphorus pentoxide; tetramethylammonium amide. **Conditions to Avoid:** Heat, ignition sources, *contact with oxidizing agents*, combustible materials and incompatibles. **Hazardous Decomposition Products:** Thermal oxidative decomposition of *anhydrous ammonia* can produce fumes of ammonia and nitrogen oxides (NO_x).

Section 11- Toxicological Information

Toxicity Data:*

Genetic Effects:
Bacteria - *E. Coli*, 1500 ppm/3 hr resulted in mutations (-S9).
Multiple Dose Toxicity Data:
Rat, inhalation, 300 ppm/6 hr/5 days, intermittently, *caused other changes in blood*, other degenerative changes in brain and coverings.

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Section 11- Toxicological Information, *continued*

Tumorigenicity:
Rat, oral, 1680 mg/kg/24 weeks, continuously, resulted in gastrointestinal tumors.

Cytogenetic Analysis:
Rat, inhalation: 19800 µg/m³/16 weeks

Acute Oral Effects:
Man, oral, TD_{Lo}: 15 µL/kg, caused changes in structure/function of esophagus.
Rat, oral, LD_{50}: 350 mg/kg

Acute Inhalation Effects:
Human, inhalation, LC_{Lo}: 5000 ppm/5 min.
Human, inhalation, TC_{Lo}: 20 ppm, caused ulcerated nasal septum, conjunctive irritation, structural/functional change in trachea.
Rat, inhalation, LC_{50}: 2000 ppm/4 hr

* See NIOSH, *RTECS* (BO0875000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Crayfish, LC_{100}=80 ppm/3 days; fathead minnow, TLm=8.2 ppm/96 hr; goldfish/yellow perch, LC_{60}=2.0-2.5 ppm/1-4 day. **Environmental Fate:** Anhydrous ammonia has a very high vapor pressure and will rapidly evaporate from water and soil. In surface water, it may sorb to suspended sediments provided that conditions are oxidizing. Ammonia does not bioconcentrate. **Environmental Degradation:** Biological nitrification (conversion to nitrate) will rapidly occur in soil and water under aerobic conditions. In the atmosphere, ammonia will rapidly combine with sulfate ion and be removed via wet deposition, though some may be oxidized to nitrogen oxides (NO_x) and nitrate (NO_3), contributing to rainfall acidity.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Consider dilution with water, cautious neutralization with hydrochloric acid (HCl), and discharge to sewer. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Ammonia, anhydrous
Shipping Symbols: I; D
Hazard Class: 2.3; 2.2
ID No.: UN1005
Packing Group: —
Label: POISON GAS, CORROSIVE MATERIAL; NONFLAMMABLE GAS
Special Provisions (172.102): 8; 13

Packaging Authorizations
a) **Exceptions:** None
b) **Non-bulk Packaging:** 173.304
c) **Bulk Packaging:** 173.314; 173.315

Quantity Limitations
a) **Passenger, Aircraft, or Railcar:** Forbidden
b) **Cargo Aircraft Only:** 25 kg

Vessel Stowage Requirements
a) **Vessel Stowage:** D
b) **Other:** 40, 57

Section 15 - Regulatory Information

EPA Regulations:
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per CWA Section 311(b)(4)
CERCLA Final Reportable Quantity (RQ), 100 lb. (45.35 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a SARA EHS (Extremely Hazardous Substance) (40 CFR 355), Threshold Planning Quantity (TPQ): 500 lb.

OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)
OSHA Process Safety TQ: 10,000 lb.
OSHA Specifically Regulated Substances (29 CFR 1910.111)

Section 16 - Other Information

References: 1, 73, 103, 124, 136, 149, 176, 190, 208, 209, 216, 217, 218, 222, 223, 224, 227, 228, 230

Prepared By ..... HM Spliethoff, MS
Industrial Hygiene Review ..... DJ Wilson, CIH
Medical Review ..... G Kelafant, MD

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Material Safety Data Sheets Collection:

Sheet No. 296
Arsenic and Compounds

Issued: 4/90

Section 1. Material Identification

Arsenic Description: Obtained from flue dust of copper and lead smelters as white arsenic (arsenic trioxide). Reduction with charcoal and sublimation in an N_2 current yields pure arsenic. Metallic arsenic is used for hardening copper, lead, and alloys; as a doping agent in germanium and silicon solid-state products, special solders, and medicine; and to make gallium arsenide for dipoles and other electronic devices. Arsenic compounds are used in manufacturing certain types of glass; in textile printing, tanning, taxidermy, pharmaceuticals, insecticides and fungicides, pigment production, and antifouling paints; and to control sludge formation in lubricating oils. Arsenic trioxide is the source for 97% of all arsenic products.

Other Designations: CAS No. 7440-38-2; arsen; arsenic black; As; gray arsenic; metallic arsenic.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

R	1
I	4
S	2
K	0

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Section 2. Ingredients and Occupational Exposure Limits

Arsenic and soluble compounds, as As

OSHA PEL
8-hr TWA: 0.5 mg/m³,* 0.01 mg/m³†

NIOSH REL, 1987
Ceiling: 0.002 mg/m³

ACGIH TLV, 1989-90
TLV-TWA: 0.2 mg/m³

Toxicity Data‡
Man, oral, TD_{Lo}: 76 mg/kg administered intermittently over a 12-year period affects the liver (tumors) and blood (hemorrhage)
Man, oral: 7857 mg/kg administered over 55 years produces gastrointest (in the structure or function of the esophagus), blood (hemorrhage), and skin and appendage (dermatitis) changes
Rat, oral, TC_{Lo}: 605 µg/kg administered to a 35-week pregnant rat affects fertility (pre- and post-implantation mortality)

* Organic compounds.
† Inorganic compounds.
‡ See NIOSH, *RTECS* (CG0525000), for additional mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: sublimes at 1134 °F/612 °C
Melting Point: 1497 °F/814 °C
Vapor Pressure: 1 mm at 702 °F/372 °C (sublimes)
Atomic Weight: 74.92
Density: 5.724 at 57 °F/14 °C
Water Solubility: Insoluble†

Appearance and Odor: A brittle, crystalline, silvery to black metalloid. Odorless.

* This data pertains to arsenic only.
† Arsenic is soluble in nitric acid (HNO_3).

Section 4. Fire and Explosion Data

Flash Point: *None reported*	***Autoignition Temperature:*** *None reported*	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Use dry chemical, CO_2, water spray, or foam to fight fires.
Unusual Fire or Explosion Hazards: *Flammable and slightly explosive in the form of dust when exposed to heat or flame.*
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiec operated in the pressure-demand or positive-pressure mode. Be aware of runoff from fire control methods. Do not release to sewers or waterwa

Section 5. Reactivity Data

Stability/Polymerization: *Arsenic is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous* polymerization cannot occur.
Chemical Incompatibilities: *Arsenic can react vigorously on contact with powerful oxidizers such as bromates, peroxides, chlorates, iodates,* lithium, silver nitrate, potassium nitrate, potassium permanganate, and chromium (VI) oxide. This material is also incompatible with halogens, bromine azide, palladium, dirubidium acetylide, zinc, and platinum.
Hazardous Products of Decomposition: Thermal oxidative decomposition of arsenic and its compounds produces irritating or poisonous gase

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Section 6. Health Hazard Data

Carcinogenicity: The IARC, NTP, and OSHA list arsenic as a human carcinogen (Group 1). This evaluation applies to arsenic and arsenic compounds as a whole, and not necessarily to all individual chemicals within the group. Studies report that both the trivalent and pentavalent compounds are strongly implicated as causes of skin, lung, and lymphatic cancers. Experimental studies have shown that arsenic has tumorigenic and teratogenic effects in laboratory animals.
Summary of Risks: Arsenic compounds are irritants of the skin, mucous membranes, and eyes. The moist mucous membranes are most sensitive to irritation. Prolonged contact results in local hyperemia (blood congestion) and later vesicular or pustular eruption. Epidermal carcinoma is a reported risk of exposure. Peripheral neuropathy (degenerative state of the nervous system) is common after acute or chronic arsenic poisoning. Symptoms include decreased sensation to touch, pinprick, and temperature; loss of vibration sense; and profound muscle weakness and wasting. Other complications of acute and chronic arsenic poisoning are encephalopathy (alterations of brain structure) and toxic delirium.
Medical Conditions Aggravated by Long-Term Exposure: Damage to the liver, nervous, and hematopoietic (responsible for the formation of blood or blood cells in the body) system may be permanent. Pulmonary and lymphatic cancer may also occur.
Target Organs: Liver, kidneys, skin, lungs, lymphatic system.
Primary Entry Routes: Inhalation, ingestion of dust and fumes, via skin absorption.
Acute Effects: Acute industrial intoxication is more likely to arise from inhalation of arsine. However, with corrosive arsenical vapors, conjunctivitis, eyelid edema, and even corneal erosion may result. Inhalation may result in nasal irritation with perforation of the septum, cough, chest pain, hoarseness, pharyngitis, and inflammation of the mouth. If ingested, metallic or garlic taste, intense thirst, nausea, vomiting, abdominal pain, diarrhea, and cardiovascular arrhythmias (heartbeat irregularities) may occur. Symptoms generally occur within 30 minutes, but may be delayed for several hours if ingested with food. Acute poisoning may result in acute hemolysis (breakdown of red blood cells).
Chronic Effects: Chronic symptoms include weight loss, hair loss, nausea, and diarrhea alternating with constipation, palmar and plantar hyperkeratoses (thickening of the corneous layer of skin on palms and soles of feet), and skin eruptions, and peripheral neuritis (inflammation of the nerves). Leukemia, bone marrow depression, or aplastic anemia (dysfunctioning of blood-forming organs) may occur after chronic exposure.
FIRST AID
Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.
Skin: *Quickly* remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a *conscious* person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: If emesis is unsuccessful after two doses of Ipecac, consider gastric lavage. Monitor urine arsenic level. Alkalinization of urine may help prevent disposition of red cell breakdown products in renal tubular cells. If acute exposure is significant, maintain high urine output and monitor volume status, preferably with central venous pressure line. Abdominal X-rays should be done routinely for all ingestions. Chelation therapy with BAL, followed by n-penicillamine is recommended, but specific dosing guidelines are not clearly established.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel of spill, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and contact with skin and eyes. Use nonsparking tools. With a clean shovel, scoop material into a clean, dry container and cover. Absorb liquid material with sand or noncombustible inert material and place in disposal containers. Do not release to sewers, drains, or waterways. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations*
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance† (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [† per Clean Water Act, Sec. 307(a); per Clean Air Act, Sec. 112]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations‡
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

* Designations for arsenic only.
‡ Listed as arsenic organic compounds (as As).

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.
Warning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PELs, ACGIH TLVs, and NIOSH REL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed, properly labeled, containers in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and heat and ignition sources. Protect containers from physical damage.

Engineering Controls: Avoid inhalation or ingestion of dust and fumes, and skin or eye contact. Practice good personal hygiene and housekeeping procedures. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program with training, maintenance, inspection, and evaluation. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement and annual physical examination with emphasis on the skin, respiratory system, and blood.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Arsenic, solid
DOT Hazard Class: Poison B
ID No.: UN1558
DOT Label: Poison
DOT Packaging Requirements: 173.366
DOT Packaging Exceptions: 173.364

IMO Shipping Name: Arsenic, metallic
IMO Hazard Class: 6.1
IMO Label: Poison
IMDG Packaging Group: II
ID No.: UN1558

***MSDS Collection* References:** 7, 26, 38, 53, 73, 85, 87, 88, 89, 100, 103, 109, 123, 124, 126, 127, 130, 136, 138
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD

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Material Safety Data Sheet Collection

Arsenic Trioxide

MSDS No. 194
Date of Preparation: 6/86
Revision: A, 4/95

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Arsenic Trioxide
Chemical Formula: As_2O_3
CAS Number: 1327-53-3
Synonyms: arsenic oxide, arsenic (III) oxide, arsenic sesquioxide, arsenicum album, arsenious acid, arsenious acid anhydride, arsenious oxide, arsenious trioxide, arsenite, arsenolite, arsenous acid, arsenous acid anhydride, arsenous anhydride, claudelite, claudetite, crude arsenic, diarsenic trioxide, white arsenic
Derivation: By smelting of copper and lead concentrates, adding pyrite or galena to yield arsenic trioxide vapor and condensation to yield 90 to 95% pure arsenic trioxide. Re-sublimation will yield 99 +%. Available in crystals (monoclinic-*claudetite*; cubic-*arsenolite*) and amorphous lumps.
General Use: No longer produced in the US, but it is imported. Used in the manufacture of other arsenic compounds, glass (decolorizer), Paris green, enamels, weed killers, insecticides, and rodenticides; for preserving hides and wood, and as a textile mordant. Formerly used in veterinary medicine.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Arsenic trioxide, ca 95 to 99+% wt (various purities are available).
Trace Impurities: 10,000 to 20,000 ppm antimony, 300 to 600 ppm lead and iron, 100 to 800 ppm copper, 300 ppm zinc, and 15 ppm cadmium, selenium, mercury, and tellurium.

OSHA PEL
Inorganic compounds, as As
8-hr TWA: 0.01 mg/m^3

NIOSH REL
Inorganic compounds, as As
15-min Ceiling: 0.002 mg/m^3

DFG (Germany) MAK
None established

ACGIH TLV
Inorganic compounds, as As
8-hr TWA: 0.01 mg/m^3

IDLH Level
5 mg/m^3 as As

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Arsenic trioxide exists as odorless, tasteless, white or transparent, amorphous lumps or crystalline powder. It is irritating to the eyes, skin, and respiratory tract. Severe acute and chronic toxicity occurs via all routes of exposure and includes peripheral nervous system damage, anemia, and possible cancer of the respiratory tract and skin. Arsenic trioxide is easily absorbed through the skin. It is not combustible.

Wilson Risk Scale
R 1
I 4
S 1*
K 1
*Skin absorption

HMIS
H 3*
F 0
R 0

*Chronic effects
PPE†
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, eye and skin contact/absorption.
Target Organs: Kidneys, liver, lungs, skin, lymphatic system, peripheral nervous system, bone marrow.
Acute Effects
Inhalation: Symptoms include irritation of the respiratory tract, headache, coughing, difficulty breathing, chest pains, and pulmonary edema (fluid in lungs).
Eye: Irritation of the eye and conjunctiva.
Skin: Irritation of the skin.
Ingestion: Symptoms generally occur within 30 to 60 minutes but may be delayed for several hours if ingested with food. Symptoms include a metallic or garlic taste in the mouth, nausea and vomiting, abdominal pain, difficulty swallowing, and profuse, watery, sometimes bloody diarrhea, dehydration, intense thirst, fluid-electrolyte disturbances, severe hypotension (low blood pressure), metabolic acidosis, hemolysis (breakage of red blood cells), pancytopenia (reduction in all formed blood elements), anemia, Mee's lines (transverse white lines in the nails), peripheral neuropathy (damage to the peripheral nerves resulting in sensation and motor disturbances) with muscle wasting, tingling sensations, and burning pain in a "stocking and glove" distribution. Brain damage (1 to 6 months post exposure) may also occur. Human fatal dose = 1 to 2.5 mg/kg.
Carcinogenicity: The following agencies list arsenic trioxide (as arsenic compounds) as a carcinogen: EPA-A (Human carcinogen with sufficient epidemiological evidence to support a casual association between exposure and cancer), IARC-1 (carcinogenic to humans, sufficient evidence of carcinogenicity), DFG MAK-A1 (capable of inducing malignant tumors as shown by experience with humans), NIOSH-X (carcinogen defined with no further categorization), and OSHA-X (Carcinogen defined with no further categorization). The ACGIH lists arsenic trioxide *production* as TLV-A2 (Suspected human carcinogen).
Medical Conditions Aggravated by Long-Term Exposure: Blood or liver disorders.

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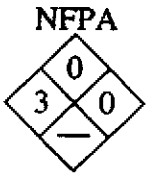
Chronic Effects: Symptoms include nasal, eye, and skin irritation, tearing, photophobia (sensitivity to light), hair loss, perforation of the nasal septum (tissue between the nostrils), hoarse voice, cirrhosis of the liver (rare), nausea and vomiting (infrequent), aplastic anemia (anemia characterized by defective functioning of blood-forming organs such as bone marrow and caused by exposure to chemicals or x-rays), and painful ulceration of the wrists, scrotal skin, lips, and nostrils.
Other: Ingestion of arsenic trioxide has caused premature birth with subsequent death. Arsenic trioxide can be passed to an infant through breast milk.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.
Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation persist.
Skin Contact: *Quickly* remove contaminated clothing. *Do not* shake arsenic trioxide dusts off clothing! Rinse with flooding amounts of water to remove loose material followed by a thorough soap and water wash. For reddened or blistered skin, consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting. ***After first aid, get appropriate in-plant, paramedic, or community medical support.***
Note to Physicians: Support respiratory and cardiovascular function. Assure adequate hydration and renal function: alkalinization of the urine may prevent disposition of red blood cell products from hemolysis in renal tubular cells.
Special Precautions/Procedures: Chelation therapy may be indicated if urine arsenic levels exceed 200 µg/liter or higher.

Section 5 - Fire-Fighting Measures

Flash Point: Noncombustible.
Autoignition Temperature: Noncombustible.
LEL: None reported.
UEL: None reported.
Extinguishing Media: Use agents suitable for surrounding fire.
Unusual Fire or Explosion Hazards: None reported.
Hazardous Combustion Products: Arsenic trioxide fumes and arsine gas.
Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind.
Small Spills: *Do not* sweep! Carefully scoop up or vacuum (with appropriate filter) and place in suitable container.
Large Spills
Containment: Flush spill to containment area with water for later reclamation or disposal. Neutralize spill with agricultural lime, crushed limestone, or sodium bicarbonate. *Do not* release into sewers or waterways.
Cleanup: Damp mop any residue with dilute sodium bicarbonate solution.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use only with adequate ventilation. Wear appropriate PPE to prevent inhalation and skin/eye contact.
Storage Requirements: Store in a cool, dry, well-ventilated area away from incompatibles (Sec. 10). Floors and shelves should be made of an impermeable material to prevent absorption of arsenic trioxide.
Regulatory Requirements: Follow 29 CFR 1910.1018.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Enclose all processes where possible to prevent dispersion of dusts into work area.
Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Administrative Controls: Consider preplacement and periodic medical exams of exposed workers. Measurement of arsenic levels in urine can be indicative of exposure. Advise against seafood ingestion for 48 to 72 hr prior to testing.
Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following recommendations are for inorganic arsenic compounds. For any detectable concentration, use a SCBA with a full facepiece operated in pressure-demand or other positive-pressure mode or any supplied-air respirator with a full facepiece operated in pressure demand or other positive pressure mode in combination with an auxiliary SCBA. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical

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certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. Due to the potential skin irritation associated with respirator use and arsenic dust exposure, workers should be allowed to leave work area every two hours to wash face and obtain a clean respirator.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Butyl rubber and polycarbonate have been suggested as suitable materials for PPE. Barrier creams, such as those which are silicone-based will provide some protection against absorption of arsenic trioxide through the skin. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. *Do not* shake or blow arsenic trioxide dusts off clothing! Launder before reuse. Laundry personnel should be informed of the health hazards associated with arsenic trioxide and provided with PPE to protect against exposure. Remove arsenic trioxide from your shoes and PPE.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using arsenic trioxide, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: White or transparent crystals (monoclinic - *claudetite*), (cubic - *arsenolite*); or amorphous lumps; odorless; tasteless

Vapor Pressure: 66 mm Hg at 406.4 °F (312 °C)

Formula Weight: 197.82

Density (H_2O=1, at 4 °C): 4.15 g/cm^3 (*claudetite*), 3.856 g/cm^3 (*arsenolite*)

Water Solubility: 1.82 % (*claudetite*), 1.2 % (*arsenolite*) at 68 °F (20 °C). Soluble in 15 parts water at 212 °F (100 °C).

Other Solubilities: Soluble in alkali hydroxide or carbonate solutions, acids, and glycerol; insoluble in alcohol, chloroform and ether.

Boiling Point: 869 °F (465 °C), sublimes

Melting Point: 595.4 °F (313 °C), *claudetite*; 527 °F (275 °C), *arsenolite*

Refractive Index: 1.871, 1.92, 2.01 (*claudetite*); 1.755 (*arsenolite*)

Henry's Law Constant: 1.7 x 10^{-12} atm/m^3/mole

Section 10 - Stability and Reactivity

Stability: Arsenic trioxide is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Tannic acid, infusion cinchona, and other vegetable astringent fusions and decoctions, acids, volatile, highly toxic arsine gas), halogens (rubidium chloride, chlorine trifluoride, fluorine, sodium chlorate, hydrogen fluoride), aluminum, zinc fillings (explodes upon heating), sodium nitrate, and mercury. Corrosive to many metals in the presence of moisture.

Conditions to Avoid: Exposure to incompatibles, elevated temperatures, and dispersion into air.

Hazardous Decomposition Products: Thermal oxidative decomposition of arsenic trioxide can produce arsenic trioxide fumes and arsine gas.

Section 11 - Toxicological Information

Toxicity Data:*

Acute Oral Effects:

Human, oral, LD_{Lo}: 1429 µg/kg

Human, oral, LD_{Lo}: 29 mg/kg caused changes in sleep, muscle weakness, hypermotility, and diarrhea.

Rat, oral, LD_{50}: 14600 µg/kg

Multiple Dose Toxicity Data:

Rat, inhalation: 31 µg/m^3/24 hr administered continuously for 22 weeks produced toxic effects of the brain and coverings.

Reproductive Effects:

Woman, oral: 600 mg/kg taken in the 30th week of pregnancy resulted in premature birth with subsequent death.

Mouse, inhalation: 28,500 µg/m^3/4 hr administered from 9 to 12 days of pregnancy produced cytologic effects (including somatic cell genetic material) and specific developmental abnormalities of the musculoskeletal system.

Mutagenicity:

Human, HeLa cell: 500 µmol caused DNA inhibition.

Human, lymphocyte: 2 µg/cm^3 caused sister chromatid exchange.

* See NIOSH, *RTECS* (CG3325000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Salmon, LC_{50} = 8, 330 mcg/L/48 hr; pink salmon, LC_{100} = 7,195 mcg/L/ 7 days; fathead minnow, LC_{50} = 109 mg/L/96 hr

Environmental Fate: Arsenic trioxide adsorbs strongly to soil and sediment in water, especially those soils/sediment which contain clay or are high in ferrous and aluminum oxides. Its half-life in soil is ~ 6.5 years. In water, inorganic trivalent arsenic is slowly oxidized to pentavalent arsenic at neutral pH. Oxidation is more rapid in strong acid or base solutions. Arsenic trioxide may also undergo reduction, methylation, and demethylation conversion to alkyl arsines which are volatile and can lead to

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dissipation into the atmosphere. Arsenic trioxide may be found bound to particulates in air (generally < 2 μm in diameter) and transported by wind and air currents. Deposition will eventually occur (dry or precipitation). Typical residence time in air is ~ 9 days (varies depending on particle size and weather conditions).
Bioconcentration: BCF = 4 (*Lepomis macrochirus* at 28 days), 10 (*Daphnia magna* at 21 days).

Section 13 - Disposal Considerations

Disposal: Arsenic trioxide is a poor candidate for incineration. For small quantities, dissolve in a minimum amount of hydrochloric acid. Add to water until a white precipitate forms. Add 6 M hydrochloric acid again. Saturate with hydrogen sulfide. Filtrate, wash the precipitate, dry, package, and return to supplier. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
Disposal Regulatory Requirements: Follow 29 CFR 1910.1018.
Container Cleaning and Disposal: Triple rinse containers. Dispose of rinse water as described above.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Arsenic trioxide
Shipping Symbols: –
Hazard Class: 6.1
ID No.: UN1561
Packing Group: II
Label: Poison
Special Provisions (172.102): –

Packaging Authorizations
a) Exceptions: None
b) Non-bulk Packaging: 173.212
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 25 kg
b) Cargo Aircraft Only: 100 kg

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: –

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste (40 CFR 261.33): P012
CERCLA Hazardous Substance (40 CFR 302.4) listed specific per RCRA, Sec. 3001 and CWA, Sec. 311 (b)(4)
CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)
Listed (as arsenic compounds) as a SARA Toxic Chemical (40 CFR 372.65)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355), Threshold Planning Quantity (TPQ): 100/10,000 lb*
OSHA Regulations:
Listed (as inorganic arsenic compounds as As) as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)
OSHA Specifically Regulated Substance (29 CFR 1910.1018, *arsenic compounds*)

* The lower quantity applies only if the solid exists in powdered form with a particle size of < 100 microns, or is handled in solution or molten form, or meets the NFPA rating of 2, 3, or 4 for reactivity. If the solid does not meet any of these criteria, it is subject to the upper quantity.

Section 16 - Other Information

References: 73, 103, 124, 136, 149, 176, 189, 190, 197, 200, 201, 204, 205

Prepared By ..... M Gannon, BA
Industrial Hygiene Review ..... RE Langford, PhD, CIH
Medical Review ..... R Teichman, MD

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Material Safety Data Sheet Collection

Atrazine

MSDS No. 103

Date of Preparation: 3/97

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Atrazine
Chemical Formula: $C_8H_{14}ClN_5$
CAS Number: 1912-24-9
Synonyms: AAtrex; Atranex; Atred; 2-chloro-4-ethylamino-6-isopropylamino-s-triazine; 6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine; Cristina; Gesaprial; Griffex; Primatol; Purge; Vecta
Derivation: Prepared by the reaction of cyanuric chloride with one equivalent of ethylamine followed by one equivalent of isopropylamine in the presence of an acid-binding agent; by reaction of 2,6-dichloro-4-ethylamino-*s*-triazine with isopropylamine.
General Use: Herbicide; plant growth regulator (inhibits photosynthesis); and weed control agent for corn, etc. and for non-crop and industrial sites.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Atrazine, ca 100% wt

OSHA PEL
Vacated 1989 Final Rule Limit:
8-hr TWA: 5 mg/m^3

NIOSH REL
10-hr TWA: 5 mg/m^3

DFG (Germany) MAK
TWA: 2 mg/m^3, *total dust* (*total inspirable dust fraction*)

ACGIH TLV
TWA: 5 mg/m^3

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Atrazine is an odorless, white, crystalline (sand-like) substance or powder which is often mixed with liquid in herbicides. It is irritating to the eyes and may cause dermatitis and skin sensitization. Based on animal data, exposure to high concentrations affects the nervous system and can cause liver injury. IARC classifies atrazine as a possible carcinogen. It is a noncombustible substance, but may be dissolved in a flammable carrier.

Wilson Risk
S
R
I 2
S 2
K 0

HMIS
H 2*
F 0
R 0
PPE†
*Chronic effects
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact
Target Organs: Eyes, skin, respiratory system, central nervous system, liver, kidney
Acute Effects *Note! Because adverse effects in humans have not been reported, the following symptoms are from animal data.*
Inhalation: Atrazine presents a low inhalation hazard due to its low vapor pressure. Dust inhalation may produce dyspnea (difficulty breathing). Exposure to high concentrations may produce systemic effects similar to those produced when ingested (see below).
Eye: Contact may cause irritation.
Skin: Contact may cause irritation.
Ingestion: Ingestion of large amounts may cause dyspnea (difficulty breathing), weakness, incoordination, anorexia (loss of appetite), muscle spasms, salivation, hypothermia, and liver injury.
Carcinogenicity: NTP and OSHA do not list atrazine as a carcinogen. IARC classifies it as Group 2B (possibly carcinogenic to humans). The ACGIH classifies it as TLV-A4 (not classifiable as a human carcinogen).
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Chronic Effects: Repeated skin contact may cause dermatitis and sensitization.
Other: Conflicting results are reported for the mutagencity of atrazine. Human mutagenic data is reported (see Sec. 11). Atrazine is not a genetic hazard based on a weight of evidence approach. During dietary studies, no teratogenic effects were observed in rats receiving 100 ppm. At maternal doses of 800 to 2000 mg/kg, embryotoxic effects were seen. Atrazine was not teratogenic at maternally toxic dose levels in rabbits (75 mg/kg/day on gestational days 7 to 19) and in rats (70 mg/kg/day on gestational days 6 to 15). See Sec. 11 for additional reproductive effects data.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention immediately.

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Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician or ophthalmologist if pain and/or irritation develop.

Skin Contact: *Quickly* remove contaminated clothing, flush exposed area with water for at least 15 minutes, and get medical attention immediately.

Ingestion: If victim is conscious, have victim drink water or milk and induce vomiting. Never give anything by mouth to an unconscious or convulsing person. Keep them warm and get medical attention immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Urinary metabolites include 2-chloro-4-ethylamino-6-amino-*s*-traizaine and N-dealkylated atrazine.

Special Precautions/Procedures: Preliminary medical exam to detect chronic diseases of CNS, liver, heart, kidneys, lung and skin, as well as endocrinological or immunological disturbances should be given to susceptible individuals.

Section 5 - Fire-Fighting Measures

Genium

Flash Point: None reported

Autoignition Temperature: None reported

LEL: None reported

UEL: None reported

Flammability Classification: Noncombustible solid

Extinguishing Media: Use an agent suitable for type of surrounding fire.

Unusual Fire or Explosion Hazards: Atrazine is often dissolved in a liquid "carrier" which may be flammable. Also, storage containers may explode in a fire.

Hazardous Combustion Products: Upon decomposition, poisonous gases, such as hydrogen chloride and nitrogen oxide, may be produced.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel and isolate and ventilate area. Restrict persons not wearing protective equipment from area of spill or leak until clean-up is complete.

Small Spills: Carefully scoop up powdered material and deposit in sealed containers. Absorb liquid containing atrazine in vermiculite, dry sand, earth, or similar material.

Large Spills

Containment: For large spills, dike far ahead of liquid spill for later disposal. Cover dry spills with plastic sheet to prevent further dispersion. *Do not* release into sewers or waterways. Immediately call your fire department.

Cleanup: Use a vacuum or a wet method to reduce dust during clean-up. *Do not* dry sweep. Use water spray to "knock down" dust.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid dust inhalation and skin and eye contact. Use with ventilation sufficient to reduce airborne concentrations to nonhazardous levels (see Sec. 2). Avoid contamination of food, feed, and water supplies.

Storage Requirements: Store in tightly closed containers in a cool, well-ventilated area away from heat and ignition sources and strong acids and bases. Transfer atrazine from drums or other storage containers to process containers.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to prevent dust dispersion into the work area.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (see Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103)

Administrative Controls: Consider preplacement and periodic medical exams with emphasis on the skin, liver, and nervous system. Prior to working with atrazine, train workers on its proper handling and storage.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved full facepiece respirator with a pesticide cartridge. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

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Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact; data suggest Tyvek, cotton, or cotton and cotton/polyester soil repellent finished fabric provide barrier protection. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses should not be worn when working with this chemical. Appropriate eye protection must be worn instead of contact lenses.
Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in w
Contaminated Equipment: Separate contaminated work clothes from street clothes. *Do not* take contaminated work clothe home; they should be laundered by those aware of the hazards of atrazine.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Crystalline solid
Appearance and Odor: Colorless or white, odorless
Vapor Pressure: 3×10^{-7} mm Hg at 68 °F (20 °C)
Formula Weight: 215.68
Specific Gravity (H_2O=1, at 4 °C): 1.19
Corrosivity: Noncorrosive
Water Solubility: 70 ppm at 77 °F (25 °C); 28 mg/L at 68 °F (20 °C)
Other Solubilities: Ether: 12,000 ppm; chloroform: 52,000 ppm; methanol: 18,000 ppm
Boiling Point: Decomposes
Melting Point: 340 °F (173 °C)
Octanol/Water Partition Coefficient: log K_{ow} = 2.75

Section 10 - Stability and Reactivity

Stability: Atrazine is stable (shelf-life: 3 years) at room temperature in closed containers under normal storage and handling conditions. It is stable in neutral, slightly acidic, or basic media.
Polymerization: Hazardous polymerization cannot occur.
Chemical Incompatibilities: Strong acids and strong bases.
Hazardous Decomposition Products: Thermal oxidative decomposition of atrazine-containing chemicals can produce hydrogen chloride and nitrogen oxide.

Section 11 - Toxicological Information

Toxicity Data:*

Eye Effects:
Rabbit: 6320 µg caused severe irritation.

Skin Effects:
Mammal (unspecified species): 500 mg caused mild irritation.

Acute Dermal Effects:
Rabbit, skin, LD_{50}: 7500 mg/kg
Rat, skin, LD_{50}: >12500 mg/kg

Acute Inhalation Effects:
Rat, inhalation, LD_{50}: 5200 mg/m^3/4 hr

Acute Oral Effects:
Rat, oral, LD_{50}: 672 mg/kg
Mice, oral, LD_{50}: 850 mg/kg

Multiple Dose Toxicity Data:
Rat, oral: 20 mg/kg/day/6 months, 40% died with signs of respiratory distress and paralysis of the limbs.

Tumorigenicity:
Rat, oral, TD_{Lo}: 33,775 mg/kg/2 yr administered continuously produced leukemia and uterine tumors.
Mouse, oral: 9000 mg/kg/78 weeks administered intermittently produced tumors of respiratory system and liver.

Genetic Effects:
Human, lymphocyte: 100 mg/L caused DNA damage.
Human, fibroblast: 3 mmol/L caused unscheduled DNA synthesis.

Cytogenetic Analysis:
Human lymphocyte: 1 mg/L

Reproductive Effects:
Rat, oral, TD_{Lo}: 700 mg/kg/administered to a female on gestational days 6 to 15 caused maternal effects and specific developmental abnormalities of the musculoskeletal system.
Rabbit, oral: 975 mg/kg administered to female on gestational days 7 to 19 produced specific developmental abnormalities of the musculoskeletal system.

* See NIOSH, *RTECS* (XY5600000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Rainbow trout (*Salmo gairdneri*), LC_{50} = 4.5 - 8.8 mg/L/96 hr (conditions unspecified). *Anas platyrhynchos* (6 mo old, female mallards), oral, LD_{50}: >2000 mg/kg. *Colinis virginianus* (bobwhite quail), oral, LD_{50}: 5760 mg/kg (8 day dietary diet). *Lepomis machrochirus* (bluegill), LC_{50}: 16.0 mg/L/96 hr; conditions of bioassay not specified.
Environmental Fate: Leaching is limited by its adsorption to certain soil constituents. Volatilization is not expected to be environmentally important. In soil and water, atrazine may hydrolyze in either acidic or basic types yet is fairly resistant to hydrolysis at neutral pHs. This rate can be dramatically increased by the addition of humic materials. Atrazine has the po to photolyze from surface soils. Bioconcentration and volatilization of atrazine are not expected to be environmentally important. In the air, atrazine reacts with photochemically-produced hydroxyl radicals with an estimated half-life of 2.6 hours.

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Soil Adsorption/Mobility: If released to soil, atrazine has a moderate to high mobility. Adsorption is not irreversible and desorption often occurs readily, depending on temperatures, moisture and pH.

Section 13 - Disposal Considerations

Disposal: For small quantities, consider hydrolysis with acid or bases (10% wt/vol aqueous sodium hydroxide). Heating speeds hydrolysis. When hydrolysis is complete, dilute with copious amounts of water and wash down the sewer (with approval from local municipality). For large quantities, consider incineration with a caustic wet scrubber to remove nitrogen oxides and hydrochloric acid from product gases.

Container Cleaning and Disposal: Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Triazine pesticides, solid, toxic
Shipping Symbols: –
Hazard Class: 6.1
ID No.: UN2763
Packing Group: III
Label: 6.1
Special Provisions (172.102): –

Packaging Authorizations
a) Exceptions: 173.153
b) Non-bulk Packaging: 173.213
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 100 kg
b) Cargo Aircraft Only: 200 kg

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: 40

Section 15 - Regulatory Information

EPA Regulations:
RCRA Hazardous Waste (40 CFR 261.33): Not listed.
RCRA Hazardous Waste Classification (40 CFR 261.21-.24): Not classified.
CERCLA Hazardous Substance (40 CFR 302.4): Not listed.
Listed as a SARA Toxic Chemical (40 CFR 372.65).
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed.

OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A, Vacated 1989 Final Rule Limit)

Section 16 - Other Information

References: 73, 99, 103, 136, 167, 190, 197, 209, 211

Prepared By ..... J Sawyer, MS/MJ Wurth, BS
Industrial Hygiene Review ..... DJ Wilson, CIH
Medical Review ..... T Thoburn, MD, MPH

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GENIUM PUBLISHING CORP.

No. 22

CALCIUM OXIDE

(Revision C)
Issued: September 1978
Revised: April 1989

SECTION 1. MATERIAL IDENTIFICATION

Material: CALCIUM OXIDE

Description (Origin/Uses): Used in the manufacture of steel, aluminum, glass, and paper; also found in plaster, mortar, bricks, stucco, and in other building and construction materials.

Other Designations: Lime; Quicklime; Burnt Unslaked Lime; High-Calcium Lime; CaO; *CAS No. 1305-78-8*

Manufacturer: Contact your supplier or distributor. Consult the latest edition of *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

NFPA

HMIS	
H 1	R 1
F 1	I 2
R 0	S 3
PPG*	K 0
*See sect. 8	

SECTION 2. INGREDIENTS AND OCCUPATIONAL EXPOSURE LIMITS

Calcium Oxide, ca 100%

OSHA PEL
8-hr TWA: 5 mg/m³

ACGIH TLV, 1988-89
TLV-TWA: 2 mg/m³

Toxicity Data
Not Listed*

*Monitor NIOSH, *RTECS* (EW3100000), for future data.

SECTION 3. PHYSICAL DATA

Boiling Point: 5162 °F (2850 °C)
Melting Point: 4658 °F (2570 °C)
pH: >10 (Strongly Basic)

Molecular Weight: 56 g/mol
Solubility in Water (%): Reacts
Specific Gravity (H_2O = 1): 3.2 to 3.4

Appearance and Odor: A white or grayish white solid (it can appear yellowish or brownish if iron impurities are present; commercial calcium oxide is available in a wide variety of forms such as lumps, pellets, pebbles, and powders); odorless.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point: *	Autoignition Temperature: *	LEL: *	UEL: *

Extinguishing Media: *Calcium oxide will not burn. Use an extinguishing agent that will put out the surrounding fire. Water reacts dangerously with calcium oxide and is not recommended as an extinguishing agent for fires that involve it. If water must be used, prevent it from coming into direct contact with the calcium oxide. If such contact is unavoidable, apply the water in flooding amounts to safely absorb the heat that will be generated. **Unusual Fire or Explosion Hazards:** Do not allow water to get inside containers of calcium oxide; reaction with the water will cause the calcium oxide to swell, generate heat, and burst its container. The heat generated by this reaction may ignite nearby combustible materials. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Calcium oxide is stable in closed, airtight containers during routine work operations. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Calcium oxide can react dangerously with boric oxide and calcium chloride, boron trifluoride, chlorine trifluoride, fluorine, hydrofluoric acid, phosphorus pentoxide, and water. **Conditions to Avoid:** Control exposure to incompatible chemicals. Always establish the compatibility of calcium oxide with another material before using it in bulk operations by testing small quantities under appropriate conditions. Avoid exposing calcium oxide to air because it reacts with the ambient moisture and carbon dioxide. **Hazardous Products of Decomposition:** Oxides of calcium may be produced when calcium oxide reacts with other materials during fires.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Calcium oxide is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: Calcium oxide is a strongly alkaline material; its contact with the skin, eyes, or inhalation results in severe irritation. Dust containing 25 mg/m³ of this material causes strong nasal irritation; dust containing 9 to 10 mg/m³ does not. The presence of moisture on the skin or on the mucous membrane of the respiratory system increases the possibility of corrosive tissue damage (chemical burns). Dehydration and thermal effects (the heat generated from reaction with water) are contributing factors to the irritating properties of calcium oxide. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, nose, and respiratory system. **Primary Entry:** Inhalation and contact with skin and eyes. **Acute Effects:** Irritation and burns to the skin, eyes, and nose; irritation and inflammation of the respiratory system; coughing; and sneezing. **Chronic Effects:** Ulceration and perforation of the nasal septum, pneumonia. May cause nails to become brittle and fissure (split). *(Cont'd.)*

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SECTION 6. HEALTH HAZARD INFORMATION, continued

FIRST AID

Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. An occupational ophthalmologist should monitor and treat the eye for calcium oxide burns. **Skin:** Do not rinse the affected area with water because severe skin damage is likely to occur if water is applied directly to the calcium oxide on the skin. Before wetting the calcium oxide, try to remove it from the skin with oil or grease; then apply water in a forcefully directed, powerful stream in flooding amounts that will mechanically and immediately remove the calcium oxide particles from the skin. **Inhalation:** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. **Ingestion:** Unlikely. **Get in plant, paramedic, or community medical help for all exposures.** Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to Physician:** Severe exposure indicates hospitalization for 72 hours with careful monitoring for the delayed onset of pulmonary edema.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, prevent accidental contact between the spilled calcium oxide and water, and avoid generating dust. Cleanup personnel need protection against its contact with skin or eyes as well as against inhalation of its dust (see sect. 8). Carefully pick up the solid, creating a minimum of dust, and collect it in metal containers with covers for disposal. Flush the trace residue in the spill area to a drain, using plenty of water.

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Follow all applicable Federal, state, and local regulations. Large amounts of calcium oxide may require neutralization by acid before disposal. Flush any residue to a sewer after diluting it properly. Alternatively, the waste calcium oxide can be used for neutralizing plant acid waste.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z)
EPA Designations
Assigned the RCRA Hazardous Waste No. D003 (40 CFR 261.23)
Assigned the CERCLA Reportable Quantity (RQ): 100 lb (45.4kg) (40 CFR 302.5 [b])

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Consult Genium reference 88 for recommendations on selecting the proper respirator for use around calcium oxide. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres.

Other: Wear *dry* rubber gloves, boots, aprons, gauntlets, and coveralls.

Ventilation: Install and operate general and local ventilation systems powerful enough to maintain airborne concentrations of calcium oxide below the OSHA PEL standard cited in section 2.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas.

Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment.

Other: Design all work operations in a way that does not generate dust and prevents water from being accidentally introduced into any part of a production system that contains calcium oxide.

Comments: Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store calcium oxide in sealed, dry, airtight containers in a cool, dry, well-ventilated area separate from incompatible chemicals (see sect. 5). Store it away from strong oxidizing agents, acids, organic materials, water, and combustibles.

Special Handling/Storage: Protect containers of calcium oxide from physical damage. Prevent water from contacting stored calcium oxide. To maintain the full effectiveness of this material, avoid extended contact with air.

Comments: Calcium oxide generates substantial heat when mixed with water. Prevent accidental mixing by following planned work procedures in all shipping, receiving, transferring, and production operations. When calcium oxide is deliberately mixed with water, undertake proper precautions to ensure that the resulting heat can be safely generated. *Always add calcium oxide to water; never add water to calcium oxide.*

Hazardous Materials Table (49 CFR 172.101)

DOT Shipping Name: Calcium Oxide
DOT Hazard Class: ORM-B
DOT ID No.: UN1910
DOT Label: None

References: 1, 26, 38, 84-94, 100, 116

Prepared by: PJ Igoe, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD

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MATERIAL SAFETY DATA SHEET

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(518) 377-8855

GENIUM PUBLISHING CORP.

NO. 410

CARBON TETRACHLORI

Revision A

Date December 1980

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: CARBON TETRACHLORIDE
OTHER DESIGNATIONS: Tetrachlormethane, Perchlormethane, Methane Tetrachloride, CCl_4, GE Material D5850, CAS #000 056 235
MANUFACTURER: Available from several suppliers, including:
Linden Chemicals & Plastics
PO Drawer J,
Moundsville, WV 26041 Phone: (314) 843-1310

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Carbon Tetrachloride *ACGIH (1980 Intended Changes List). OSHA 8-hr TWA is 10 ppm. NIOSH has proposed a 10-hr TWA of 2 ppm. ACGIH and NIOSH recommend labeling as a suspected human carcinogen. (skin) notation indicates absorption through the skin can contribute significantly to overall exposure.	ca 100	8-hr TWA 5 ppm (skin) or 30 mg/m^3* Human, oral LDlo 43 mg/kg Human, inhalation LCLo 1000 ppm TCLo 20 ppm (CNS) Hamsters and mice have developed cancer on long term feeding.

SECTION III. PHYSICAL DATA

Boiling point at 1 atm, deg C ---	76.7	Specific gravity, 25/4 C ---	1.585
Vapor pressure @ 20 C, mm Hg -----	ca 91	Melting point, deg C -------	-23
Vapor density (Air=1) ----------	5.3	Volatiles, % ----------	ca 100
Solubility in water @ 20 C, wt % -	0.08	Molecular weight ----------	153.8

Appearance & Odor: A clear, colorless liquid with a characteristic sweetish odor. Odor recognition threshold (100% of test panel): 21.4 ppm in air when prepared from CS_2; 100 ppm in air when prepared from CH_4. Odor may not be objectionable at acutely toxic levels.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER

Extinguishing Media: It is nonflammable. Use that which is appropriate for the surrounding fire. Use water spray to cool fire-exposed containers.
When involved in a fire situation, this material will emit highly toxic and irritating fumes and gases. Metals, such as aluminum and magnesium, can react violently with carbon tetrachloride when hot or burning.
Firefighters must wear self-contained breathing apparatus and full protective gear to fight fires involving this material.

SECTION V. REACTIVITY DATA

This material is stable under normal conditions of handling and use. It does not polymerize.
Thermal-oxidative decomposition will produce toxic, corrosive fumes, including phosgene and hydrogen chloride.
Violent reactions or explosions can occur with incompatible materials, such as barium, lithium, sodium, and potassium metal, powdered aluminum, magnesium, dimethylformamide (above 65 C), fluorine, etc. (See NFPA, "Manual of Hazardous Chemical Reactions".)

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NO. 410

SECTION VI. HEALTH HAZARD INFORMATION

TLV 5 ppm (skin) (See Sect. II)

Carbon tetrachloride is highly toxic and irritating by inhalation and ingestion (mean lethal dose is 5-10 ml). It is toxic by skin absorption. Excessive exposure may result in CNS depression and/or gastrointestinal symptoms.* It is irritating to skin and eyes. Eye contact or systemic effects can produce visual disturbances (haze, blind spots, narrowing of visual field, etc.). Skin contacts can cause defatting & dermatitis.

Kidney & liver damage can occur from severe acute or chronic exposure. It is a suspected carcinogen in humans.

FIRST AID:

Eye Contact: Flush eyes with running water for 15 minutes, including under the eyelids. Get medical help if irritation persists or when visual disturbances occur.

Skin Contact: Remove contaminated clothing promptly. Wash exposed skin with soap and water. Get medical help for repeated or gross exposures.

Inhalation: Remove to fresh air. Restore and/or support breathing; have qualified person administer oxygen if needed. Get medical help.

Ingestion: Contact physician for gastric lavage. (If medical help and advice is not readily available, give water to drink and induce vomiting.)

*Also cardic arrhythmias.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel when large spills occur. Evacuate area. Provided maximum exhaust ventilation. Clean-up personnel must use protection against contact and inhalation (see Sect.VIII). Contain spill; pick up liquid for disposal. Small spills and residues can be absorbed on paper, vermiculite, etc. and allowed to evaporate in a hood. Prevent release of CCl_4 to surface water or sewers. Spills or discharges in 24 hours of 5000 lb or more (proposed RQ* is 1000 lb) must be reported to U.S. Government.

DISPOSAL: Consider recovery and reuse, if feasible. Scrap may be burned in approved, high temperature incinerator with scrubber or it may be disposed of as hazardous waste (EPA number U211 or F001 as a spent degreasing solvent under RCRA). Follow Federal, State and Local regulations.

*Reportable Quantity.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV. Exhaust hoods need 100 lfm min. face velocity. Ventilate sumps and low lying areas. Use air-supplied or self-contained respirators above TLV, with full face piece above 100 ppm.

PVA or neoprene gloves and protective clothing needed to prevent skin contact. Wear safety goggles and/or face shield for eye protection.

An eyewash station and chemical safety shower should be readily accessible.

Provide preplacement and twice a year medical exams. Workers with obesity, diabetes, alcoholism or pulmonary problems should have a physician's approval before working with CCl_4. Retain medical records for 30 years after termination of employment.

Provide training to those exposed to CCl_4 in the workplace. Monitor vapor levels in the workplace.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated, low fire-risk area. Protect containers against physical damage. Keep away from sources of heat, direct sunlight, and incompatible materials (see Sect. V). Prevent exposure of vapors to high temperature to prevent decomposition to toxic and corrosive gases and vapors. No smoking in areas where vapors may be present.

Prevent contact with the skin or eyes. Avoid exposure to vapors. Use good personal hygiene.

CCl_4 toxicity is markedly increased by the synergistic effects of alcohol. When possible, substitute a less hazardous solvent for CCl_4.

DOT Classification - ORM-A

DATA SOURCE(S) CODE: 1-12,15,16,21-26,31,37,38,41

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APPROVALS: MIS J.M. Nielsen

Industrial Hygiene and Safety 12-9-80

MEDICAL REVIEW: 16 Dec. 1980

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
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(518) 377-8855

GENIUM PUBLISHING CORP.

No. 53

CHLORINE
(Revision B)
Issued: July 1979
Revised: April 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: CHLORINE

Description (Origin/Uses): *Used* mainly to manufacture chlorinated lime for bleaching fabrics; as a versatile reagent in organic chemistry; in water purification; and as a military poison gas (bertholite).

Other Designations: *Bertholite; Molecular Chlorine;* Cl_2; *NIOSH RTECS* No. FO2100000; CAS No. 7782-50-5

Manufacturer: *Contact your supplier or distributor. Consult the latest edition of the Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS
H 3
F 0
R 1
PPG*
*See sect. 8

R 1
I 4
S 4
K 0

SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	EXPOSURE LIMITS
Chlorine, CAS No. 7782-50-5	ca 100	IDLH* Level: 30 ppm **OSHA PEL** Ceiling: 1 ppm, 3 mg/m³ TLV-STEL: 3 ppm, 9 mg/m³ **NIOSH REL** 15-Min Ceiling: 0.5 ppm, 1.45 mg/m³ ***Toxicity Data***** Rat, Inhalation, LC_{50}: 293 ppm (1 Hr) Mouse, Inhalation, LC_{50}: 137 ppm (1 Hr)

*Immediately dangerous to life and health
**See NIOSH, *RTECS*, for additional data with references to irritative and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: ca -29°F (-34°C)
Vapor Pressure: >760 Torrs (Normal Atmospheric Pressure)
Vapor Density (Air = 1): 1.4085 at 68°F (20°C)
Melting Point: ca -150°F (-101°C)
Molecular Weight: 71 Grams/Mole
Water Solubility: Slight

Appearance and Odor: A greenish yellow, noncombustible gas; pungent, suffocating, nauseating odor. Its odor-recognition threshold is reported to be ca 0.3 ppm.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air % by Volume	LOWER	UPPER
*	*		*	*

Extinguishing Media: *Chlorine will not burn, but it supports combustion of materials already involved in a fire. Use agents that will extinguish the surrounding fire. Use a *water spray to cool fire-exposed tanks and to protect personnel attempting to stop a chlorine leak.
Unusual Fire or Explosion Hazards: Chlorine is a reactive/explosive gas. Fight fires involving it from the maximum possible distance; this gas greatly increases the flammability hazards of other combustibles that are present. **Warning:** Flammable gases, vapors, and *mists form dangerously explosive mixtures with chlorine gas.*
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Fire fighters must use the maximum personal protective equipment available. If possible, have specially trained personnel remove intact cylinders of chlorine from the fire area and protect them with any available resource such as directed water spray.

SECTION 5. REACTIVITY DATA

Chlorine is stable in closed, pressurized containers at room temperature under normal storage and handling conditions. It does not undergo *hazardous polymerization.*
Chemical Incompatibilities: Chlorine reacts dangerously with acetylene, ammonia, hydrogen, ether, fuel gas, hydrocarbons, turpentine, finely divided metals, diborane, benzene, and acetaldehyde (see Genium ref. 84, pp. 49-28 and 491M-53 to 491M-56).
Conditions to Avoid: Do not allow open flame, unprotected heaters, lighted tobacco products, electric sparks, or excessive heat in work areas because chlorine gas can form explosive mixtures with other gases. Do not heat pressurized storage tanks or cylinders containing chlorine because they may explode. Do not allow chlorine to be directly exposed to incompatible chemicals (see above).
Hazardous Products of Decomposition: Toxic gases such as carbon monoxide, phosgene, and hydrogen chloride (Genium Industrial MSDSs 35, 66, 30) can be produced in fires involving chlorine and other combustibles.

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SECTION 6. HEALTH HAZARD INFORMATION

Chlorine is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks, Warning: This material is a powerful respiratory irritant. The most important acute health effect of exposure is lung damage from hydrochloric acid (HCl) caused by the reaction of chlorine with the moisture in the upper respiratory tract (URT). Fatal pulmonary edema (lungs filled with fluid) may be delayed from 24 to 48 hours after exposure. Erosion of teeth, decreased lung capacity, and increased susceptibility to tuberculosis are chronic effects in workers who handle this gas. **Medical Conditions Aggravated by Long-Term Exposure:** Cardiac, pulmonary, or respiratory problems. Administer preplacement and periodic medical exams emphasizing the respiratory system to workers who regularly handle chlorine. **Target Organs:** Respiratory system. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** Burning and severe irritation of the eyes, skin, and URT; wheezing, shortness of breath; nausea; vomiting; headache; dizziness; and (delayed) pulmonary edema. **Chronic Effects:** Reduced respiratory capacity may result from chronic low-level exposure to chlorine.

FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Skin contact with chlorine causes severe damage from frostbite (cryogenic injury) as well as chemical burns. Irrigate the area with water and treat the exposed person accordingly. **Inhalation.** Remove exposed person to fresh air; restore and/or support his or her breathing as needed. Recommended treatment includes administering pure oxygen gas (O_2) as soon as symptoms of exposure develop (Genium ref. 39, p. 1975). Observe exposed person for respiratory effects. **Ingestion.** This type of exposure to chlorine is highly unlikely because it is a gas.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Preplan and carefully explain proper emergency procedures to relevant personnel. Notify safety personnel, evacuate all nonessential personnel, provide maximum explosion-proof ventilation, and eliminate all sources of ignition immediately. Cleanup personnel must wear protection against contact with and inhalation of vapor (see sect. 8). Try to shut off the flow of chlorine gas. Use a water spray to protect personnel attempting to stop the leak.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z): Not Listed

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste: Listed without Number

CERCLA Hazardous Substance, Reportable Quantity: 10 lbs (4.54 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks) wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves; boots; aprons; and clean, impervious, body-covering clothing to prevent any possibility of skin contact. **Ventilation:** Install and operate general and local ventilation systems powerful enough to maintain airborne levels of chlorine gas strictly below the OSHA PEL standard cited in section 2. Make all ventilation systems of maximum explosion-proof design, e.g., nonsparking, electrically grounded and bonded, etc. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. **Other:** Use enclosed-containment processing operations; otherwise, the ventilation systems may not be able to keep airborne levels of chlorine below the legal ceiling limit of 1 ppm (3 mg/m³) set by OSHA. Automatic air-monitoring sensing equipment connected to an alarm system is recommended for continual-use operations. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Avoid prolonged skin contact with this material.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store chlorine in a cool, dry, well-ventilated area away from organics, sources of ignition, any flammable or explosive materials, cylinders containing oxygen, and incompatible chemicals (see sect. 5). Use outside or detached storage. Store cylinders upright and secure them tightly. **Special Handling/Storage:** Chlorine is shipped/stored as a pressurized gas in cylinders or tank cars. Protect them against physical damage and regularly inspect them for cracks, leaks, or faulty valves. Follow standard safety procedures for handling compressed, corrosive gases. Electrically ground and bond all containers used in shipping and transferral operations to prevent static sparks. Do not drag or slide cylinders containing chlorine; move them in a carefully supervised manner with a suitable hand truck. Do not smoke in use or storage areas. **Engineering Controls:** All engineering systems (ventilation, production, etc.) must be of maximum explosion-proof design. Use chlorine in closed engineering systems to prevent dispersion of this gas into general work areas. Monitor all piping systems, reactor vessels, and holding tanks for unwanted moisture contamination or buildup. Liquid chlorine levels should be less than 85% of a tank's or cylinder's capacity. **Comments:** Perform all operations with chlorine carefully to prevent accidental ignition of explosive mixtures. Prevent any contact with incompatible chemicals (see sect. 5). Keep the valve-protection cap in place until immediately before using chlorine. Insert a check valve or trap into the transferral line to prevent a dangerous backflow into the original container. Use a pressure-reducing regulator when connecting a storage vessel to a lower-pressure piping system. A trained chemist or safety specialist familiar with the physical and chemical properties of this gas should be present during all work operations.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Chlorine
DOT Class: Nonflammable Gas
References: 1, 2, 12, 73, 84-94, 100, 103.

DOT Label: Nonflammable Gas *and* Poison
DOT ID No. UN1017

IMO Label: Poison Gas
IMO Class: 2.3

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

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Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 315

CHLOROFORM
(Revision D)
Issued: August 1979
Revised: April 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: CHLOROFORM

Description (Origin/Uses): Used as a solvent for fats, oils, rubber, alkaloids, waxes, and resins; as a cleansing agent.

Other Designations: Trichloromethane; $CHCl_3$; NIOSH *RTECS* No. FS9100000; CAS No. 0067-66-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS			
H	2		
F	0	R	1
R	0	I	3
PPG*		S	2
*See sect. 8		K	0

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Chloroform, CAS No. 0067-66-3	Ca 100	**OSHA PEL** Ceiling: 50 ppm, 240 mg/m³ **ACGIH TLV, 1987-88** TLV-TWA: 10 ppm, 50 mg/m³ **NIOSH REL** Ceiling: 2 ppm, 9.78 mg/m³ **Toxicity Data*** Human, Oral, LD_{Lo}: 140 mg/kg Rat, Oral, LD_{50}: 908 mg/kg
*See NIOSH, *RTECS*, for additional toxicity data with references to mutagenic, reproductive, tumorigenic, and irritative effects.		

SECTION 3. PHYSICAL DATA

Boiling Point: 142°F (61°C)
Melting Point: -82.3°F (-63.5°C)
Vapor Pressure: 158.4 Torrs at 68°F (20°C)
Vapor Density (Air = 1): 4.13

Water Solubility (%): 0.822 ml of $CHCl_3$ per 100 ml of H_2O at 68°F (20°C)
% Volatile by Volume: 100
Molecular Weight: 119 Grams/Mole
Specific Gravity (H_2O = 1): 1.484 at 68°F (20°C)

Appearance and Odor: A heavy, colorless, clear, volatile liquid; characteristic, pleasant, ethereal, sweet odor (recognition threshold: 0.3 mg/m³); sweet taste.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air % by Volume	LOWER	UPPER
*	*		*	*

Extinguishing Media: *Chloroform does not burn. Use an agent that will put out the surrounding fire.

Unusual Fire or Explosion Hazards: None reported.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Chloroform is stable if kept in closed containers and protected from air and sunlight. It does not undergo hazardous polymerization; however, even when stabilized with ethanol, this material develops acidity from prolonged exposure to air and light.

Chemical Incompatibilities: This material is incompatible with strong alkalies.

Conditions to Avoid: Avoid prolonged exposure to air and light and to strong alkalies.

Hazardous Products of Decomposition: Toxic and corrosive gases like hydrochloric acid (HCl), chlorine (Cl_2), carbon monoxide (CO), and oxides of chlorine (ClO_x) can be produced during fires.

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SECTION 6. HEALTH HAZARD INFORMATION

Chloroform is listed as a suspected human carcinogen by ACGIH.

Summary of Risks: Exposure to this material affects the central nervous system (anesthesia); heart (arrhythmia, ventricular tachycardia, bradycardia); liver (necrosis, hepatoma); kidney (necrosis); and it is an embryonic toxin. Fatalities are associated with cardiovascular depression and ventricular fibrillation.
Medical Conditions Aggravated by Long-Term Exposure: Ailments of the heart, liver, and kidneys may be worsened by exposure to chloroform. **Target Organs:** Liver, kidneys, heart, skin, eyes. **Primary Entry:** Skin contact, inhalation.
Acute Effects: Dizziness, mental dullness, nausea, headache, fatigue, and anesthesia. **Chronic Effects:** Possible cancer.
FIRST AID
Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.
Skin: Immediately wash the affected area with soap and water. **Inhalation:** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed.
Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. If the exposed person is responsive, give him or her several glasses of milk or water to drink and induce vomiting. Repeat if large quantities were ingested.
Comments: Workers who are regularly exposed to chloroform require preplacement and periodic medical exams emphasizing kidney, liver, skin, and central nervous system functions. Carefully evaluate each exposure that produces a noticeable effect to determine the extent to which factors like alcohol or drugs have affected it.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel of a chloroform spill or leak. Provide ventilation. Cleanup personnel need protection against contact with and inhalation of vapor (see sect. 8). Chloroform vapor is heavier than air and will collect in low-lying areas. Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.
Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.
OSHA Designations
Air Contaminant (29 CFR 1910.1000 Subpart Z)
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. U044
CERCLA Hazardous Substance, Reportable Quantity: 5000 lbs (2270 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield as a supplementary protective measure. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Wear a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** To prevent contact with skin, wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment. **Ventilation:** Install and operate general and local ventilation systems that are powerful enough to maintain airborne levels of chloroform below the OSHA PEL standard cited in section 2.
Safety Stations: Make eyewash stations, washing facilities, and safety showers available in use and handling areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store chloroform in closed containers away from light and alkalies.

Special Handling/Storage: Protect containers from physical damage. Do not transfer chloroform through plastic or rubber hoses or pipes.

Transportation Data (49 CFR 172.101-2)
DOT Shipping Name: Chloroform
DOT Class: ORM-A
DOT Label: None
DOT ID No. UN1888
IMO Label: Poison
IMO Class: 6.1

References: 1, 2, 12, 73, 84-94, 100, 103.

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Prepared by PJ Igoe, BS
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Medical Review: MJ Hardies, MD

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CEDAR CHEMICAL CORPORATION
MEMPHIS, TENNESSEE

MATERIAL SAFETY DATA SHEET
Equivalent to OSHA form 174

PRODUCT NAME: TECHNICAL DINOSEB DATE: 08/15/86 PAGE 1
EPA REG. NO.: 56077-5

SECTION I

Manufacturer's Name: Cedar Chemical Corporation
5100 Poplar Ave. 24th Floor
Memphis, TN 38137
Emergency Phone Number: 1-800-424-9300
Information Phone Number: 1-601-636-1231
Prepared by: M. S. Bernard

SECTION II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENT	OSHA PEL	ACGIH TLV	PERCENT
Dinoseb	n/d	0.3mg/m³	95.00
Dinoseb (2-sec-butyl-4,6-dinitrophenol) CAS = 88-85-7			
Impurities	n/d	n/d	5.00

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point(°F)	above 212	Specific Gravity	1.258
Vapor Pressure(mm Hg.)	below 1	Melting Point(°F)	90
Vapor Density(Air=1)	n/a	Evaporation Rate	n/d

Solubility in Water: 0.0052g/100ml
Appearance and Odor: Brown solid, organic acid odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point(Method Used): 350.6°F TCC
Flammable Limits: LEL- n/d UEL- n/d
Extinguishing Media:
Water Fog, Foam, Alcohol Foam, CO_2, and Dry Chemical

CONTINUED ON PAGE 2

Special Fire Fighting Procedures:
Self-contained air supply. Confine water used in fire fighting.

Unusual Fire and Explosion Hazards:
Noxious fumes may form. Material undergoes rapid exothermic decomposition at 190°C. Vapors may ignite.

SECTION V REACTIVITY DATA

Stability: Stable in normal use and storage.
Conditions to Avoid: Heating above 100°C. Product undergoes rapid exothermic decomposition at 190°C. Avoid ignition sources.
Incompatibility: Strong Bases and Strong Oxidizers
Hazardous Decomposition or Byproducts: Oxides of Nitrogen
Hazardous Polymerization: Will not occur. No known conditions to avoid.

SECTION VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation: Moderate Toxicity
Skin: Readily Absorbed
Ingestion: Highly Toxic

Health Hazards (Acute and Chronic):

Oral Ingestion: High Single Dose Oral Toxicity. LD_{50} for Rats 25 mg/kg. May be fatal if swallowed.

Eye Contact: May cause severe irritation and corneal injury. Corneal injury should heal in 1-2 weeks.

Skin Contact: May cause slight irritation or mild burn. Colors the skin yellow.

Skin Absorption: Readily absorbed through skin, high toxicity. LD_{50} rabbits 80mg/kg.

Inhalation: May be irritating. Cedar industrial guide for Dinoseb is 0.3 mg/m³.

Carcinogenicity:
NTP: Negative
IARC Monographs: Negative
OSHA Regulated: Negative

Signs and Symptoms of Exposure:
Fatigue, sweating, thirst, and fever. Increased metabolic rate.

Medical Conditions Generally Aggravated by Exposure:
Liver and kidney problems may be aggravated by extreme exposure.

Emergency and First Aid Procedures:

Oral Ingestion: Toxic by ingestion. Induce vomiting and seek medical help immediately.

Eye Contact: Flush immediately with continuous irrigation with flowing water for at least thirty minutes. Seek medical consultation immediately.

Skin Contact: Immediately flush skin with plenty of water for at least fifteen minutes while removing contaminated clothing. Consult physician. Wash clothing before reuse.

Inhalation: Remove to fresh air if effects occur. Consult physician.

Note to Physician:

Eyes: Stain for evidence of corneal injury. If cornea is burned, instill antibiotic steroid preparation frequently. Consult ophthalmologist. May cause temporary injury.

Overexposure: Treat for symptoms. No specific antidote. Human effects not established.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to Be Taken in Case Material Is Released or Spilled:

Use proper safety equipment. Absorb spill with absorbant inert material such as oil-dry. Dike area for large spills. Keep out of streams and water supplies.

Waste Disposal Method:

Dispose of in non-crop area away from water supplies or in an approved landfill in accordance with State, Federal, and local regulations.

Precautions to Be Taken in Handling and Storing:

Do not get on skin, on clothing, or in eyes. Keep out of reach of children.

Other Precautions:

Do not breathe spray mists. Keep away from heat or flame.

SECTION VIII CONTROL MEASURES

Respiratory Protection:

None normally needed. During spraying use organic vapor respirator.

Ventilation: Required to control level of dinoseb.

Protective Gloves: Impervious rubber gloves

Eye Protection: Chemical workers' goggles

Other Protective Clothing or Equipment: Rubber boots and apron and body-covering clothing.

Work/Hygenic Practices: Shower after handling.

THE INFORMATION HEREIN IS SUPPLIED IN GOOD FAITH. BUT NO WARRANTY, EXPLICITE OR IMPLIED, IS MADE.

Material Safety Data Sheet

from Genium's Reference Collection

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GENIUM PUBLISHING CORP.

No. 385

ETHYL BENZENE
(Revision A)
Issued: August 1978
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

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Material Name: ETHYL BENZENE

Description (Origin/Uses): Used as a solvent and as an intermediate in the production of styrene monomer.

Other Designations: Phenylethane; Ethylbenzol; $C_2H_5C_6H_5$; CAS No. 0100-41-4

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

NFPA

HMIS	
H 2	R 1
F 3	I 3
R 0	S 2
PPG*	K 4

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Ethyl Benzene, CAS No. 0100-41-4	Ca 100	**OSHA PELs** 8-Hr TWA: 100 ppm, 435 mg/m³ 15- Min STEL: 125 ppm, 545 mg/m³ **ACGIH TLVs, 1988-89** TLV-TWA: 100 ppm, 435 mg/m³ TLV-STEL: 125 ppm, 545 mg/m³ **Toxicity Data*** Human, Inhalation, TC_{Lo}: 100 ppm (8 Hrs) Rat, Oral, LD_{50}: 3500 mg/kg
*See NIOSH, *RTECS* (DA0700000), for additional data with references to reproductive, irritative, and mutagenic effects.		

SECTION 3. PHYSICAL DATA

Boiling Point: 277°F (136°C)
Melting Point: -139°F (-95°C)
Vapor Pressure: 7.1 Torrs at 68°F (20°C)
Vapor Density (Air = 1): 3.7
% Volatile by Volume: Ca 100

Molecular Weight: 106 Grams/Mole
Solubility in Water (%): Slight
Specific Gravity (H_2O = 1): 0.86258 at 77°F (25°C)

Appearance and Odor: A clear, colorless, flammable liquid; characteristic aromatic hydrocarbon odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method: 64°F (18°C) CC	Autoignition Temperature: 810°F (432.22°C)	LEL: 1% v/v	UEL: 6.7% v/v

Extinguishing Media: Use foam, dry chemical, or carbon dioxide to put out ethyl benzene fires. A water spray may be ineffective in extinguishing the fire, because it can scatter and spread the burning liquid. Use water spray to cool fire-exposed containers of ethyl benzene, to disperse ethyl benzene vapor, and to protect personnel attempting to stop an ethyl benzene leak. **Unusual Fire or Explosion Hazards:** This liquid can readily form explosive vapor-air mixtures, especially when heated. Ethyl benzene vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flash back to its origin. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Ethyl benzene is stable in closed containers during routine operations. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Hazardous chemical reactions can occur between ethyl benzene and strong oxidizing agents, acids, ammonia, and bases. **Conditions to Avoid:** Avoid any exposure to sources of ignition such as heat, sparks, open flame, and lighted tobacco products, etc., and to incompatible chemicals. Use caution when entering confined spaces, particularly low-lying areas where explosive concentrations of ethyl benzene vapor may be present. Provide good ventilation to such areas to prevent the concentration of this vapor. **Hazardous Products of Decomposition:** Thermal-oxidative degradation can include toxic gases such as carbon monoxide and/or aromatic hydrocarbon gases.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Ethyl benzene is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: Ethyl benzene vapor is severely irritating to the eyes and to the mucous membranes of the respiratory system. Sustained inhalation of excessive levels can cause depression of the central nervous system (CNS) characterized by dizziness, headache, narcosis, and coma. Skin contact with liquid ethyl benzene causes irritation; dermatitis and defatting can also develop. The acute oral toxicity of ethyl benzene is low; however, ingestion of it presents a serious aspiration hazard. Aspirating even a small amount into the lungs can result in extensive edema (lungs filled with fluid) and hemorrhaging of the lung tissue. No systemic effects are expected at the levels that produce pronounced, unignorable, disagreeable skin and eye irritation. The TLVs cited in section 2 are set to prevent this intolerable irritation. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, respiratory system, and CNS. **Primary Entry:** Inhalation, skin contact **Acute Effects:** Irritation of the skin, eyes, and respiratory system. Also, cardiac-rhythm disturbance due to sensitization: acute bronchitis, bronchospasm, pulmonary and laryngeal edema; euphoria; headache; giddiness; dizziness; and incoordination, as well as possible depression; confusion; and coma. **Chronic Effects:** None reported. **First Aid:** Eyes. Immediately

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SECTION 6. HEALTH HAZARD INFORMATION, cont.

flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. Skin. Rinse the affected area with plenty of water, then wash it with soap and water. Inhalation. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Ingestion. Unlikely. Should this type of exposure occur, the aspiration hazard must be considered. Do not induce vomiting unless directed to do so by a physician. To prevent aspiration by spontaneous vomiting, keep the victim's head low (between his or her knees). Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. Note to Physician: Professional judgment is required as to whether or not to induce vomiting because of the possibility of aspiration. A gastric lavage may be administered, followed by saline cathartic, if this procedure is appropriate to the specific incident. Monitor cardiac and pulmonary functions.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate explosion-proof ventilation. Cleanup personnel need protection against skin or eye contact with this liquid as well as inhalation of its vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways. **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), §§ 311 (b) (4) and 307 (a).

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets, etc., to prevent prolonged or repeated skin contact with this material. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of this material below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale ethyl benzene vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store ethyl benzene in closed containers in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage. **Special Handling/Storage:** Outside, isolated, detached, or remote storage is recommended for large quantities of ethyl benzene. Isolate bulk storage areas from acute fire hazards. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. To prevent static sparks, electrically ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations. **Other:** Use safety cans for transferring small amounts of ethyl benzene.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Ethyl Benzene
DOT Hazard Class: Flammable Liquid
ID No. UN1175
DOT Label: Flammable Liquid
DOT Packaging Exceptions: 49 CFR 173.118
DOT Packaging Requirements: 49 CFR 173.119

IMO Shipping Name: Ethylbenzene
IMO Hazard Class: 3.2
IMO Label: Flammable Liquid
IMDG Packaging Group: II

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: W Silverman, MD

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METHANEARSONIC ACID, SODIUM SALT

MSA

Common Synonyms	Solid	Colorless unless impurities may be red or green	Chemical
Disodium methane arsonate Monosodium methane arsonate MSAA DSMA Disodium methyl arsonate Monosodium methyl arsonate	Solid may float or sink on water; solid and solution mix with water.		

Stop discharge if possible
Avoid contact with solid and solution
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Not flammable
POISONOUS GASES ARE PRODUCED WHEN HEATED
Wear goggles and self-contained breathing apparatus

Exposure

CALL FOR MEDICAL AID

SOLID OR SOLUTION
Irrigating to eyes and eyes
If swallowed, can cause nausea, vomiting, or loss of consciousness
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES: hold eyelids open and flush with plenty of water
IF SWALLOWED and victim is CONSCIOUS: have victim drink water to rinse and have victim induce vomiting
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS: do nothing except keep victim warm

Water Pollution

Dangerous to aquatic life in high concentrations
May be dangerous if it enters water intakes
Notify local health and wildlife officials
Notify operators of nearby water intakes

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue a "hazardous waste" alert
Wear air-tight
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Poison
2.2 Class: 6

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $CH_3AsO(OH)(ONa)$
$CH_3AsO(ONa)_2 \cdot 6H_2O$
3.3 EEC/UN Designation: 6.1/1557
3.4 DOT ID No.: 1557
3.5 CAS Registry No.: 2163-80-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid or water solution
4.2 Color: Colorless; solutions may develop red or green dyes
4.3 Odor: None

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective clothing to prevent contact with skin; chemical goggles.
5.2 Symptoms Following Exposure: Substance poisoning by arsenicals causes early taste, burning in throat and stomach, and intestinal pain. Acute toxicity indicated by headache, vomiting, stupor, convulsions, paralysis. About 1 ounce to 1 pound must be taken to cause these symptoms.
5.3 Treatment of Exposure: INGESTION: cause vomiting; give water and repeat; give a saline cathartic such as sodium sulfate. SKIN: wash with soap and water. EYES: wash with water; special physician if irritation remains.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Not pertinent
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5-5 g/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: None
5.9 Liquid or Solid Irritant Characteristics: Repeated contact may cause skin sensitivity
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic gases may be generated in fire.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: None
7.2 Reactivity With Common Materials: None
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: > 1000 ppm/48 hr/bluegill sunfish/LC_{50}/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: The solid disodium salt (DSMA) contains water crystallization. Salts are often shipped as solutions in water with concentrations up to about 50% solids.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

SS

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Poison, B
11.2 NAS Hazard Rating for Bulk Water Transportation: Not rated
11.3 NFPA Hazard Classification: Not rated

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid or water solution
12.2 Molecular Weight: 162 (MSMA); 252 (DSMA hexahydrate)
12.3 Boiling Point at 1 atm: Decomposes
12.4 Freezing Point:
(MSMA) 243°F = 117°C = 390°K
(DSMA) 137°F = 58°C = 332°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity:
(DSMA) 1.0 at 20°C (solid)
(MSMA solutions) 1.4-1.6 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: Data not available
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: Data not available

NOTES

Material Safety Data Sheet

from Genium's Reference Collection
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GENIUM PUBLISHING CORP.

No. 310
METHYLENE CHLORIDE
(Revision F)

Issued: September 1985
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: METHYLENE CHLORIDE

Description (Origin/Uses): Used widely in paint removers, as a solvent for plastics, as a degreasing agent, in propellant mixtures for aerosol sprays, and as a blowing agent in foams.

Other Designations: Dichloromethane; Freon 30®; Methane Dichloride; Methylene Bichloride; Methylene Dichloride; CH_2Cl_2; CAS No. 0075-09-2

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS				
H	2	R	1	NFPA
F	1	I	3	
R	0	S	3	
PPG*		K	1	

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS/EXPOSURE LIMITS

Methylene Chloride, ca 100%

OSHA PEL
8-Hour TWA: 500 ppm
Ceiling: 1000 ppm Acceptable Maximum Peak above the Ceiling: 2000 ppm for 5 Minutes in Any 2-Hour Period

ACGIH TLV, 1988-89
TLV-TWA: 50 ppm, 175 mg/m³
(Adopted 1988-89)

Toxicity Data*
Rat, Oral, LD_{50}: 2136 mg/kg
Human, Inhalation, TC_{Lo}: 500 ppm (8 Hours)

*See NIOSH, *RTECS* (PA8050000), for additional data with references to irritative, reproductive, mutagenic, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 103.55°F (39.75°C) at 76 Torrs
Melting Point: -142°F (-96.7°C)
Vapor Density (Air = 1): 2.9
Vapor Pressure: 440 Torrs at 77°F (25°C)

Molecular Weight: 84.94 Grams/Mole
Solubility in Water (%): 1% by Weight
Specific Gravity (H_2O = 1): 1.3255 at 68°F (20°C)
% Volatile by Volume: Ca 100

Appearance and Odor: A clear, colorless, volatile liquid; distinctive, penetrating, ethereal odor. The odor will not serve as a useful warning property because concentrations of 100 ppm are not easily perceptible. Most persons can detect this odor at above 300 ppm.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point*	Autoignition Temperature: 1033°F (556°C)	LEL: 12% v/v	UEL: 19% v/v

Extinguishing Media: *Methylene chloride is not flammable under ordinary conditions. However, flammable vapor-air mixtures can form at approximately 212°F (100°C). Use water spray to cool fire-exposed containers and to flush spills away from exposures. Use extinguishing agents that will put out the surrounding fire. **Unusual Fire or Explosion Hazards:** Methylene chloride vapor is heavier than air and may collect and concentrate in low-lying, confined spaces. The high vapor pressure of methylene chloride means that when it is spilled, its vapor concentration in air can increase rapidly. If this vapor is heated, an explosion hazard is associated with the vapor-air mixture. Containers of this material may rupture violently if they are involved in fires. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Methylene chloride is stable in closed containers during routine operations. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Methylene chloride can react dangerously with nitrogen tetroxide, liquid oxygen, potassium, sodium, sodium-potassium alloys, lithium, potassium hydroxide with N-methyl-N-nitroso urea, potassium *t*-butoxide, and finely powdered aluminum and magnesium. **Conditions to Avoid:** Avoid all exposure to sources of ignition, heat, and incompatible chemicals. Prolonged exposure to water may cause hydrolysis to highly corrosive hydrochloric acid when the temperature is above 140°F (60°C). In oxygen-enriched atmospheres or when heated (>212°F [100°C]), methylene chloride vapor can be readily ignited. **Hazardous Products of Decomposition:** Exposure to high temperature (from open flame, hot surfaces, uninsulated steam lines, welding arcs, etc.) can produce toxic and corrosive thermal-oxidative products of decomposition such as hydrogen chloride, carbon monoxide, and even small quantities of phosgene gas, which is extremely poisonous.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Methylene chloride is listed as a suspected human carcinogen by the ACGIH (which classifies it as a group A2 carcinogen). **Summary of Risks:** Accidental contact of liquid methylene chloride with skin or eyes causes painful irritation and possible burns if not promptly removed. Exposure by way of contaminated gloves, clothing, or paint remover formulations can produce these same irritant effects. Long-term exposure to mild or moderate doses of methylene chloride may cause a delayed (24 to 48 hours) onset of dizziness, headache, mental confusion, slurred speech, double vision, and sleeplessness. Medical recovery can be slow. Overexposure to methylene chloride can cause elevated levels of carboxy hemoglobin in the blood (this same effect results from overexposure to carbon monoxide). **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, respiratory system, C[illegible] liver, kidneys, and blood. **Primary Entry:** Inhalation, skin contact/absorption. **Acute Effects:** Headache, giddiness, stupor, irritability, fatigue, tingling in the limbs, and narcosis that is not usually fatal if the exposure is terminated before anesthetic death occurs. **Chronic Effects:** The ACGIH classification of this material as a suspected human carcinogen implies that cancer is a possible effect of chronic exposure to methylene chloride. **FIRST AID:** Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with

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SECTION 6. HEALTH HAZARD INFORMATION, cont.

flooding amounts of running water for at least 15 minutes. **Skin.** Rinse the affected area with flooding amounts of water and then wash it with soap and water. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. **Note to Attending Physician:** Do not administer adrenalin. **Ingestion.** Unlikely. Should this type of exposure occur, do not induce vomiting because of the danger of aspiration. If spontaneous vomiting should occur, position the exposed person's head below his or her trunk to resist aspiration. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to Physician:** Absorbed methylene chloride is stored in body fat and metabolizes to carbon monoxide. This produced carbon monoxide increases and sustains carboxyhemoglobin levels in the blood, which concommitantly reduces the oxygen-carrying capacity of the blood. NIOSH advises preplacement and annual medical exams that emphasize liver, kidney, eye, skin, CNS, and respiratory system functions and a complete blood count. Simultaneous exposure to tobacco smoke, alcohol, and carbon monoxide, along with heavy manual labor, increases the body burden of a worker as well as the toxic hazards of the methylene chloride. In significant exposures, serum methylene chloride levels are of no clinical importance. Neurologic and hepatic status as well as carboxy hemoglobin should be monitored.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate explosion-proof ventilation. Cleanup personnel need protection against this liquid's contact with the skin or eyes as well as inhalation of its vapor. Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways. **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, NO. U080
CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), § 307 (a), and the Resource Conservation and Recovery Act (RCRA), § 3001.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious neoprene, PVA, or Viton gloves, boots, aprons, and gauntlets, etc., to prevent any skin contact with liquid methylene chloride. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of acetone below the exposure limits cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. Floor or sump ventilation may be necessary. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Other:** Because the health effects of carbon monoxide and methylene chloride are additive (see sect. 6), workplaces should be equipped with automatic sensing equipment that identifies workroom atmospheric levels of both of these materials. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale methylene chloride vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store methylene chloride in closed, moisture-proof containers in a cool, dry, well-ventilated area away from sources of ignition, strong oxidizers, caustics, and incompatible chemicals (see sect. 5). Protect containers from physical damage. **Special Handling/Storage:** Prevent moist air from entering storage containers. Provide ventilation at the floor level in storage areas because methylene chloride vapor is denser than air. Installation of a dryer and a safety seal on each tank is recommended. Aluminum is not recommended for use as a storage material; appropriate storage materials include galvanized iron, black iron, or steel. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Electrically ground and bond all containers and pipelines used in shipping, transferring, reacting, production, and sampling operations to prevent generating static sparks.

Transportation Data (49 CFR 172.101-2)
DOT Shipping Name: Dichloromethane *or* Methylene Chloride
DOT Hazard Class: ORM-A
ID No. UN1593
DOT Packaging Requirements: 49 CFR 173.605
DOT Packaging Exceptions: 49 CFR 173.505

IMO Shipping Name: Dichloromethane
IMO Hazard Class: 6.1
IMO Label: Saint Andrew's Cross (X)*
IMDG Packaging Group: III

*Harmful-Stow away from Foodstuffs.

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

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Medical Review: MJ Hardies, MD

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METHYL PARATHION

MPT

Common Synonyms

Metacid 50PT
Penphos Alkylate
Nitrox, Wofatox
O, O-Dimethyl O-p-nitrophenyl thiophosphate
Parathion-methyl

Solid crystals with a solid or liquid. Pungent odor or garlic odor

Solid and liquid sink in water; solubility limits on water. Melting (freezing) point is 95°F.

AVOID CONTACT WITH LIQUID. Keep people away.
Wear chemical protective suit with self-contained breathing apparatus.
Stop discharge if possible.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE AND WHEN HEATED.
Containers may explode in fire.
Wear chemical protective suit with self-contained breathing apparatus. Do not let fighting water run to sewers or waterways if possible.
Extinguish with water.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.
LIQUID OR SOLID.
POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.
Wear protective clothing and gloves.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water, milk or mild soap solution if available.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Solution is toxic to shellfish.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Wear protective clothing.
Restrict access.
Should be removed.
Chemical and physical treatment.

2. LABEL

2.1 Category: Poison
2.2 Class: 6

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $(CH_3O)_2PSOC_6H_4NO_2$
3.3 IMO/UN Designation: 6.1/2783
3.4 DOT ID No.: 2783
3.5 CAS Registry No.: 298-00-0

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid (dust), or solution
4.2 Color: Colorless crystal or brownish liquid
4.3 Odor: Characteristic, like rotten eggs or garlic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved mask or respirator; natural rubber gloves, overshoes; protective clothing, goggles.
5.2 Symptoms Following Exposure: Exposure to fumes from a fire, or to the liquid, causes nausea, blurred vision, constricted pupils of the eyes, weakness, nausea, vertigo, diarrhea, and tightness in the chest. Muscle twitch and convulsions may follow. Symptoms may develop over a period of 8 hrs.
5.3 Treatment of Exposure: Speed is essential. INGESTION: call a doctor. If victim is not breathing, immediately institute artificial respiration by mouth-to-mouth, mouth-to-nose, or mouth-to-endotracheal method, when victim is conscious, give milk, water, or salt-water and induce vomiting repeatedly. SKIN OR EYES: flood and wash exposed areas thoroughly with water. Remove contaminated clothing under a shower.
5.4 Threshold Limit Value: 0.2 mg/m³
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 4, LD_{50} below 50 mg/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Not pertinent
5.9 Liquid or Solid Irritant Characteristics: Poisonous when absorbed through skin
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 115°F O.C.
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Water
6.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic gases are produced in fire.
6.6 Behavior in Fire: Drums may rupture violently
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Not decomposed in 5 days at 40°C
7.2 Reactivity with Common Materials: Is absorbed in wood, etc., which must be removed to eliminate prolonged hazard.
7.3 Stability During Transport: Decomposes above 90°C with possible explosive force.
7.4 Neutralizing Agents for Acids and Caustics: Apply caustic or soda ash slurry and yellow stains disappear.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Water Rate (Reactant to Products): Data not available
7.8 Reactivity Groups: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
1.0 ppm/96 hr/bluegill/TL_m/fresh water
9.3 ppm/96 hr/saltwell/TL_m/fresh water
8.2 Waterfowl Toxicity: LD_{50} = 10 mg/kg
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Pure (solid, technical) Bound: 80% in xylene
9.2 Storage Temperature: Below 50°F
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-E-V

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Poison, B
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification*
Health Hazard (Blue)	4
Flammability (Red)	3
Reactivity (Yellow)	2

*First column for solution, second for solid.

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 263.2
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: 95°F = 35°C = 291°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.358 at 20°C (liquid)
12.8 Liquid Surface Tension: Data not available
12.9 Liquid Water Interfacial Tension: Data not available
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Data not available
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.26 Heat of Fusion: Data not available
12.28 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

Material Safety Data Sheet

From Genium's Reference Collection
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GENIUM PUBLISHING CORP.

No. 7

NITRIC ACID
(Revision C)
Issued: October 1980
Revised: August 1988

SECTION 1. MATERIAL IDENTIFICATION

26

Material Name: NITRIC ACID

Description (Origin/Uses): Used to dissolve noble metals, for etching and cleaning metals, to make organic nitrates and nitrocompounds, to destroy residues of organic matter, and in explosives.

Other Designations: Red Fuming Nitric Acid; HNO_3; CAS No. 7697-37-2

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

NFPA

HMIS	
H 3	R 1
F 0	I 4
R 1	S 4
PPG*	K 0

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Nitric Acid, CAS No. 7697-37-2	*	**OSHA PEL** 8-Hr TWA: 2 ppm, 5 mg/m³ **ACGIH TLVs, 1987-88** TLV-TWA: 2 ppm, 5 mg/m³ TLV-STEL: 4 ppm, 10 mg/m³ **Toxicity Data**** Mouse, Inhalation, LC_{50}: 67 ppm/4 Hrs

*Contact your supplier to determine the percent by weight of nitric acid in the purchased product. Water is the other component of the product.
**See NIOSH, *RTECS* (QU5775000, QU5900000), for additional data with references to reproductive effects.

SECTION 3. PHYSICAL DATA

Boiling Point: Ca 251°F (122°C)*
Specific Gravity (H_2O = 1): 1.4*
pH: Very Acidic

Water Solubility (%): Complete
Molecular Weight: 63 Grams/Mole
Melting Point: Ca -30°F (-34°C)*

Appearance and Odor: A water white to slightly yellow liquid that darkens to a brownish color on aging and exposure to light; characteristic nitrogen dioxide (NO_2) odor.

*These properties are for the approximately 68%-by-weight nitric acid that is commercially available.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air % by Volume	LOWER	UPPER
*	*		*	*

Extinguishing Media: *Nitric acid does not burn. Use extinguishing agents that will put out the surrounding fire. Use a water spray to dilute nitric acid during fires and to absorb liberated oxides of nitrogen.

Unusual Fire or Explosion Hazards: Although nitric acid does not burn, it is a strong oxidizing agent that can react with combustible materials to cause fires. Also, it can react with metals to liberate extremely flammable hydrogen gas. If this happens, direct fire-fighting procedures at this evolved hydrogen gas.

Special Fire-fighting Procedures: Wear a self-contained breathing apparams (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Choose protective equipment carefully (see sect. 5, Conditions to Avoid).

SECTION 5. REACTIVITY DATA

Nitric acid is stable in closed containers at room temperature under normal storage and handling conditions. It cannot undergo hazardous polymerization.

Chemical Incompatibilities: Nitric acid reacts explosively with metallic powders, carbides, hydrogen sulfide, and turpentine. Contact with organic materials such as wood, paper, sawdust, or alcohol, etc., may cause fires. Combustible materials can attain an increased flammability after being exposed to nitric acid even if they do not immediately catch fire.

Conditions to Avoid: Avoid any contact with incompatible chemicals. Because it is so reactive, always establish another material's compatibility with nitric acid before mixing the two materials. This applies to the selection of safety and handling equipment, because nitric acid can attack some forms of coatings, plastics, and rubber.

Hazardous Products of Decomposition: Various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO_2), nitrous oxide (N_2O), as well as nitric acid mist or vapor, can be produced by the decomposition reactions that can affect the nitric acid during fires.

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SECTION 6. HEALTH HAZARD INFORMATION

Nitric acid is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: This material is corrosive to any body tissue it contacts. Dental erosion is also reported.
Medical Conditions Aggravated by Long-Term Exposure: None reported. **Target Organs:** Skin, eyes, mucous membranes of the respiratory tract, teeth. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** Irritation and/or corrosive burns of skin, eyes, and upper respiratory tract (URT), delayed pulmonary edema, pneumonitis, bronchitis, and dental erosion. **Chronic Effects:** None reported.

FIRST AID: **Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Treat for eye burns. **Skin.** Immediately wash the affected area with soap and water. Watch for chemical skin burns and treat them accordingly. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. If the exposure is severe, hospitilization with careful monitoring by trained medical personnel to detect the delayed onset of severe pulmonary edema (lungs filled with fluid) is recommended for at least 72 hours. **Ingestion.** Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. Do not induce vomiting. If the exposed person is responsive, give him or her one or two glasses of milk or water to drink as quickly as possible after exposure.
GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. NOTE TO PHYSICIAN: Wash affected skin areas with a 5% solution of sodium bicarbonate ($NaHCO_3$). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of *no* value. Do *not* give the exposed person bicarbonate to neutralize the material.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately in case contact with metals should produce highly flammable hydrogen gas. Cleanup personnel need protection against contact with and inhalation of nitric acid (see sect. 8). Contain large spills and collect waste. Use water sprays to direct nitric acid away from incompatible chemicals (see sect. 5). Neutralize the spilled nitric acid with soda ash or sodium bicarbonate. Use an absorbent such as sand, earth, or vermiculite on the resulting slurry and place the neutralized nitric acid material into containers suitable for eventual disposal, reclamation, or destruction.
Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.
OSHA Designations
Air Contaminant (29 CFR 1910.1000 Subpart Z)
EPA Designations (40 CFR 302.4)
CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per Clean Water Act (CWA), Section 311 (b) (4)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of nitric acid solution is possible, wear a full face shield as a supplementary protective measure. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Consult the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for general recommendations on proper respirator procedures. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent skin contact with nitric acid. Choose protective equipment carefully (see sect. 5, Conditions to Avoid).
Ventilation: Install and operate both general and local exhaust-ventilation systems powerful enough to maintain airborne concentrations of nitric acid below the OSHA PEL standard cited in section 2. Construct exhaust ducts and systems with material such as fiberglass, which resists attack by nitric acid. **Safety Stations:** Make emergency eyewash stations, washing facilities, and safety/quickdrench showers available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean nitric acid from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Provide preplacement and annual medical exams with emphasis on skin irritation to workers who are regularly exposed to nitric acid. Workers must receive training before handling this material in the workplace; even experienced workers should undergo refresher training periodically.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store nitric acid in a cool, dry, well-ventilated area away from incompatible chemicals (see sect. 5). Consider outside, isolated, or detached storage. Protect containers from direct sunlight.
Special Handling/Storage: Build all storage facilities of nonflammable materials that are resistant to chemical attack by nitric acid. Protect containers from physical damage. Preplan for routine use and emergency response.
Engineering Controls: Proper ventilation is essential in bulk storage areas; consider installing an automatic monitoring system to detect hazardous levels of nitrogen oxides that can develop from this material.
Comments: Separate nitric acid from hydrazine, diethylenetriamine, fluorides, and all other corrosives except sulfuric acid and sulfur trioxide when shipping or transferring it.
Transportation Data (49 CFR 172.101-2)
DOT Shipping Name: (I) Nitric Acid, Fuming or (II) Nitric Acid, Over 40% or (III) Nitric Acid, 40% or Less
DOT Label: (I) Oxidizer and Poison or (II) Oxidizer and Corrosive or (III) Corrosive
DOT Hazard Class: (I) and (II) Oxidizer or (III) Corrosive Material
DOT ID Nos. (I) UN2032; (II) UN2031; (III) NA1760
IMO Class: 8 (All Types of Nitric Acid)
IMO Label: (I) Corrosive, Oxidizer, Poison; or (II) and (III) Corrosive
References: 1, 2, 26, 38, 84-94, 100, 112, 113, 114.

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Material Safety Data Sheets Collection:
Sheet No. 47
Nitrogen Dioxide
Issued: 12/78 Revision: B, 9/92

Section 1. Material Identification

Nitrogen Dioxide (NO_2) Description: Occurs from combustion of fossil fuels, fermentation of animal feed in silos, as a by-product of chemical manufacture (explosives, dyes, lacquers), and whenever nitric acid acts on metals or contacts organic material. Derived commercially by oxidation of nitric acid. Available as a pressurized liquid which contains an equilibrium of nitrogen dioxide (NO_2) and nitrogen tetroxide (N_2O_4). Used as an intermediate in sulfuric and nitric acid production, nitration of organic compounds and explosives, in bleaching flour, in the manufacture of oxidized cellulose compounds (hemostatic cotton), as a component of fuel for jet propulsion (proposed use), and as a polymerization inhibitor.

R 1
I 4
S 3*
K 2
* Skin absorption

NFPA: 3 / 0 / 3 / OX

HMIS
H 3
F 0
R 0
PPE‡

† Chro Effe
‡ Sec.

Other Designations: CAS No. 10102-44-0, nitrito. Since NO_2 and N_2O_4 are always found together at normal environmental temperatures, dinitrogen tetroxide, nitrogen peroxide, and nitrogen tetroxide are used as synonyms for NO_2.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

Cautions: Nitrogen dioxide is a strong oxidizer which causes corrosive nitric acid formation on contact with mucous membranes and moist skin and can produce severe pulmonary edema (fluid in lungs) leading to death.

Section 2. Ingredients and Occupational Exposure Limits

Nitrogen dioxide, ca 99.5%

1991 OSHA PEL
15-min STEL: 1 ppm (1.8 mg/m³)

1990 IDLH Level
50 ppm

1990 NIOSH REL
STEL: 1 ppm (1.8 mg/m³)

1992-93 ACGIH TLVs
TWA: 3 ppm (5.6 mg/m³)
STEL: 5 ppm (9.4 mg/m³)

1990 DFG (Germany) MAK
TWA: 5 ppm (9 mg/m³)
Category 1: local irritants
Peak Exposure Limit: 10 ppm, 5 min momentary value, 8 per shift

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 90 ppm/40 min caused cough, difficulty breathing, and other changes.
Human, inhalation, LC_{Lo}: 200 ppm/1 min; no toxic effect noted
Rat, inhalation, TC_{Lo}: 85 µg/m³/24 hr (1 to 22 days of pregnancy) produced fetotoxicity including fetal death.
Rat, inhalation: 27 ppm/3 continuous hours caused gene mutation in mammalian cells.

* See NIOSH, *RTECS* [QW9800000 (QW9805000, *liquid*)], for additional mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 69.8 °F (21 °C)
Melting Point: 15.3 °F (-9.3 °C)
Vapor Pressure: 400 mm Hg at 176 °F (80 °C), 720 mm Hg at 68 °F (20 °C)
Saturated Vapor Density (Air = 1.2 kg/m³; 0.075 lb/ft³): 1.866 kg/m³; 0.116 lb/ft³
Refraction Index: 1.40 at 68 °F (20 °C)

Odor Threshold: 0.058 to 0.4 ppm
Molecular Weight: 46.01
Density: 1.49 at 32 °F (0 °C)
Water Solubility: Decomposes to form nitric acid and nitric oxide.
Other Solubilities: Soluble in sulfuric and nitric acids, alkalies, chloroform, and carbon disulfide
Ionization Potential: 9.75 eV

Appearance and Odor: Colorless or bluish-white solid, yellow liquid, or brownish-red gas with an irritating, acrid odor.

Section 4. Fire and Explosion Data

Flash Point: Nonflammable	**Autoignition Temperature:** Nonflammable	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Nitrogen dioxide is nonflammable but enhances combustion of organic matter and other combustible materials (carbon, sulfur, phosphorus). Use extinguishing media appropriate to surrounding fire.
Unusual Fire or Explosion Hazards: Cylinder may explode in heat of fire. Mixture with fuels may explode.
Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing is not effective for fires involving nitrogen dioxide. Apply cooling water to sides of container until well after fire is out. Stay away from ends of tanks. For massive fir in cargo area, use monitor nozzles or unmanned hose holders; if this is impossible, withdraw from area and let fire burn. Do not release runoff from *fire control methods to sewers or waterways.*

Section 5. Reactivity Data

Stability/Polymerization: Nitrogen dioxide is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: NO_2 is corrosive to wet steel, reacts with alkalies to form nitrates and nitrites, and decomposes in water to form nitric acid and nitric oxide. It is incompatible with metals, ammonia, acetic anhydride, alkenes, acetonitrile + indium, barium oxide, carbon dichloride, carbon disulfide, chloroform, dimethyl sulfoxide, iron oxide, formaldehyde, fluorine, cyclohexane, nitrobenzene, sulfuryl chloride, trichloroethane, and ozone.
Conditions to Avoid: Avoid contact with organic materials and other incompatibles.
Hazardous Products of Decomposition: Thermal oxidative decomposition of nitrogen dioxide can produce other nitrogen oxide (NO_x) gases.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,[164] NTP,[169] and OSHA[164] do not list nitrogen dioxide as a carcinogen.
Summary of Risks: Nitrogen dioxide is a strong oxidizer which causes severe burns of the eyes, skin (if moist), and mucous membranes of the respiratory tract as it forms nitric acid in contact with water/moisture. Death due to pulmonary edema (fluid in lungs) is common after severe exposures. Nitrogen dioxides' toxicity is mainly due to the peroxidation of lipids causing severe cell membrane damage. This results in decreased resistance to pulmonary infection by adversely affecting the mucociliary system, macrophages, and antibodies. Chronic pulmonary fibrosis may occur after repeated exposures to low concentrations. Animal studies have shown lesions representative of emphysema in humans.

Continue on next pag

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Section 6. Health Hazard Data, *continued*

Medical Conditions Aggravated by Long-Term Exposure: Chronic respiratory diseases. **Target Organs:** Eyes, skin, respiratory and cardiovascular systems. **Primary Entry Routes:** Inhalation, eye and skin contact. **Acute Effects:** Brief exposures to 250 ppm can cause cough, frothy sputum, and increased difficulty breathing; within 1 to 2 hr victim may develop pulmonary edema, cyanosis (bluish skin and lip color due to lack of oxygenated blood), loud wheezing, rapid heart beat with increased respiration rate. Sometimes only cough, difficulty breathing will occur with symptoms subsiding over 2 to 3 weeks, but may be followed by a second stage of increasingly severe symtoms characterized by fever, chills, increasingly difficult respiration, cyanosis, and recurring pulmonary edema. Death may occur in initial or secondary stage. A mild initial stage does not indicate a mild or absence of second stage; indeed, a mild first stage may be followed by a severe secondary stage resulting in death. If the second stage is survived, recovery usually occurs within 2 to 3 weeks. However, some do not fully recover and suffer varying degrees of impaired lung function. Contact with the eyes may cause corneal irritation and conjunctivitis. Contact with moist skin is irritating and may cause burns (formation of nitric acid). Sudden bursts of the compressed liquid can produce frostbite. **Chronic Effects:** Chronic pulmonary fibrosis leading to obstruction of the bronchioles (*bronchiolitis obliterans*) may be severe. Yellow-brown staining of the skin & teeth may occur from repeated exposure but is generally due to the formation of nitric acid.

FIRST AID *Rescuers entering areas of potentially dangerous NO_2 levels need to wear a SCBA (Sec. 8) to prevent becoming a secondary victim.* **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** If frostbite occurs, rewarm at 42 °C (107 °F) until skin color and temperature are completely normal. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** *Unlikely*! NO_2 is a gas above 69.8 °F but if it occurs have that *conscious and alert* person drink water to dilute. *Do not induce vomiting.* **Note to Physicians:** Effects may be delayed for 48 to 72 hours, keep under observation. Pulmonary function tests may reveal obstructive and restrictive defects. In its early stages, bronchiolitis obliterans is reversible with corticosteroids for up to 12 months.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Keep combustibles away from leak. NO_2 is a strong oxidizer and can create a fire. Use water spray to disperse vapors and personnel. Be aware that runoff will contain nitric acid and must be contained. Cleanup personnel should protect against inhalation and skin contact. If cold liquid is spilled, allow to vaporize. If cylinder cannot be repaired in place, remove to a safe, outside location and fix or allow gas to empty. Follow applicable OSHA regulations (29 CFR 1910.120).
Ecotoxicity Values: Mosquito fish, TLm =72 ppm/96 hr (fresh water); cockle, LC_{50} = 330 to 1000 ppm/48 hr (salt water).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. P078
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 10 lb (4.54 kg) [* per RCRA, Sec. 3001 & CWA, Sec. 311 (b)(4)]
Listed as a SARA Extremely Hazardous Substance (40 CFR 355), TPQ: 100 lb
SARA Toxic Chemical (40 CFR 372.65): Not listed
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)
Listed as a Process Safety Hazardous Chemical (29 CFR 1910.119), TQ: 250 lb

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 25 ppm, use any supplied-air respirator (SAR) operated in a continuous-flow mode. For < 50 ppm, use any SAR or SCBA with a full facepiece. *Never* wear a respirator with charcoal filters as NO_2 supports combustion of charcoal! For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, or gauntlets to prevent skin contact. Polyvinylidine chloride/polyethylene have breakthrough times (BT) of > 4 hr and are recommended as suitable materials for PPE. Polyvinyl chloride and fluorocarbon rubber have BT's of < 1 hr and are not recommended. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean personal protective equipment. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from organic, combustible, and reducing, materials and other incompatibles (Sec. 5). NO_2 can be stored in steel containers when moisture content is < 0.1%. Outside or detached storage is preferred. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Only stainless steel fittings should be used for equipment. **Administrative Controls:** Prohibit entrance of silos for 6 weeks after filling (fermentation yields high levels of NO_2). Consider preplacement or periodic medical exams of exposed workers with emphasis on the respiratory tract, skin, and teeth.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Dinitrogen tetroxide, liquefied
DOT Hazard Class: 2.3
ID No.: UN1067
DOT Label: Poison Gas, Oxidizer
DOT Packing Group: –
Special Provisions (172.102): 1, B7, B12, B14, B45, B46, B61, B66, B67, B77

Packaging Authorizations
a) Exceptions: –
b) Non-bulk Packaging: 173.336
c) Bulk Packaging: 173.314

Vessel Stowage Requirements
a) Vessel Stowage: D
b) Other: 40, 43

Quantity Limitations
a) Passenger, Aircraft, or Railcar: Forbidden
b) Cargo Aircraft Only: Forbidden

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 140, 148, 149, 153, 159, 163, 164, 167, 171, 174, 180
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** AC Darlington, MPH, MD

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NITROGEN TETROXIDE

NOX

Common Synonyms	Liquefied compressed gas; Red-brown gas	Sharp, unpleasant chemical odor

Stable and reacts with water. Poisonous brown vapor is produced.

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber protective clothing (including gloves).
Stop discharge if possible.
Evacuate area in case of large discharge.
Notify local health and pollution control agencies.

Fire

Not flammable.
May cause fire and explosion on contact with combustibles.
POISONOUS GASES ARE PRODUCED IN FIRE AND WHEN HEATED.
Wear goggles, self-contained breathing apparatus, and rubber protective clothing (including gloves).
Flood discharge area with water.
Stop flow of gas or liquid.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.
VAPOR
POISONOUS IF INHALED.
Irritating to eyes.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.
LIQUID
Will burn skin and eyes.
POISONOUS IF SWALLOWED.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-caution, or contaminate, water downstream, consume
Restrict access
Evacuate area

2. LABEL

2.1 Category: Poison gas; Oxidizer
2.2 Class: 2 and 5

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: N_2O_4
3.3 SMCA/IMI Designation: 8/1087
3.4 DOT ID No.: 1067
3.5 CAS Registry No.: 10102-44-0

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (at ambient): Liquid
4.2 Color: Red-brown at ambient temperature; colorless below about 14°F
4.3 Odor: Pungent, acrid, mildly irritating

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Rubber gloves; safety goggles and face shield; protective clothing; and gas canister respirator or self-contained breathing apparatus.

5.2 Symptoms Following Exposure: Very concentrated fumes produce coughing, choking, headache, nausea, pain in chest and abdomen; dizziness; low symptoms appear at time of exposure. After symptom-free period of 5-72 hours, pulmonary edema gradually develops, causing fatigue, restlessness, coughing, difficulty in breathing, rising temperature, mental confusion, cyanosis, bluish skin, and sweat; rales (rales). Severe NOX overdoses with gas discharges in lungs, unconscious- ness and death by asphyxiation can result, usually within a few hours after onset of pulmonary edema.

5.3 Treatment of Exposure: INHALATION: remove victim to fresh air and have him breathe as deeply as possible and a doctor; victim remains rest for 24-48 hours; keep warm; give oxygen if coughing starts; physician may administer morphine (10 mg.) EYES AND SKIN: flush with water for at least 15 min.

5.4 Threshold Limit Value: 5 ppm

5.5 Short Term Inhalation Limits: 25 ppm for 5 min.

5.6 Toxicity by Ingestion: Data not available

5.7 Late Toxicity: Data not available

5.8 Vapor (Gas) Irritant Characteristics: Vapors cause severe irritation of eyes and throat and can cause eye and lung injury. They cannot be detected even at low concentrations.

5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes chemical- and thermal-type burns on skin contact and is very irritating to the eyes.

5.10 Odor Threshold: 5 ppm

5.11 IDLH Value: 20 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Stop flow of gas
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Produces toxic gas which fumes
6.6 Behavior in Fire: Does not burn, but supports combustion of combustible materials such as wood; may cause fire or explosion on contact with some materials
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazards: Data not available
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts to form nitric acid and nitric oxide. Nitric oxide reacts with air to form more nitrogen dioxide.
7.2 Reactivity with Common Materials: Very corrosive to metals when wet. Reacts vigorously with combustible materials such as wood.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Flush with water. Dilute with soda ash or lime.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Water Ratio (Reactions to Products): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
72 ppm/96 hr/mosquito fish/TL_m/fresh water
330-1600 ppm/48 hr/rainbow trout/LC_{50}/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Data not available
9.2 Storage Temperature: Ambient. Storage and transfer structures shall be equipped with mechanical ventilation systems.
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure relief valves or conservation

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-4-J-O

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Poison, A

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	4
Liquid or Solid Irritant	4
Poisons	4
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	3
Aesthetic Effect	4
Reactivity	
Other Chemicals	2
Water	0
Self Reaction	

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0
	Ox

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Soluble
12.2 Molecular Weight: 92.02
12.3 Boiling Point at 1 atm: 70.1°F = 21.2°C = 294°K
12.4 Freezing Point: 11.9°F = −11.2°C = 262°K
12.5 Critical Temperature: 317.6°F = 158.2°C = 431.4°K
12.6 Critical Pressure: 1470 atm = 100 atm = 10.1 MN/m²
12.7 Specific Gravity: 1.45 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: 3.2
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.202
12.12 Latent Heat of Vaporization: 170 Btu/lb = 39.1 cal/g = 6.16 × 10⁴ J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Data not available
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: 69.2 cal/g
12.18 Limiting Values: Data not available
12.27 Reid Vapor Pressure: 32 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 205

POTASSIUM NITRATE

Issued: January 1987

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: POTASSIUM NITRATE

DESCRIPTION/USES: Used in pyrotechnics; explosives; matches; as a specialty fertilizer; reagent; to modify burning properties of tobacco; in glass manufacture; tempering steel; curing foods; as an oxidizer in solid rocket propellants.

OTHER DESIGNATIONS: Nitric Acid, Potassium Salt; Niter; Saltpeter; KNO_3; CAS #7757-79-1

MANUFACTURER/SUPPLIER: Available from several suppliers, including: Aldrich Chemical Co., Inc., PO Box 355, Milwaukee, WI 53201; Telephone: (414) 273-3850

Nonfire

Fire

HMIS			
H	1		
F	0	R	1
R	1	I	–
PPE*		S	2
*See Sect. 8		K	0

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Potassium Nitrate, CAS #7757-79-1	>99%	ACGIH TLV: None Established OSHA PEL: None Established Oral, Rat, LD_{50}: 3750 mg/kg Oral, Rabbit, LD_{50}: 1901 mg/kg

SECTION 3. PHYSICAL DATA

Melting Point ... 633°F (334°C)
Boiling Point ... 400°C (Decomposes)
Specific Gravity @ 16°C ... 2.11
Vapor Pressure @ 20°C ... Negligible
% Volatiles ... 0
Evaporation Rate ... Not Found

Solubility in Water, at 0°C ... 13.3 g/100 cc
at 100°C ... 247 g/100 cc
pH of 5% Solution, at 25°C ... 4.5-7.0
Molecular Weight ... 101.1

Appearance and odor: White crystalline powder or granules. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
Not Found	Not Found	Not Found	--	--

Potassium nitrate is not combustible. However, it is a strong oxidizer and can initiate and intensify combustion of flammable materials.

EXTINGUISHING AGENTS: Flood fires involving this material with water. Keep fire-exposed containers cool with water spray. Remove containers from the fire area if it can be done safely.

UNUSUAL FIRE/EXPLOSION HAZARDS: At high temperatures this material can fuse or melt; application of water when large quantities are involved can result in extensive scattering of molten material.

SPECIAL FIRE-FIGHTING PROCEDURES: Toxic fumes/gases can be evolved in a fire situation. Fire fighters should use self-contained breathing apparatus and wear full protective gear.

SECTION 5. REACTIVITY DATA

Potassium nitrate is stable at room temperature. It does not polymerize.

Violent reactions (including fire and explosion) may occur on its contact with organic materials, combustible materials, and reducing agents. Specific incompatibles under various conditions include aluminum, titanium, antimony, germanium, zinc, zirconium (and other metals), calcium disilicide, chromium nitride, metal sulfides, boron, carbon, sulfur, phosphorus, phosphides, sodium phosphinate, sodium thiosulfate, citric acid, tin chloride, sodium acetate, and thorium carbide.

Potassium nitrate decomposes at approximately 752°F (400°C) with the evolution of oxygen and oxides of nitrogen (toxic).

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SECTION 6. HEALTH HAZARD INFORMATION

Potassium nitrate has not been identified as a known or suspected carcinogen by the NTP, IARC, or OSHA. This material can enter the body if it is inhaled or swallowed.

EFFECTS OF OVEREXPOSURE: Inhalation of excessive concentrations may be irritating to the nose, throat, and respiratory tract. Prolonged exposure may cause anemia, methemoglobinemia (the presence of methemoglobin, a soluble brown crystalline blood pigment that differs from hemoglobin in that it contains ferric iron and is unable to combine reversibly with molecular oxygen), and kidney injury (nephritis). Ingestion can cause severe gastrointestinal distress with abdominal pain, nausea, vomiting, and diarrhea. Eye contact may cause irritation.

FIRST AID: EYE CONTACT: Flush eyes, including under the eyelids, with a gentle flow of running water. Get medical help.* SKIN CONTACT: Wash affected area with mild soap and water. If irritation persists, prevent further contact and get medical help.* INHALATION: Remove victim from exposure. Get medical help if irritation or discomfort persists.* INGESTION: Give victim a large quantity of water to drink. Induce vomiting and get prompt medical help.* Keep him warm and at rest. NOTE: Never give anything by mouth or induce vomiting if the victim is unconscious.
* GET MEDICAL ASSISTANCE = In plant, community, paramedic. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Ventilate the potassium nitrate spill area. Prevent contact of spilled material with combustible and incompatible materials. Cleanup personnel should wear personal protective equipment as necessary to prevent skin/eye contact and dust inhalation. Carefully scoop spilled material into a suitable container for reclamation or disposal. Avoid generating dust during cleanup. Absorb small solution spills on inert (noncombustible) material such as dry sand or earth.
Disposal: Potassium nitrate requires disposal as a hazardous waste. Reclaim material when possible. Contact your supplier or a licensed chemical waste disposal contractor for treatment and disposal instructions. Follow all applicable Federal, state, and local regulations.

Reportable Spill Quantity: Not listed in 40 CFR 117.3, "Reportable Quantities of Hazardous Substances."
EPA Hazardous Waste Number: D001 (Ignitable, 40 CFR 261.21)

SECTION 8. SPECIAL PROTECTION INFORMATION

Use local exhaust ventilation to control airborne levels where potassium nitrate dust, mist, or fumes are generated.

Use an appropriate NIOSH-approved respirator for protection against potassium nitrate dust/mist where airborne levels are excessive. Respirator usage must be in accordance with OSHA requirements (29 CFR 1910.134).

Wear protective clothing (aprons, coveralls, etc.) where the possibility of skin or clothing contamination exist. Wear rubber gloves and safety goggles when handling this material.

Eyewash stations and washing facilities should be readily accessible to workers handling this material.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Particles may adhere to contact lenses and cause corneal damage.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store potassium nitrate in closed containers in a cool, dry location on a noncombustible surface. Store it away from flammable and combustible materials, reducing agents, and other incompatible materials (see sect. 5). Protect containers from physical damage.

Practice good housekeeping. Clean up spills promptly. Use procedures and techniques that minimize dust generation. Practice good personal hygiene. Wash thoroughly after handling this material and before eating, drinking, and smoking. Do not eat, drink, or smoke in the work area. Remove contaminated clothing promptly. Launder it before wearing it again. Do not take this material out of your work area or to your home on your clothing or equipment.

DOT Hazard Classification: Oxidizer (49 CFR 172.101) DOT ID No. UN1486 DOT Label: Oxidizer

Data Source(s) Code: 4, 5, 6, 9, 25, 49, 58, 77, 82, CV

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Approvals	
Indust. Hygiene/Safety	4/87
Medical Review	4/87

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Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 317
TOLUENE
(Revision D)

Issued: August 1979
Revised: April 1986

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: TOLUENE

OTHER DESIGNATIONS: Methyl Benzene, Methyl Benzol, Phenylmethane, Toluol, C_7H_8, CAS #0108-88-3

MANUFACTURER/SUPPLIER: Available from many suppliers, including:
Allied Corp., PO Box 2064R, Morristown, NJ 07960; Telephone: (201) 455-4400
Ashland Chemical Co., Industrial Chemicals & Solvents Div., PO Box 2219, Columbus, OH; Telephone: (614) 889-3844

HMIS
H: 2
F: 3
R: 0
PPE*
*See sect. 8

R 1
I 3
S 2
K 4

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Toluene	ca 100	8-hr TLV: 100 ppm, or 375 mg/m^3* (Skin)** Man, Inhalation, TCLo: 100 ppm: Psychotropic*** Rat, Oral, LD_{50}: 5000 mg/kg Rat, Inhalation, LCLo: 4000 ppm/4 hrs. Rabbit, Skin, LD_{50}: 14 gm/kg Human, Eye: 300 ppm

* Current (1985-86) ACGIH TLV. The OSHA PEL is 200 ppm with an acceptable ceiling concentration of 300 ppm and an acceptable maximum peak of 500 ppm/10 minutes.

** Skin designation indicates that toluene can be absorbed through intact skin and contribute to overall exposure.

*** Affects the mind.

SECTION 3. PHYSICAL DATA

Boiling Point ... 231°F (111°C)
Vapor Pressure @ 20°C, mm Hg ... 22
Water Solubility @ 20°C, wt. % ... 0.05
Vapor Density (Air = 1) ... 3.14
Evaporation Rate (BuAc = 1) ... 2.24
Specific Gravity (H_2O = 1) ... 0.866
Melting Point ... -139°F (-95°C)
Percent Volatile by Volume ... ca 100
Molecular Weight ... 92.15

Appearance and odor: Clear, colorless liquid with a characteristic aromatic odor. The odor is detectable to most individuals in the range of 10 to 15 ppm. Because olfactory fatigue occurs rapidly upon exposure to toluene, odor is not a good warning property.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
40°F (4°C) CC	896°F (480°C)	% by Volume	1.27	7.1

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, alcohol foam. Do not use a solid stream of water because the stream will scatter and spread the fire. Use water spray to cool tanks/containers that are exposed to fire and to disperse vapors.

UNUSUAL FIRE/EXPLOSION HAZARDS: This OSHA class IB flammable liquid is a dangerous fire hazard. It is a moderate fire hazard when exposed to oxidizers, heat, sparks, or open flame. Vapors are heavier than air and may travel a considerable distance to an ignition source and flash back.

SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus with full facepiece operated in a positive-pressure mode when fighting fires involving toluene.

SECTION 5. REACTIVITY DATA

CHEMICAL INCOMPATIBILITIES: Toluene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization. This material is incompatible with strong oxidizing agents, dinitrogen tetraoxide, silver perchlorate, tetranitromethane, and uranium hexafluoride. Contact with these materials may cause fire or explosion. Nitric acid and toluene, especially in the presence of sulfuric acid, will produce nitrated compounds that are dangerously explosive.

CONDITIONS TO AVOID: Avoid exposure to sparks, open flame, hot surfaces, and all sources of heat and ignition. Toluene will attack some forms of plastics, rubber, and coatings. Thermal decomposition or burning produces carbon dioxide and/or carbon monoxide.

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SECTION 6. HEALTH HAZARD INFORMATION | TLV

Toluene is not considered a carcinogen by the NTP, IARC, or OSHA. SUMMARY OF RISKS: Vapors of toluene may cause irritation of the eyes, nose, upper respiratory tract, and skin. Exposure to 200 ppm for 8 hours causes mild fatigue, weakness, confusion, lacrimation (tearing) and paresthesia (a sensation of prickling, tingling, or creeping on the skin that has no objective cause). Exposure to higher concentrations may cause headache, nausea, dizziness, dilated pupils, and euphoria, and, in severe cases, may cause unconsciousness and death. The liquid is irritating to the eyes and skin. Contact with the eyes may cause transient corneal damage, conjunctival irritation, and burns if not promptly removed. Repeated and/or prolonged contact with the skin may cause drying and cracking. It may be absorbed through the skin in toxic amounts. Ingestion causes irritation of the gastrointestinal tract and may cause effects resembling those from inhalation of the vapor. Chronic overexposure to toluene may cause reversible kidney and liver injury. FIRST AID: EYE CONTACT: Immediately flush eyes, including under eyelids, with running water for at least 15 minutes. Get medical attention if irritation persists.* SKIN CONTACT: Immediately flush skin (for at least 15 minutes) while removing contaminated shoes and clothing. Wash exposed area with soap and water. Get medical attention if irritation persists or if a large area has been exposed.* INHALATION: Remove victim to fresh air. Restore and/or support breathing as required. Keep victim warm and quiet. Get medical help.* INGESTION: Give victim 1 to 2 glasses of water or milk. Contact a poison control center. Do not induce vomiting unless directed to do so. Transport victim to a medical facility. Never give anything by mouth to a person who is unconscious or convulsing. * GET MEDICAL ASSISTANCE = In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid, if indicated.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of large spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Limit access to spill area to necessary personnel only. Remove leaking containers to safe place if feasible. Cleanup personnel need protection against contact with liquid and inhalation of vapor (see sect. 8).
WASTE DISPOSAL: Absorb small spills with paper towel or vermiculite. Contain large spills and collect if feasible, or absorb with vermiculite or sand. Place waste solvent or absorbent into closed containers for disposal using nonsparking tools. Liquid can be flushed with water to an open holding area for handling. Do not flush to sewer, watershed, or waterway.
COMMENTS: Place in suitable container for disposal by a licensed contractor or burn in an approved incinerator. Consider reclaiming by distillation. Contaminated absorbent can be buried in a sanitary landfill. Follow all Federal, state, and local regulations. TLm 96: 100-10 ppm. Toluene is designated as a hazardous waste by the EPA. The EPA (RCRA) HW No. is U220 (40 CFR 261). The reportable quantity (RQ) is 1000 lbs/454 kg (40 CFR 117).

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Ventilation fans and other electrical service must be nonsparking and have an explosion-proof design. Exhaust hoods should have a face velocity of at least 100 lfm (linear feet per minute) and be designed to capture heavy vapor. For emergency or nonroutine exposures where the TLV may be exceeded, use an organic chemical cartridge respirator if concentration is less than 200 ppm and an approved canister gas mask or self-contained breathing apparatus with full facepiece if concentration is greater than 200 ppm.
Safety glasses or splash goggles should be worn in all work areas. Neoprene gloves, apron, face shield, boots, and other appropriate protective clothing and equipment should be available and worn as necessary to prevent skin and eye contact. Remove contaminated clothing immediately and do not wear it until it has been properly laundered.

Eyewash stations and safety showers should be readily available in use and handling areas.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store in a cool, dry, well-ventilated area away from oxidizing agents, heat, sparks, or open flame. Storage areas must meet OSHA requirements for class IB flammable liquids. Use metal safety cans for handling small amounts. Protect containers from physical damage. Use only with adequate ventilation. Avoid contact with eyes, skin, or clothing. Do not inhale or ingest. Use caution when handling this compound because it can be absorbed through intact skin in toxic amounts. SPECIAL HANDLING/STORAGE: Ground and bond metal containers and equipment to prevent static sparks when making transfers. Do not smoke in use or storage areas. Use nonsparking tools. ENGINEERING CONTROLS: Preplacement and periodic medical exams emphasizing the liver, kidneys, nervous system, lungs, heart, and blood should be provided. Workers exposed to concentrations greater than the action level (50 ppm) should be examined at least once a year. Use of alcohol can aggravate the toxic effects of toluene.
COMMENTS: Emptied containers contain product residues. Handle accordingly!
Toluene is designated as a hazardous substance by the EPA (40 CFR 116). DOT Classification: Flammable liquid. UN1294.
Data Source(s) Code: 1-9, 12, 16, 20, 21, 24, 26, 34, 81, 82. CR

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Approvals J.O. Acciacco, 11/86.
Indust. Hygiene/Safety DJW 10-86
Medical Review [signature] Oct 86

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Material Safety Data Sheet Collection

Toxaphene

MSDS No. 97

Date of Preparation: 10/95

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Toxaphene
Chemical Formula: $C_{10}H_{10}Cl_8$
CAS Number: 8001-35-2
Synonyms: Alltex, camphechlor, chlorinated camphene, chlorocamphene, Cristoxo-90, Estonox, Geniphene, Melipax, octachlorocamphene, Phenatox, polychlorocamphene, Strobane-T
Derivation: Produced by chlorination of camphene to 67-69% chlorine.
General Use: Although formerly widely used as an agricultural insecticide, today it has only conditional/restricted uses for existing stock, such as for cattle dips, pineapples in Peurto Rico, bananas in the Virgin Islands, and emergency use on corn, cotton, and small grains and the US. Available as a dust containing 20% toxaphene, emulsifiable formulas containing up to 8 lb/gallon, oil solutions (90% toxaphene) and wettable powders containing 40% toxaphene.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Toxaphene, ca 100 %wt

OSHA PELs
8-hr TWA: 0.5 mg/m^3 (skin)
Vacated 1989 Final Rule Limit
STEL: 1 mg/m^3 (skin)

ACGIH TLVs
8-hr TWA: 0.5 mg/m^3 (skin)
STEL: 1 mg/m^3 (skin)

NIOSH REL
Ca; lowest feasible concentration
LOQ: 0.01 mg/m^3 (skin)

IDLH Level
200 mg/m^3

DFG (Germany) MAK
TWA: 0.5 mg/m^3
Category III: Substances with systemic effects
Onset of effect: > 2 hr
Half-life: > shift length (strongly cumulative)

Peak Exposure Limit:
5 mg/m^3, 30 min average value, 1/shift

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Toxaphene exists as an amber, waxy solid with a pleasant pine odor. It is irritating to the skin and is toxic to the central nervous system, many times resulting in convulsions. It is a possible human carcinogen. Toxaphene may be found in water as well as oil solutions. Oil solutions can present an increased health hazard and may also be flammable.

Wilson Risk Scale	
R	1
I	3
S	2*
K	1

*Skin absorption

HMIS	
H	3*
F	0
R	0

*Chronic effects
PPE†
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, skin contact/absorption.
Target Organs: Skin, central nervous system (CNS).
Acute Effects
Inhalation: Symptoms include nausea and vomiting, salivation, muscle spasms followed by convulsions, and possibly death due to respiratory failure. Allergic bronchopneumonia was observed in two workers after using toxaphene, but this does not appear to be a common effect.
Skin: Irritation and allergic dermatitis may occur. Skin absorption can occur, especially when toxaphene is in a solution form. Two cases of aplastic anemia have been seen after skin absorption, however, the toxaphene was in a lindane mixture and it is not known which (or if both) chemical was responsible.
Ingestion: The estimated oral lethal dose is 2 to 7 grams; 10 mg/kg causes non-fatal convulsions in some individuals and no symptoms in others.
Carcinogenicity: The following agencies classify the carcinogenicity of toxaphene: IARC (group 2B, possibly carcinogenic to humans with limited human evidence in the absence of sufficient animal evidence), NIOSH-X (carcinogen defined with no further categorization), NTP (group 2, reasonably anticipated to be a carcinogen with limited human evidence or sufficient animal evidence), and EPA (group 2, probable human carcinogen with limited human epidemiological evidence and sufficient animal evidence). OSHA does not list toxaphene as a carcinogen.
Medical Conditions Aggravated by Long-Term Exposure: Skin and central nervous system disorders including epilepsy.
Chronic Effects: Animal studies have demonstrated the inducement of liver cancer by chronic exposure to toxaphene. It is not known whether or not the same effect will occur in humans. Chromosomal aberrations (mutations) have been seen in humans (lymph cell cultures) exposed to toxaphene.

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Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.
Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation persist.
Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water followed by a thorough soap and water wash. For reddened or blistered skin, consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting. *Note*: Do not induce vomiting if toxaphene is found in an oil solution.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

Flash Point: Although toxaphene is a noncombustible solid, it is commercially available in formulations (solutions, emulsifiables) that are combustible. Flash points have been given for the following solutions: 60% (275 °F/135 °C), CC; 90% (239 °F/115 °C), TCC; and Strobane-T90 (95 °F/35 °C), TCC. The most commonly used solvent appears to be xylene.

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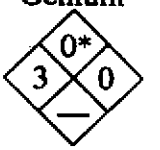

Autoignition Temperature: Varies according to formulation.
LEL: Varies according to formulation.
UEL: Varies according to formulation.
Extinguishing Media: Use agents suitable for the *solvent* in the toxaphene formulation.
Unusual Fire or Explosion Hazards: Hazards may vary according to specific formulation. Consult the MSDS on the particular solvent involved.
Hazardous Combustion Products: Carbon oxide(s), chlorine, and hydrogen chloride gas.
Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

*The fire rating for toxaphene is "0" for the pure compound, but can be a "1" or "2" depending on the solvent used.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against inhalation and skin contact.
Small Spills: Carefully scoop up or vacuum (with appropriate filter) and place in suitable containers. If toxaphene is in solution, take up with earth, sand, vermiculite, or other absorbent, noncombustible material.
Large Spills
Containment: Flush with water to containment area for later disposal. *Do not* release into sewers or waterways.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use only with adeqaute ventilation and appropriate PPE.
Storage Requirements: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec. 10). Preferably, store in glass or polyolefin containers. If metal containers are used, they must be lined with polyolefin.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Enclose all processes to prevent dust dispersion into work area. Metal piping must be lined (polyolefin recommended) to prevent corrosion, especially from emulsifiable formulations.
Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin and central nervous system. Exams should be performed *at least* annually.
Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For any detectable concentration, wear any SCBA with a full facepiece and operated in pressure-demand or other positive-pressure mode, or any supplied-air respirator with a full facepiece in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

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Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in wor

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove toxaphe from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using toxaphene, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: Amber, waxy, with a pine odor.

Odor Threshold: 2.366 mg/m^3

Vapor Pressure: 0.2 to 0.4 mm Hg at 68 °F (20 °C)

Formula Weight: 414 (average)

Specific Gravity (H_2O=1, at 4 °C): 1.65 at 77 °F (25 °C)

Water Solubility: 0.0003 g/100 g at 68 °F (20 °C)

Other Solubilities: Soluble in petroleum oils, alcohol, acetone, hexane; > 450 g/100 mL in benzene, carbon tetrachloride, ethylene dichloride, and xylene; 280 g/100 mL in kerosene.

Boiling Point: Decomposes at 155 °C (dechlorination)

Melting Point Range: 149 to 194 °F (65 to 90 °C)

Octanol/Water Partition Coefficient: log Kow = 3.3 (+/- 0.4)

Henry's Law Constant: 6.3 x 10^{-2} to 4.98 x 10^{-3} atm-m^3/mole

Section 10 - Stability and Reactivity

Stability: Toxaphene is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Toxaphene is corrosive to iron and certain other metalsand incompatible with strong oxidizers. It dechlorinates in the presence of alkalis and upon exposure to sunlight, releasing hydrogen chloride gas.

Conditions to Avoid: Exposure to heat and incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of toxaphene can produce carbon oxide(s), chlorine, and hydrogen chloride gas.

Section 11 - Toxicological Information

Toxicity Data:*

Acute Dermal Effects:

Human, skin, TD_{Lo}: 675 mg/kg caused allergic dermatitis.

Rabbit, skin, LD_{50}: 1025 mg/kg caused excitement, affected food intake, and caused regional or general arteriolar or venous dilation.

Reproductive Effects:

Rat, oral: 280 mg/kg administered to males (10 weeks prior to mating) had an effect on spermatogenesis.

Rat, oral: 150 mg/kg administered from 7 to 16 days of pregnancy resulted in specific developmental abnormalities of the musculoskeletal system.

Acute Oral Effects:

Rat, oral, LD_{50}: 50 mg/kg

Human, oral, LD_{Lo}: 28 mg/kg caused somnolence, coma, and convulsions or effect on seizure threshold.

Multiple Dose Toxicity Data:

Dog, oral: 385 mg/kg administered intermittently for 13 weeks caused changes in liver weight and biochemical effects (phosphatases).

Tumorigenicity:

Mouse, oral: 6.6 g/kg administered continuously for 80 weeks resulted in liver tumors.

Mutagenicity:

S. typhimurium: 100 µg/plate (+ S9)

Human, lymphocyte: 10 µmol/L caused sister chromatid exchange.

* See NIOSH, *RTECS* (XW5250000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: *Salmo gairdneri* (rainbow trout), LC_{50} = 10.6 µg/L/96 hr; *Pimephales promelas* (fathead minnow), LC_{50} = 18 µg/L/96 hr; *Micropterus salmoides* (largemouth bass), LC_{50} = 2 µg/L/96 hr.

Environmental Fate: If released to soil, toxaphene is very persistent and can remain for 1 to 14 years, depending upon conditions. Leaching to groundwater is not significant, as it strongly adsorbs to soil. Volatilization can occur from soil surfaces and biodegradation will occur, especially under anaerobic conditions such as flooded soil. In water, evaporation is expected to be significant with a half-life of 6 hr from a model river 1 m deep, flowing 1 m/sec with a wind speed of 3 m/sec. Bioconcentration is high in aquatic organisms with a BCF of 3,100 to 33,000 for fish, 400 to 1,200 for shrimp, and 6,902 for algae. In the air, toxaphene will photolyze slowly, but most will react with photochemically-produced hydroxyl radicals with an estimated half-life of 4 to 5 days.

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Section 13 - Disposal Considerations

Disposal: Dissolve in a flammable solvent and atomize in a suitable incinerator equipped with an afterburner and scrubber. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Organochlorine pesticides, solid, toxic, n.o.s.
Shipping Symbols: –
Hazard Class: 6.1
ID No.: UN2761
Packing Group: II
Label: Poison
Special Provisions (172.102): –

Packaging Authorizations
a) **Exceptions:** None
b) **Non-bulk Packaging:** 173.212
c) **Bulk Packaging:** 173.242

Quantity Limitations
a) **Passenger, Aircraft, or Railcar:** 25 kg
b) **Cargo Aircraft Only:** 100 kg

Vessel Stowage Requirements
a) **Vessel Stowage:** A
b) **Other:** 40

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste (40 CFR 261.33): P123
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307(a)
CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a SARA EHS (Extremely Hazardous Substance) (40 CFR 355), Threshold Planning Quantity (TPQ): 500/10,000 lb
OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 73, 103, 124, 167, 176, 189, 190, 197, 201, 203

Prepared By ..... M Gannon, BA
Industrial Hygiene Review ..... RE Langford, PhD, CIH
Medical Review ..... T Thoburn, MD, MPH

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GENIUM PUBLISHING CORP.

XYLENE (Mixed Isomers)
(Revision D)
Issued: November 1980
Revised: August 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: XYLENE (Mixed Isomers)

Description (Origin/Uses): Used as a raw material for the production of benzoic acid, phthalic anhydride, isophthalic and terephthalic acids and their dimethyl esters in the manufacture of polyester fibers; in sterilizing catgut; with Canadian balsam as oil-immersion in microscopy; and as a cleaning agent in microscopic techniques.

Other Designations: Dimethylbenzene; Xylol; C_8H_{10}; CAS No. 1330-20-7

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

Comments: Although there are three different isomers of xylene (*ortho*, *meta*, and *para*), the health and physical hazards of all three isomers are very similar. This MSDS is written for a xylene mixture of all three isomers, which is usually commercial xylene.

NFPA

HMIS	
H	2
F	3
R	0
PPG*	
*See sect. 8	

R	1
I	3
S	2
K	3

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Xylene (Mixed Isomers), CAS No. 1330-20-7*	**	IDLH*** Level: 1000 ppm
o-Xylene, CAS No. 0095-47-6 *m*-Xylene, CAS No. 0108-38-3 *p*-Xylene, CAS No. 0106-42-3		**OSHA PEL** 8-Hr TWA: 100 ppm, 435 mg/m³ **ACGIH TLVs, 1987-88** TLV-TWA: 100 ppm, 435 mg/m³ TLV-STEL: 150 ppm, 655 mg/m³
**Check with your supplier to determine if there are additions, contaminants, or impurities (such as benzene) that are present in reportable quantities per 29 CFR 1910.		**Toxicity Data**** Human, Inhalation, TC_{Lo}: 200 ppm Man, Inhalation, LC_{Lo}: 10000 ppm/6 Hrs Rat, Oral, LD_{50}: 4300 mg/kg
*** Immediately dangerous to life and health.		
**** See NIOSH, *RTECS* (No. ZE2100000), for additional data with references to reproductive, irritative, and mutagenic effects.		

SECTION 3. PHYSICAL DATA

Boiling Point: 275°F to 293°F (135°C to 145°C)*
Melting Point: -13°F (-25°C)
Evaporation Rate: 0.6 Relative to BuAc = 1
Specific Gravity (H_2O = 1): 0.86

Water Solubility (%): Insoluble
Molecular Weight: 106 Grams/Mole
% Volatile by Volume: Ca 100
Vapor Pressure: 7 to 9 Torrs at 68°F (20°C)
Vapor Density (Air = 1): 3.7

Appearance and Odor: A clear liquid; aromatic hydrocarbon odor.

*Materials with wider and narrower boiling ranges are commercially available.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
81°F to 90°F (27°C to 32°C)	867°F (464°C)	% by Volume	1%	7%

Extinguishing Media: Use foam, dry chemical, or carbon dioxide. Use water sprays to reduce the rate of burning and to cool containers.

Unusual Fire or Explosion Hazards: Xylene vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flashback.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Xylene is stable in closed containers during routine operations. It does not undergo hazardous polymerization.

Chemical Incompatibilities: This material may react dangerously with strong oxidizers.

Conditions to Avoid: Avoid any exposure to sources of ignition and to strong oxidizers.

Hazardous Products of Decomposition: Carbon monoxide (CO) may be evolved during xylene fires.

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SECTION 6. HEALTH HAZARD INFORMATION

Xylene is not listed as a carcinogen by the IARC, NTP, or OSHA.

Summary of Risks: Liquid xylene is a skin irritant and causes erythema, dryness, and defatting; prolonged contact may cause blistering. Inhaling xylene can depress the central nervous system (CNS), and ingesting it can result in gastrointestinal disturbance; and possibly hematemesis (vomiting blood). Effects on the eyes, kidneys, liver, lungs, and the CNS are also reported. **Medical Conditions Aggravated by Long-Term Exposure:** Problems with eyes, skin, central nervous system, kidneys, and liver may be worsened by exposure to xylene. **Target Organs:** CNS, eyes, gastrointestinal tract, blood, liver, kidneys, skin. **Primary Entry:** Inhalation, skin contact/absorption. **Acute Effects:** Dizziness; excitement; drowsiness; incoordination; staggering gait; irritation of eyes, nose, and throat; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; and dermatitis. **Chronic Effects:** Reversible eye damage, headache, loss of appetite, nervousness, pale skin, and skin rash.

FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Immediately wash the affected area with soap and water. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have a trained person administer oxygen. **Ingestion.** Never give anything by mouth to someone who is unconscious or convulsing. Vomiting may occur spontaneously, but do not induce it. If vomiting should occur, keep exposed person's head below his or her hips to prevent aspiration (breathing the liquid xylene into the lungs). Severe hemorrhagic pneumonitis with grave, possibly fatal, pulmonary injury can occur from aspiring very small quantities of xylene.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. If exposure is severe, hospitilization for at least 72 hours with careful monitoring for delayed onset of pulmonary edema is recommended.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately. Cleanup personnel need *protection against* contact with and inhalation of xylene vapor (see sect. 8). Contain large spills and collect waste or absorb it with an ine material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U239

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), section 311 (b) (9)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield as a supplementary protective measure. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOS approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** A purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets etc., as required by the specifics of the work operation to prevent prolonged or repeated skin contact with xylene. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of xylene below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of xylene into general work areas by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make eyewash stations, safety/quick-drench showers, and washing facilities available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean xylene from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale xylene vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store xylene in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect *containers from physical damage.*

Special Handling/Storage: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design Ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, producing, and sampling operations.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Xylene
DOT ID No. UN1307
DOT Label: Flammable Liquid
DOT Hazard Class: Flammable Liquid
IMO Label: Flammable Liqu
IMO Class: 3.2 or 3.3

References: 1, 2, 12, 73, 84-94, 100, 103.

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APPENDIX D

INCIDENT REPORT FORM

APPENDIX D
FORM HS-502
HAZARDOUS WASTE INCIDENT REPORT

DATE _____ PROJECT/LOCATION _____ BUSINESS UNIT _____

DESCRIPTION OF INCIDENT, INCLUDING INJURIES, PROPERTY DAMAGE AND EMERGENCY ACTION TAKEN AND PERSONNEL INVOLVED (use additional sheets if needed):

WITNESSES OF INCIDENT:

POSSIBLE OR KNOWN CAUSES:

WHAT ACTIONS ARE NEEDED TO PREVENT A SIMILAR INCIDENT?

REPORTER _____ BUSINESS UNIT SAFETY OFFICER _____

PROJECT MANAGER _____ CORPORATE HEALTH AND SAFETY OFFICER _____

APPENDIX E

HNU PHOTOIONIZATION DETECTOR

APPENDIX E

HNU PHOTOIONIZATION DETECTOR (MODEL PI 101)

The instrument is turned to the battery check position first. Assuming proper charge, the main control switch is set to the standby position using the zero knob. The instrument is then allowed to warm up for above five minutes in the standby mode. The calibration gas (usually isobutylene from the HNU factory) is attached. The proper range setting is selected (usually 0-200 ppm) and the calibration gas turned on.

The gas flows through a critical orifice which reduces its flow rate to the proper rate for calibration purposes. The normal factory calibration of this instrument is for benzene in air. Isobutylene is used for normal calibration because it is less toxic. The relative response of isobutylene as compared to benzene is about 70 percent with the 10.2 eV and 11.7 eV lamps (there is a slight difference between the relative response of the two different energy probes, but it is not considered significant for most field calibration purposes). Accordingly, a bottle of isobutylene calibration gas that contains 100 ppm isobutylene will read out as about 70 ppm on a factory calibrated instrument. A bottle of factory calibration gas will state the proper readout on the instrument "as benzene".

If the instrument does not calibrate exactly, the span pot knob is normally adjusted to bring the instrument into calibration. The normal "factory" settings are 9.8 for the 10.2 eV lamp and 5.90 for the 11.7 eV lamp. If the instrument cannot be brought into calibration by using the span pot, the lamp may need to be cleaned or other maintenance items performed so that the unit will calibrate accurately.

APPENDIX H

GROUNDWATER MONITORING DATA

Contents of Appendix H:

- **Table H-1 Data Locator and Impact Summary**
- **Table H-2 Constituents of Concern**
- **Table H-3 Cross Reference to TCL Compounds**
- **Table H-4 Groundwater Data Level Measurements**
- **Table H-5 The Data**

(Note that the compounds are not organized in alphabetical order. Refer to the Data Locator to find the appropriate "H" page.)

Note: The data in Appendix H is data from wells MW-1A, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14 and MW-15. It does not include data from RFI investigations or the new wells MW-1C, MW-10C, MW-12C, MW-17A, MW-17B, MW-18A and MW-18B, since the data from those temporary and permanent wells is included in the body of the GWA Report.

APPENDIX H – TABLE H-1

DATA LOCATOR AND IMPACT SUMMARY
MW1A, MW2, MW3, MW4, MW5, MW6, MW7, MW8, MW9, MW10, MW11, MW12, MW13, MW14, MW16

(Note: Data of PZ series of wells and new wells MW-1C, MW-10C, MW-12C, MW-17A, MW-17B, MW-18A, and MW-18C is found in the body of the report.)

Compound	Data Summarized on Page	Well Impacted Well Number (Con. Range in ppb)
Arsenic	H-21A, H-22A, H-21B, H-22B, H-21C, H-22C	1A (ND-54), 2 (ND-26), 3 (ND-22), 4 (ND-8.9), 5 (ND-70), 6 (ND-15), 7 (ND-30), 8 (ND-80), 9 (ND-9), 10 (ND-15), 11 (ND-12), 12 (ND-20), 13 (ND-32), 14 (ND-7), 16 (ND-21)
Dinitrobutylphenol (Dinoseb)	H-37A, H-38A, H-37B, H-38B, H-37C, H-38C	1A (2.34-5500), 2 (ND-32), 4 (ND-5.1), 5 (ND-12.0), 6 (ND-75.0), 7 (ND-4.5), 8 (ND-0.686), 9 (ND-11.4), 10 (ND-0.836), 11 (ND-29), 12 (ND-0.91), 13 (ND-1.21), 14 (ND-4.1), 16 (ND-0.391)
Toxaphene	H-51A, H-52A, H-51B, H-52B, H-51C, H-52C	6 (ND-25.0), 7 (ND-2.77), 11 (ND-2.22)
Acetone	H-18A, H-18B, H-18C, H-18D	None – Lab artifacts noted
Acrolein	H-19A, H-19B	None
Acrylonitrile	H-20A, H-20B, H-20C, H-20D	None
Benzene	H-23A, H-23B, H-23C, H-23D	None
Bromochloromethane	H-43C, H-43D	None
Bromodichloromethane	H-24A, H-24B, H-24C, H-24D	None
Bromoform	H-25A, H-25B, H-25C, H-25D	None
Bromomethane	H-26A, H-26B, H-26C, H-26D	None
2-Butanone (MEK)	H-14A, H-14B, H-14C, H-14D	None
Carbon Disulfide	H-27A, H-27B, H-27C, H-27D	None
Carbon Tetrachloride	H-28A, H-28B, H-28C, H-28D	None
Chlorobenzene	H-29A, H-29B, H-29C, H-29D	None

CONSTITUENTS OF CONCERN – TABLE H-2
(DETERMINED FROM TABLE H-1)

Constituent	Monitor Wells With More Than One "Hit"	Comment	Likely Original Source of Impact
Special List			
Arsenic	1A, 5, 7, 8, 12	Concentrations in Wells 3 and 4 are good indicators of background concentration of arsenic.	SWMU 11 (Former MSMA Production Area)
Dinoseb	1A, 5, 6, 7, 9, 11	Concentrations reported in Well 4 are a good indication of cross contamination error (sampling or lab).	SWMU 20 (Railroad Car Unloading) SWMU 7 (Former Dinoseb Production Area) SWMU 2 (Inactive Landfill) SWMU 3 (Surface Impoundment)
Toxaphene	6	Not a likely groundwater contaminant	SWMU 2 (Inactive Landfill)
TCL Volatiles			
Chloroform	1A, 12, 13		Unknown
1,2-Dichlorobenzene	1A		Unknown
1,2-Dichloroethene	2		Unknown
Trichloroethene	1A, 2, 11		Unknown
Vinyl Chloride	6, 8		Unknown
TCL Semivolatiles			
Insufficient Data To Date			
Pesticide/PCBs			
Insufficient Data to Date Other Than Toxaphene (see Special List Above)			
TAL (Metals)			
Insufficient Data To Date Other Than Arsenic (see Special List Above)			

APPENDIX H – TABLE H-1 (Continued)

DATA LOCATOR AND IMPACT SUMMARY (Continued)
MW1A, MW2, MW3, MW4, MW5, MW6, MW7, MW8, MW9, MW10, MW11, MW12, MW13, MW14, MW16

Compound	Data Summarized on Page	Well Impacted Well Number (Con. Range in ppb)
Chloroethane	H-31A, H-31B, H-31C, H-31D	None
2-Chloroethylvinyl Ether	H-15A, H-15B	None
Chloroform	H-32A, H-32B, H-32C, H-32D	1A (ND-4), 12 (ND-1.37), 13 (ND-1.21), 14 (ND-1.43)
Chloromethane	H-33A, H-33B, H-33C, H-33D	None
Chlorodibromomethane	H-30A, H-30B	None
1,2 Dicromo-3-chloropropane	H-58C	None
Dibromoethane	H-35A, H-35B, H-36C, H-36D	None
Dichlorobenzene	H-56C	1A (ND-2.75), 2 (ND-1.42)
Dichlorodifluoromethane	H-36A, H-36B	None
1,1-Dichloroethane	H-10A, H-10B, H-10C, H-10D	None
1,2-Dichloroethane	H-11A, H-11B, H-11C, H-11D	None
1,1-Dichloroethene	H-53B, H-53C, H-53D	9 (ND-1.25), 13 (ND-1.01)
Cis 1,2 dichloroethene	H-54B, H-54C, H-54D	2 (ND-6)
Trans 1,2-Dichloroethene	H-55B, H-55C, H-55D	2 (ND-1.36)
1,2-Dichloropropane	H-59C	None
Cis-1,3-Dichloropropene	H-34A, H-34B, H-34C, H-34D	None
Trans-1,3-Dichloropropene	H-1A, H-1B, H-1C, H-1D	None
1,4-Dichloro-2-Butene	H-13A, H-13B, H-13C, H-13D	None
Ethyl Benzene	H-40A, H-40B, H-40C, H-40D	None
Ethyl Methacrylate	H-41A, H-41B, H-41C, H-41D	None
2-Hexanone	H-14A, H-14B, H-14C, H-14D	None
Iodomethane	H-42A, H-42B, H-42C, H-42D	None

APPENDIX H – TABLE H-1 (Continued)

DATA LOCATOR AND IMPACT SUMMARY (Continued)
MW1A, MW2, MW3, MW4, MW5, MW6, MW7, MW8, MW9, MW10, MW11, MW12, MW13, MW14, MW16

Compound	Data Summarized on Page	Well Impacted Well Number (Con. Range in ppb)
Methylene Chloride	H-45A, H-46A, H-45B, H-46B, H-45C, H-46C	None – Lab artifacts noted
4-Methyl-2-Pentanone	H-17A, H-17B, H-17C, H-17D	None
Styrene	H-47A, H-47B, H-47C, H-47D	None
1,1,1,2 Tetrachloroethane	H-57C	None
1,1,2,2-Tetrachloroethane	H-8A, H-8B, H-8C, H-8D	None
Tetrachloroethene (PCE)	H-48A, H-48B, H-48C, H-48D	None
Toluene	H-49A, H-49B, H-49C, H-49D	13 (ND-4.47)
1,1,1-Trichloroethane	H-7A, H-7B, H-7C, H-7D	None
1,1,2-Trichloroethane	H-9A, H-9B, H-9C, H-9D	None
Trichloroethene	H-3A, H-3B, H-3C, H-3D	1A (ND-13), 2 (ND-2.16), 5 (ND-79), 6 (ND-9.03), 11 (ND-28.3), 14 (ND-7.29)
Trichlorofluoromethane	H-2A, H-2B, H-2C, H-2D	None
1,2,3-Trichloropropane	H-12A, H-12B, H-12C, H-12D	None
Vinyl Acetate	H-4A, H-4B, H-4C, H-4D	None
Vinyl Chloride	H-5A, H-5B, H-5C, H-5D	6 (ND-4), 8 (1-5)
Total Xylenes	H-6A, H-6B, H-6C, H-6D	1A (ND-5), 5 (ND-10), 6 (ND-7), 9 (ND-3.51), 12 (ND-5)

APPENDIX H – TABLE H-3

CROSS REFERENCE TO TARGET COMPOUND LIST (TCL) VOLATILES MW1A, MW2, MW3, MW4, MW5, MW6, MW7, MW8, MW9, MW10, MW11, MW12, MW13, MW14, MW16

Compound	Data Summarized on Page
Volatile Organics	
Chloromethane	H-33A, H-33B, H-33C, H-33D
Bromomethane	H-26A, H-26B, H-26C, H-26D
Vinyl Chloride	H-5A, H-5B, H-5C, H-5D
Chloroethane	H-31A, H-31B, H-31C, H-31D
Methylene Chloride	H-45A, H-46A, H-45B, H-46B, H-45C, H-46C
Acetone	H-18A, H-18B, H-18C, H-18D
Carbon Disulfide	H-27A, H-27B, H-27C, H-27D
1,1-Dichloroethane	H-10A, H-10B, H-10C, H-10D
1,2-Dichloroethane	H-11A, H-11B, H-11C, H-11D
1,2-Dichloroethene (Total)	H-54B, H-54C, H-54D, H-55B, H-55C, H-55D
Chloroform	H-32A, H-32B, H-32C, H-32D
1,2-Dichloroethane	H-11A, H-11B, H-11C, H-11D
2-Butanone	H-14A, H-14B, H-14C, H-14D
1,1,1-Trichloroethane	H-7A, H-7B, H-7C, H-7D
Carbon Tetrachloride	H-28A, H-28B, H-28C, H-28D
Vinyl Acetate	H-4A, H-4B, H-4C, H-4D
Bromodichloromethane	H-24A, H-24B, H-25C, H-25D
1,2-Dichloropropane	H-59C
Cis-1,3-Dichloropropane	H-34A, H-34B, H-34C, H-34D
Trichloroethene	H-3A, H-3B, H-3C, H-3D
Dibromochloromethane	H-30A, H-30B, H-30C, H-30D
1,1,2-Trichloroethane	H-9A, H-9B, H-9C, H-9D
Benzene	H-23A, H-23B, H-23C, H-23D
Bromoform	H-25A, H-25B, H-25C, H-25D
4-Methyl-2-pentanone	H-17A, H-17B, H-17C, H-17D
2-Hexanone	H-16A, H-16B, H-16C, H-16D
Tetrachloroethene	H-48A, H-48B, H-48CH-48D
Toluene	H-49A, H-49BH, H-49C, H-49D
1,1,2,2-Tetrachloroethane	H-8A, H-8B, H-8C, H-8D

APPENDIX H – TABLE H-4

GROUNDWATER DATA LEVEL MEASUREMENTS

Piezometer or Well Number	Casing Elevation (ft msl)	Bottom Elevation (ft msl)	Top of Screen (ft msl)	Groundwater Elevation (ft msl)												
				11-93	9-93	3-94	3-95	11-95	3-96	6-96	8-96	11-97	6-98	9-98	12-98	3-99
MW 1 A	113.01	83.01	93.51	108.39	104.78	108.54	108.59	107.53	107.32	108.54	108.96	108.11	108.24	107.68	109.35	108.43
MW 2	108.21	68.21	78.71	98.87	95.91	101.85	100.49	95.34	99.53	99.35	99.17	95.85	99.27	97.17	101.29	102.02
MW 3	99.33	69.33	79.83													
MW 4	114.70	94.70	105.20	106.89	105.58	108.41	107.71	105.4	106.72	107.3	106.36	103.22	106.69	105.4	107.01	107.01
MW 5	100.30	80.30	85.80	84.01	83.14	89.39	85.8	82.66	88.54	90.82	83.73	82.96	81.67	80.75	82.5	82.5
MW 6	100.76	73.78	79.28	86.48	85.52	91.39	88.96	84.12	87.82	90.64	85.95	84.27	87.05	83.3	85.53	90.38
MW 7	99.66	69.33	74.83	92.39	89.96	95.05	94.93	87.13	93.33	95.61	91.18	87.4	91.05	86.14	88.05	94.57
MW 8	110.83	80.83	86.33	103.14	100.87	104.08	103.71	100.77	103.43	103.11	103.00	101.61	101.91	101.60	103.20	104.49
MW 9	116.02	58.02	73.02	110.89	108.17	112.03	111.82	110.43	111.35	111.36	111.15	111.02	109.22	109.41	111.14	112.31
MW 10	114.73	61.73	74.73	107.40	104.58	108.92	108.78	107.27	108.38	108.65	107.98	106.73	106.61	106.53	109.07	109.86
MW 11	105.62	57.62	70.62	98.16	95.69	98.96	97.43	97.64	98.03	98.53	98.04	97.18	96.31	95.9	98.9	98.19
MW 12	112.06	64.56	80.06	109.32	105.09	110.83	110.6	108.17	109.59	109.89	109.07	107.64	106.36	107.09	109.57	110.57
MW 13	113.52	63.52	73.52	109.51	107.55	110.62	110.17	109.14	109.86	109.82	109.85	109.19	107.68	108.77	110.27	111.19
MW 14	113.9	57.9	67.9	107.64	105.22	108.27	107.86	107.22	107.09	107.58	108.01	107.61	106.48	105.65	108.36	108.11
MW 15	Plugged and abandoned during surface impoundment retrofit															
MW 16	111.84	58.84	68.84	108.84	106.53	110.09	109.76	108.7	109.5	109.59	109.39	107.94	108.59	108.09	109.67	109.92
PZ 12A (R)	137.87	66.97	72.97	107.64												
PZ 12B (R)	137.27	105.27	111.27	123.48												
PZ 19A	140.34	64.34	70.34	107.59												
PZ 19B	140.22	120.22	126.22	124.46												
PZ 20A	136.25	65.25	71.25	107.68												
PZ 20B	136.43	103.43	109.43	114.50												
PZ 21A	115.22	61.22	67.22	107.75												
PZ 22A	112.71	61.71	67.71	107.11												
PZ 22B	113.51	88.17	94.17	108.17												
PZ 23A	112.49	66.49	72.49	107.27												
PZ 23B	113.10	91.10	97.10	109.79												
PZ 24B	113.16	85.16	91.16	107.21												
PZ 25B	113.96	77.96	83.96	110.44												

APPENDIX H – TABLE H-3 (Continued)

CROSS REFERENCE TO TARGET COMPOUND LIST (TCL) VOLATILES MW1A, MW2, MW3, MW4, MW5, MW6, MW7, MW8, MW9, MW10, MW11, MW12, MW13, MW14, MW16

Compound	Data Summarized on Page
Chlorobenzene	H-29A, H-29B, H-29C, H-29D
Ethyl Benzene	H-40A, H-40B, H-40C, H-40D
Styrene	H-47A, H-47B, H-47C, H-47D
Xylenes (Total)	H-6A, H-6B, H-6C, H-6D

APPENDIX H – TABLE H-5

THE DATA

Vicksburg Chemical Corporation
Groundwater Monitoring for **trans-1,3-Dichloropropene (µg/l)**
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **trans-1,3-Dichloropropene (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation

Groundwater Monitoring for **trans-1,3-Dichloropropene (µg/l)**

September 1993 - August 1996

Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **trans-1,3-Dichloropropene (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **trans-1,3-Dichloropropene (µg/l)**
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW3	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **trans-1,3-Dichloropropene (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
March 1997	ND	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND

.Vicksburg Chemical Corporation

Groundwater Monitoring for **trans-1,3-Dichloropropene (µg/l)**

2000, 2001

Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW3	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **trans-1,3-Dichloropropene (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
June 2000	ND	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichlorofluoromethane (µg/l)**
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NTQ
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichlorofluoromethane (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichlorofluoromethane (µg/l)**
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichlorofluoromethane (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1994	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichlorofluoromethane (µg/l)**
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichlorofluoromethane (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichlorofluoromethane (µg/l)**
2000, 2001
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichlorofluoromethane (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichloroethene (µg/l)**
June 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
June 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Sept 1991	11	2	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	9	2	NT	NT	BDL	BDL	NT	NT
Nov 1991	10	2J	NT	NT	BDL	BDL	NT	NT
Dec 1991	9	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	13	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	9	2	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	8	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	12	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	9	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichloroethene (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
June 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.1
Sept 1991	BDL	BDL	20	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	14	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	16	BDL	BDL	BDL	BDL	
Mar 1992	BDL	BDL	18	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	13	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	20	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	25	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	27	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested
J Result is less than quantitation limit but greater than zero

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichloroethene (µg/l)**
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	9	2	ND	ND	ND	ND	ND
Dec 1993	10.8	1.7	ND	ND	ND	ND	ND
April 1994	12.9	1.42	ND	ND	ND	ND	ND
June 1994	10.0	1.62	ND	ND	ND	ND	ND
Aug 1994	11.7	1.6	ND	ND	ND	ND	ND
Dec 1994	9.92	1.78	ND	ND	ND	ND	ND
March 1995	12.9	1.59	ND	ND	ND	ND	ND
May 1995	9.17	1.44	ND	ND	ND	ND	ND
Sept 1995	10.4	1.50	ND	ND	ND	ND	ND
Nov 1995	11.3	1.50	ND	ND	ND	ND	ND
March 1996	9.97	1.51	ND	79.0	9.03	ND	ND
June 1996	9.75	1.25	ND	ND	ND	ND	ND
Aug 1996	11.0	1.52	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichloroethene (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	26	ND	ND	ND	ND
Dec 1993	ND	ND	24.2	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	25.2	ND	ND	ND	ND
Dec 1994	ND	ND	25.5	ND	ND	ND	ND
March 1995	ND	ND	26.7	ND	ND	ND	ND
May 1995	ND	ND	28.3	ND	ND	ND	ND
Sept 1995	ND	ND	26.4	ND	ND	ND	ND
Nov 1995	ND	ND	23.2	ND	ND	ND	ND
March 1996	ND	ND	23.8	ND	ND	ND	ND
June 1996	ND	ND	23.4	ND	ND	ND	ND
Aug 1996	ND	ND	26.5	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichloroethene (µg/l)**
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	8	ND	ND	ND	ND	ND	ND
June 1997	8.06	1.1	ND	ND	ND	ND	ND
August 1997	9.7	1.57	ND	ND	ND	ND	ND
November 1997	10.1	1.48	ND	ND	ND	ND	ND
March 1998	9.28	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	9	ND	ND	ND	ND	ND	ND
December 1998	11	ND	ND	ND	ND	ND	ND
March 1999	11	ND	ND	ND	ND	ND	ND
June 1999	6	ND	ND	ND	ND	ND	ND
September 1999	8	ND	ND	ND	ND	ND	ND
December 1999	12	ND	ND	ND	ND	ND	ND
March 2000	6	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichloroethene (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	20	ND	ND	ND	ND
June 1997	ND	ND	21.8	ND	ND	ND	ND
August 1997	ND	ND	19.8	ND	ND	ND	ND
November 1997	ND	ND	25.5	ND	ND	ND	ND
March 1998	ND	ND	18.1	ND	ND	ND	ND
June 1998	ND	ND	18.8	ND	ND	ND	ND
September 1998	ND	ND	18	ND	ND	ND	ND
December 1998	ND	ND	21	ND	ND	ND	ND
March 1999	ND	ND	19	ND	ND	ND	ND
June 1999	ND	ND	16	ND	ND	ND	ND
September 1999	ND	ND	22	ND	ND	ND	ND
December 1999	ND	ND	22	ND	ND	ND	ND
March 2000	ND	ND	11	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichloroethene (µg/l)**
2000, 2001
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	6.55	1.42	ND	ND	ND	ND	ND
September 2000	5.6	1.5	ND	ND	ND	ND	ND
December 2000	7.52	2.16	ND	ND	ND	ND	ND
March 2001	8.03	1.14	ND	ND	ND	ND	ND
June 2001	7.12	1.2	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Trichloroethene (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	14	ND	ND	ND	ND
September 2000	ND	ND	13.9	ND	ND	ND	ND
December 2000	ND	ND	10.6	ND	ND	7.29	ND
March 2001	ND	ND	17	ND	ND	7.29	ND
June 2001	ND	ND	13.7	ND	ND	7.29	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Acetate (µg/l)**
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Acetate (µg/l)**

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	50
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Acetate** (µg/l)
September 1993 -August 1996
Detection Limit: 2 µg/l

Sampling Well	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND	ND
March 1994	ND	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Acetate** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Acetate** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Well	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Acetate** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Acetate** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Well	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Acetate** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Chloride** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	3	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	4	ND	ND
Nov 1991	BDL	BDL	NT	NT	BDL	3J	ND	ND
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	4
Dec 1992	BDL	BDL	NT	BDL	BDL	2	BDL	2
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Chloride** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	10
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested
J Result is less than quantitation limit but greater than zero

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Chloride** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Chloride** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Chloride** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Chloride** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Chloride** (µg/l)
2000, 2001
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Vinyl Chloride** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total Xylenes** (µg/l)
September 1991 - July 1996

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	10	7	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	5	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total Xylenes** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	4
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
Sept 1992	BDL	BDL	BDL	5	BDL	BDL	BDL	4
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total Xylenes** (µg/l)
September 1993 - August 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total Xylenes** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total Xylenes** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total Xylenes** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total Xylenes** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total Xylenes** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	3.51	ND	ND	ND	ND	ND	ND
September 2000	3.51	ND	ND	ND	ND	ND	ND
December 2000	3.51	ND	ND	ND	ND	ND	ND
March 2001	3.51	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,1-Trichloroethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,1-Trichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,1,1-Trichloroethane** (µg/l)

September 1993 - August 1993

Detection Limit: 5 µ/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,1,1-Trichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,1-Trichloroethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 5 µ/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,1-Trichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,1-Trichloroethane** (µg/l)
2000, 2001
Detection Limit: 5 µ/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,1-Trichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)
September 1993 - August 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Oct 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1994	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,1,2-Trichloroethane** (µg/l)

September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,1,2-Trichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2

NOTES:

BDL Below Detection Limit

NT Not Tested

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,1,2-Trichloroethane** (µg/l)

September 1993 - August 1996

Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,1,2-Trichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2-Trichloroethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2-Trichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1,2-Trichloroethane** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for 1,1,2-Trichloroethane (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)
September *1991* - *July 1993*

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for 1,1-Dichloroethane (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	*MW 1A*	*MW 2*	*MW 4*	*MW 5*	*MW 6*	*MW 7*	*MW 8*
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)
2000, 2001
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2,3-Trichloropropane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2,3-Trichloropropane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2,3-Trichloropropane** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2,3-Trichloropropane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2,3-Trichloropropane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2,3-Trichloropropane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2,3-Trichloropropane** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2,3-Trichloropropane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,4-Dichloro-2-butene** (µg/l)

September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,4-Dichloro-2-butene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit

NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,4-Dichloro-2-butene** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,4-Dichloro-2-butene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,4-Dichloro-2-butene** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,4-Dichloro-2-butene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,4-Dichloro-2-butene** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,4-Dichloro-2-butene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Butanone (MEK)** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Butanone (MEK)** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	3
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	100
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Butanone (MEK)** (µg/l)
September 1993 - August 1996

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Butanone (MEK)** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Butanone (MEK)** (µg/l)
1997, 1998, 1999, 2000

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Butanone (MEK)** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Butanone (MEK)** (µg/l)
2000, 2001

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Butanone (MEK)** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Chloroethyl Vinyl Ether** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	4	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Chloroethyl Vinyl Ether** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	10
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Chloroethyl Vinyl Ether** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	4	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Chloroethyl Vinyl Ether** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Hexanone** (µg/l)
September 1991 - July 1996

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Hexanone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	3
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	50
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Hexanone** (µg/l)
September 1993 - August 1996
Detection Limit: 3 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Hexanone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Hexanone** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 3 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Hexanone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Hexanone** (µg/l)
2000, 2001
Detection Limit: 3 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **2-Hexanone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **4-Methyl-2-Pentanone** (µg/l)

September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitoring for **4-Methyl-2-Pentanone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	3
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	50
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3

NOTES:

BDL Below Detection Limit

NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **4-Methyl-2-Pentanone** (µg/l)
September 1993 - August 1996
Detection Limit: 3 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **4-Methyl-2-Pentanone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **4-Methyl-2-Pentanone** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 3 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **4-Methyl-2-Pentanone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **4-Methyl-2-Pentanone** (µg/l)
2000, 2001
Detection Limit: 3 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **4-Methyl-2-Pentanone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acetone** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	**100**	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acetone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	**116**	BDL	BDL	10
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	10
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	50
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10

NOTES:

BDL Below listed detection limit
NT Not tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acetone** (µg/l)
September 1993 - August 1996
Detection Limit: 10 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	14	ND	ND	ND	ND	18
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acetone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acetone** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 10 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	14	ND	ND	ND	ND	18
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acetone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acetone** (µg/l)
2000, 2001
Detection Limit: 10 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	11.1	11.2	15.2	ND	ND	ND	10.6
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acetone** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	10.7	10.7	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrolein** (µg/l)
September 1991 - December 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrolein** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	100
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Dec 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100

NOTES:

BDL Below listed detection limit
NT Not tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrolein** (µg/l)
September 1993 - August 1996
Detection Limit: 100 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrolein** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrylonitrile** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrylonitrile** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	100
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100

NOTES:

BDL Below listed detection limit
NT Not tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrylonitrile** (µg/l)
September 1993 - August 1996

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrylonitrile** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrylonitrile** (µg/l)
1997, 1998, 1999, 2000

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Acrylonitrile** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Acrylonitrile** (µg/l) 2000, 2001							
Sampling Date	**MW 1A**	**MW 2**	**MW 4**	**MW 5**	**MW 6**	**MW 7**	**MW 8**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Acrylonitrile** (µg/l)							
Sampling Date	**MW 9**	**MW 10**	**MW 11**	**MW 12**	**MW 13**	**MW 14**	**MW 16**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitor Results for **Arsenic**, Total (mg/l)
December 1981 - July 1993
Detection Limit: 0.005 µg/l

Sampling Date	MW 1	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7
Dec 1981	**0.015**	NT	NT	**0.003**	NT	NT	NT	NT
April 1982	**0.003**	NT	**0.003**	**0.0048**	**0.0039**	NT	NT	NT
Jan 1983	NT	NT	**0.002**	**0.018**	**0.0089**	NT	NT	NT
Jan 1985	NT	NT	NT	NT	NT	NT	NT	NT
July 1985	BDL	NT	BDL	BDL	BDL	**0.019**	**0.015**	**0.030**
June 1987	NT	NT	NT	NT	NT	NT	NT	NT
Sept 1987	NT	**0.054**	BDL	NT	BDL	BDL	**0.003**	**0.010**
Nov 1987	NT	NT	NT	**0.022**	NT	NT	NT	NT
Dec 1987	NT	**0.003**	**0.003**	NT	BDL	**0.007**	**0.005**	**0.013**
Mar 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	**0.005**
June 1988	NT	BDL	BDL	NT	BDL	0.006	BDL	**0.009**
Aug 1988	NT	**0.003**	**0.003**	NT	**0.006**	NT	**0.007**	**0.012**
Dec 1988	NT	BDL	BDL	NT	BDL	**0.010**	**0.003**	**0.014**
Mar 1989	NT	**0.009**	**0.005**	NT	**0.007**	**0.009**	**0.012**	**0.020**
June 1989	NT	BDL	BDL	NT	**0.003**	BDL	BDL	BDL
Sept 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Nov 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	**0.008**
Mar 1990	NT	BDL	BDL	NT	BDL	BDL	**0.005**	**0.011**
June 1990	NT	**0.003**	BDL	NT	BDL	BDL	BDL	**0.006**
Sept 1990	NT	BDL	BDL	NT	BDL	NT	BDL	BDL
Dec 1990	NT	**0.003**	**0.003**	NT	BDL	BDL	BDL	BDL
Mar 1991	NT	BDL	BDL	NT	BDL	BDL	BDL	**0.009**
June 1991	NT	BDL	BDL	NT	BDL	BDL	BDL	**0.010**
Sept 1991	NT	BDL	BDL	NT	BDL	**0.012**	BDL	**0.011**
Dec 1991	NT	BDL	BDL	BDL	BDL	**0.008**	BDL	**0.009**
Mar 1992	NT	BDL	BDL	BDL	BDL	**0.006**	BDL	**0.011**
Sept 1992	NT	BDL	BDL	NT	BDL	**0.005**	BDL	**0.014**
Dec 1992	NT	BDL	BDL	NT	BDL	**0.008**	BDL	**0.020**
April 1993	NT	BDL	BDL	NT	BDL	BDL	BDL	**0.012**
July 1993	NT	BDL	BDL	NT	BDL	**0.008**	BDL	**0.014**

Vicksburg Chemical Corporation
Groundwater Monitor Results for **Arsenic**, Total (mg/l)
September 1993 - August 1996
Detection Limit: 0.005 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7
Sept 1993	ND	ND	ND	0.009	0.007	0.02
Dec 1993	ND	0.008	ND	0.005	ND	0.004
April 1994	ND	ND	ND	0.009	ND	0.008
June 1994	ND	ND	ND	0.009	ND	0.004
Aug 1994	ND	ND	ND	0.005	ND	0.008
Dec 1994	ND	ND	ND	0.018	ND	0.012
March 1995	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	0.014	ND	0.006
Sept 1995	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	0.070	ND	0.015
June 1995	ND	ND	ND	0.009	ND	0.011
Aug 1996	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitor Results for **Arsenic**, Total (mg/l)
1997, 1998, 1999, 2000, 2001
Detection Limit: 0.005 mg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7
March 1997	ND	ND	ND	ND	ND	0.011
June 1997	ND	ND	ND	0.022	ND	ND
August 1997	ND	ND	ND	0.04	ND	0.005
November 1997	ND	ND	ND	ND	ND	ND
March 1998	0.0013	0.0013	0.0007	0.0059	ND	0.0051
June 1998	0.0025	0.0026	0.003	ND	0.0039	0.113
September 1998	ND	ND	ND	ND	0.006	0.011
December 1998	ND	ND	0.005	ND	0.008	0.019
March 1999	ND	ND	ND	ND	ND	0.010
June 1999	ND	0.005	ND	ND	ND	0.014
September 1999	ND	ND	ND	ND	0.014	0.053
December 1999	ND	ND	ND	ND	0.009	0.025
March 2000	ND	ND	ND	ND	0.008	0.011
June 2000	ND	ND	ND	ND	ND	0.009
September 2000	ND	ND	ND	ND	ND	0.019
December 2000	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	0.009
June 2001	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for Arsenic, Total (mg/l)

December 1981 - July 1993

Detection Limit: 0.005 µg/l

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 15	MW 16
Dec 1981	NT	NT	NT	NT	NT	NT	NT	NT	NT
April 1982	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan 1983	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan 1985	NT	NT	NT	NT	NT	NT	NT	NT	NT
July 1985	.080	NT	NT	NT	NT	NT	NT	NT	NT
June 1987	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sept 1987	0.017	0.004	BDL	0.010	0.006	0.018	BDL	BDL	NT
Nov 1987	NT	NT	NT	NT	NT	NT	NT	NT	NT
Dec 1987	0.039	0.004	0.005	BDL	0.005	0.023	BDL	0.005	NT
Mar 1988	BDL	BDL	BDL	0.005	BDL	BDL	BDL	0.016	NT
June 1988	0.015	0.003	BDL	0.003	BDL	0.006	BDL	0.007	NT
Aug 1988	BDL	0.006	0.003	0.007	BDL	0.011	0.003	NT	0.010
Dec 1988	0.027	BDL	0.006	0.012	0.005	0.009	0.003	NT	0.006
Mar 1989	0.040	0.009	0.014	0.011	0.020	0.032	0.007	NT	0.021
June 1989	0.007	0.003	0.008	0.008	0.010	0.007	BDL	NT	0.005
Sept 1989	BDL	BDL	BDL	0.003	BDL	BDL	BDL	NT	BDL
Nov 1989	0.033	BDL	0.005	BDL	0.009	BDL	BDL	NT	0.005
Mar 1990	0.040	0.003	0.004	BDL	0.006	0.005	0.003	NT	0.008
June 1990	0.042	0.004	0.005	0.004	0.008	0.008	BDL	NT	BDL
Sept 1990	0.003	BDL	BDL	BDL	BDL	0.004	BDL	NT	0.005
Dec 1990	BDL	BDL	BDL	BDL	0.004	0.014	0.004	NT	0.003
Mar 1991	0.048	BDL	0.015	BDL	0.008	BDL	0.004	NT	0.005
June 1991	0.049	BDL	0.009	BDL	BDL	0.007	0.003	NT	BDL
Sept 1991	0.043	BDL	0.005	BDL	0.008	BDL	BDL	NT	0.005
Dec 1991	0.049	BDL	0.006	BDL	0.011	0.003	BDL	NT	0.005
Mar 1992	0.039	BDL	0.006	BDL	0.009	BDL	BDL	NT	BDL
Sept 1992	0.051	BDL	0.006	BDL	0.017	BDL	BDL	NT	0.005
Dec 1992	0.062	BDL	0.007	BDL	0.013	0.006	BDL	NT	0.008
April 1993	0.040	BDL	0.006	BDL	0.009	0.006	BDL	NT	0.006
July 1993	0.050	BDL	0.006	BDL	0.008	0.005	BDL	NT	0.006

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Arsenic**, Total (mg/l)

September 1993 - August 1996

Detection Limit: 0.005 µg/l

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	0.052	ND	0.007	ND	0.013	ND	ND	0.006
Dec 1993	0.017	ND	ND	ND	ND	ND	ND	ND
April 1994	0.043	ND	0.007	ND	0.009	ND	ND	0.006
June 1994	0.032	ND	0.003	ND	0.004	ND	ND	ND
Aug 1994	0.038	ND	0.002	ND	0.003	0.005	ND	0.002
Dec 1994	ND	ND	ND	ND	ND	ND	ND	ND
March 1995	0.029	ND	0.008	ND	0.012	0.008	ND	0.005
May 1995	0.068	ND	ND	ND	ND	ND	ND	ND
Sept 1995	0.03	ND	ND	ND	ND	0.023	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND	ND
March 1996	0.045	ND	ND	ND	0.012	ND	ND	0.009
June 1996	0.031	ND	0.004	ND	0.008	ND	ND	ND
Aug 1996	0.023	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitor Results for **Arsenic**, Total (mg/l)
1997, 1998, 1999, 2000, 2001
Detection Limit: 0.005 mg/l

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	0.043	ND	0.008	ND	0.011	ND	ND	0.005
June 1997	0.027	ND	ND	0.008	0.008	0.004	ND	0.005
August 1997	0.01	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND	ND
March 1998	0.0329	0.0004	0.0059	0.001	0.0047	0.0036	0.006	0.0044
June 1998	0.0113	0.003	0.008	0.0043	0.0013	0.0101	0.004	0.0022
September 1998	0.042	ND	0.0059	ND	0.0072	ND	ND	ND
December 1998	0.035	ND	0.010	ND	0.012	0.008	ND	0.006
March 1999	0.043	ND	ND	ND	0.011	ND	ND	0.007
June 1999	0.047	ND	0.005	ND	0.005	0.005	ND	0.005
September 1999	0.054	ND	0.005	ND	ND	ND	ND	ND
December 1999	0.053	ND	0.006	ND	ND	0.006	ND	ND
March 2000	0.022	ND	0.005	ND	0.007	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND	ND
March 2001	0.053	0.053	ND	ND	ND	0.006	ND	ND
June 2001	0.038	0.053	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Benzene** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	BDL
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Benzene** (µg/l)
September 1991 - July 1993

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below detection limit
NT Not tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Benzene** (µg/l)
September 1993 - August 1996

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Benzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Benzene** (µg/l)
1997, 1988, 1999, 2000

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Benzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Benzene** (µg/l) 2000, 2001							
Sampling Date	**MW 1A**	**MW 2**	**MW 4**	**MW 5**	**MW 6**	**MW 7**	**MW 8**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Benzene** (µg/l)							
Sampling Date	**MW 9**	**MW 10**	**MW 11**	**MW 12**	**MW 13**	**MW 14**	**MW 16**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromodichloromethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromodichloromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromodichloromethane** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromodichloromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Bromodichloromethane** (µg/l)

1997, 1998, 1999, 2000

Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Bromodichloromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromodichloromethane** (µg/l)
2000, 2001
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromodichloromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromoform** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromoform** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromoform** (µg/l)
September 1993 - August 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromoform** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromoform** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromoform** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromoform** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	*MW 1A*	*MW 2*	*MW 4*	*MW 5*	*MW 6*	*MW 7*	*MW 8*
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromoform** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromomethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	10
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromomethane** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromomethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromomethane** (µg/l)
2000, 2001
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Bromomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Disulfide** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Disulfide** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Disulfide** (µg/l)
September 1993 - August 1996

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Disulfide** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993							
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Disulfide** (µg/l)
1997, 1998, 1999, 2000

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Disulfide** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997							
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Carbon Disulfide** (µg/l) 2000, 2001							
Sampling Date	**MW 1A**	**MW 2**	**MW 4**	**MW 5**	**MW 6**	**MW 7**	**MW 8**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Carbon Disulfide** (µg/l)							
Sampling Date	**MW 9**	**MW 10**	**MW 11**	**MW 12**	**MW 13**	**MW 14**	**MW 16**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Carbon Tetrachloride** (µg/l)

June 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
June 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitoring for **Carbon Tetrachloride** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
June 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.1
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2

NOTES:

BDL Below Detection Limit

NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Tetrachloride** (µg/l)
September 1993 - August 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Tetrachloride** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Tetrachloride** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Tetrachloride** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Tetrachloride** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Carbon Tetrachloride** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chlorobenzene** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chlorobenzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chlorobenzene** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chlorobenzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chlorobenzene** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chlorobenzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Groundwater Monitoring for **Chlorobenzene** (µg/l) 2000, 2001 Detection Limit: 1 µg/l							
Sampling Date	**MW 1A**	**MW 2**	**MW 4**	**MW 5**	**MW 6**	**MW 7**	**MW 8**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Chlorobenzene** (µg/l)							
Sampling Date	**MW 9**	**MW 10**	**MW 11**	**MW 12**	**MW 13**	**MW 14**	**MW 16**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Chlorodibromomethane** (µg/l)

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitoring for **Chlorodibromomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit

NT Not Tested

Vicksburg Chemical Corporation

Groundwater Monitoring for **Chlorodibromomethane** (µg/l)

September 1993 - August 1996

Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Chlorodibromomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Chlorodibromomethane** (µg/l)

1997, 1998, 1999, 2000

Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Chlorodibromomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Groundwater Monitoring for **Chlorodibromomethane** (µg/l) 2000, 2001 Detection Limit: 5 µg/l								
Sampling Date	**MW 1A**	**MW 2**	**MW 3**	**MW 4**	**MW 5**	**MW 6**	**MW 7**	**MW 8**
June 2000	ND	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Chlorodibromomethane** (µg/l)							
Sampling Date	**MW 9**	**MW 10**	**MW 11**	**MW 12**	**MW 13**	**MW 14**	**MW 16**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	10
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroethane** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroethane** (µg/l)
2000, 2001
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 2000	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroform** (µg/l)
June 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
June 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Sept 1991	4	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	4	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	4	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	4	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroform** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
June 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.1
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	4
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroform** (µg/l)
September 1993 - August 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	1.87	ND	ND	ND	ND	ND	ND
April 1994	2.3	ND	ND	ND	ND	ND	ND
June 1994	2.06	ND	ND	ND	ND	ND	ND
Aug 1994	2.0	ND	ND	ND	ND	ND	ND
Dec 1994	1.86	ND	ND	ND	ND	ND	ND
March 1995	2.09	ND	ND	ND	ND	ND	ND
May 1995	1.87	ND	ND	ND	ND	ND	ND
Sept 1995	1.66	ND	ND	ND	ND	ND	ND
Nov 1995	2.30	ND	ND	ND	ND	ND	ND
March 1996	1.43	ND	ND	ND	ND	ND	ND
June 1996	1.41	ND	ND	ND	ND	ND	ND
Aug 1996	1.44	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroform** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	1.2	ND	ND
April 1994	ND	ND	ND	1.37	ND	ND	ND
June 1994	ND	ND	ND	ND	1.28	ND	ND
Aug 1994	ND	ND	ND	ND	1.02	ND	ND
Dec 1994	ND	ND	ND	ND	1.26	ND	ND
March 1995	ND	ND	ND	ND	1.31	ND	ND
May 1995	ND	ND	ND	ND	1.47	ND	ND
Sept 1995	ND	ND	ND	ND	1.59	ND	ND
Nov 1995	ND	ND	ND	ND	1.3	ND	ND
March 1996	ND	ND	ND	ND	1.74	ND	ND
June 1996	ND	ND	ND	ND	1.29	ND	ND
Aug 1996	ND	ND	ND	ND	1.34	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroform** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	1.19	ND	ND	ND	ND	ND	ND
August 1997	1.25	ND	ND	ND	ND	ND	ND
November 1997	1.40	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroform** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	1.09	ND	ND
August 1997	ND	ND	ND	ND	1.43	ND	ND
November 1997	ND	ND	ND	ND	1.43	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroform** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	1.53	ND	ND	ND	ND	ND	ND
June 2001	1.33	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloroform** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	1.13	ND	ND
September 2000	ND	ND	ND	ND	1.19	ND	ND
December 2000	ND	ND	ND	ND	1.21	1.43	ND
March 2001	ND	ND	ND	ND	1.2	1.43	ND
June 2001	ND	ND	ND	ND	1.02	1.43	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloromethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	3	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	5	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	10
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2

NOTES:

BDL **Below Detection Limit**
NT **Not Tested**

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloromethane** (µg/l)
September 1993 - August 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloromethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloromethane** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Chloromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,3-Dichloropropene** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,3-Dichloropropene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,3-Dichloropropene** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,3-Dichloropropene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,3-Dichloropropene** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,3-Dichloropropene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **cis-1,3-Dichloropropene** (µg/l) 2000, 2001 Detection Limit: 1 µg/l							
Sampling Date	**MW 1A**	**MW 2**	**MW 4**	**MW 5**	**MW 6**	**MW 7**	**MW 8**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **cis-1,3-Dichloropropene** (µg/l)							
Sampling Date	**MW 9**	**MW 10**	**MW 11**	**MW 12**	**MW 13**	**MW 14**	**MW 16**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dibromoethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dibromoethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dibromoethane** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	2.66	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dibromoethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dibromoethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	2.66	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dibromoethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dibromoethane** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dibromoethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dichlorodifluoromethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dichlorodifluoromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dichlorodifluoromethane** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dichlorodifluoromethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Dinitrobutyl Phenol** (µg/l)

October 1983 - July 1993

Sampling Date	MW 1	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7
Oct 1983	**117**	NT	BDL	NT	NT	NT	**75.0**	**4.5**
Nov 1983	**1200**	NT	NT	NT	NT	NT	NT	NT
Nov 1983	BDL	BDL	NT	NT	NT	BDL	BDL	BDL
Dec 1984	**1000**	NT	NT	NT	NT	NT	NT	NT
July 1985	**1130**	NT	BDL	BDL	BDL	BDL	BDL	BDL
June 1987	NT	NT	BDL	NT	BDL	BDL	BDL	BDL
Sept 1987	NT	**340**	BDL	NT	BDL	BDL	BDL	BDL
Nov 1987	NT	NT	**32**	BDL	BDL	**12**	NT	BDL
Dec 1987	NT	**5500**	BDL	NT	BDL	BDL	BDL	BDL
Mar 1988	NT	**4000**	BDL	NT	BDL	BDL	BDL	BDL
June 1988	NT	**3500**	BDL	NT	BDL	BDL	BDL	BDL
Aug 1988	NT	ND	BDL	NT	BDL	NT	BDL	BDL
Dec 1988	NT	**61**	BDL	NT	BDL	BDL	BDL	BDL
Mar 1989	NT	**390**	BDL	NT	BDL	BDL	BDL	BDL
June 1989	NT	**103**	BDL	NT	BDL	BDL	BDL	BDL
Sept 1989	NT	**283**	BDL	NT	BDL	BDL	BDL	BDL
Nov 1989	NT	**504**	BDL	NT	BDL	BDL	BDL	BDL
Mar 1990	NT	**371**	BDL	NT	BDL	BDL	BDL	BDL
June 1990	NT	**362**	BDL	NT	BDL	BDL	BDL	BDL
Sept 1990	NT	**441**	BDL	NT	BDL	NT	BDL	BDL
Dec 1990	NT	**164**	BDL	NT	BDL	BDL	BDL	BDL
Mar 1991	NT	**177**	BDL	NT	BDL	BDL	BDL	BDL
June 1991	NT	**297**	BDL	NT	BDL	BDL	BDL	BDL
Sept 1991	NT	**163**	BDL	NT	BDL	BDL	BDL	BDL
Dec 1991	NT	**67**	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	NT	**237**	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	NT	**164J**	BDL	NT	NT	NT	NT	NT
Dec 1992	NT	**84**	BDL	NT	BDL	BDL	BDL	BDL
April 1993	NT	**260**	BDL	NT	BDL	BDL	BDL	BDL
July 1993	NT	**540**	BDL	NT	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Dinitrobutyl Phenol** (µg/l)

September 1993 - August 1996

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7
Sept 1993	160	ND	ND	ND	ND	ND
Dec 1993	2.34	ND	ND	0.23	0.58	ND
April 1994	127.6	ND	ND	ND	ND	ND
June 1994	161.5	ND	ND	ND	1.6	ND
Aug 1994	288.0	ND	ND	0.32	0.24	ND
Dec 1994	ND	ND	ND	0.84	ND	ND
March 1995	798.8	1.8	ND	2.8	2.15	2.25
May 1995	436.34	ND	ND	0.938	0.886	ND
Sept 1995	10.16	ND	ND	ND	ND	ND
Nov 1995	59.38	ND	ND	ND	ND	ND
March 1996	0.290	ND	ND	ND	ND	ND
June 1996	3.53	ND	ND	0.336	ND	ND
Aug 1996	205.8	ND	5.05	0.580	0.687	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Dinitrobutyl Phenol** (µg/l)

1997, 1998, 1999, 2000, 2001

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7
March 1997	207	ND	ND	ND	ND	ND
June 1997	85.6	ND	ND	ND	ND	0.34
August 1997	112.9	0.19	ND	ND	ND	ND
November 1997	96.82	ND	ND	ND	ND	ND
March 1998	129.2	ND	ND	ND	ND	ND
June 1998	127	0.35	0.26	ND	ND	ND
September 1998	165	ND	2	ND	1	ND
December 1998	180	ND	ND	ND	ND	ND
March 1999	77	ND	ND	ND	ND	ND
June 1999	154	ND	ND	ND	ND	ND
September 1999	81	ND	ND	ND	ND	ND
December 1999	104	ND	ND	ND	ND	ND
March 2000	52	ND	ND	ND	ND	ND
June 2000	125.7	ND	ND	ND	ND	ND
September 2000	125.7	ND	ND	ND	ND	ND
December 2000	2.38	ND	ND	ND	ND	ND
March 2001	216.38	ND	ND	ND	ND	ND
June 2001	139.6	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Dinitrobutyl Phenol** (µg/l)

October 1993 - July 1993

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 15	MW 16
Oct 1983	BDL	NT	NT	NT	NT	NT	NT	NT	NT
Nov 1983	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov 1983	BDL	NT	NT	NT	NT	NT	NT	NT	NT
Dec 1984	NT	NT	NT	NT	NT	NT	NT	NT	NT
July 1985	BDL	NT	NT	NT	NT	NT	NT	NT	NT
June 1987	BDL	NT	NT	NT	NT	NT	NT	NT	NT
Sept 1987	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
Nov 1987	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
Dec 1987	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
Mar 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
June 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
Aug 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Nov 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
July 1993	BDL	BDL	BDL	0.90	BDL	BDL	BDL	NT	BDL

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Dinitrobutyl Phenol** (µg/l)

September 1993 - August 1996

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1993	0.27	11.4	ND	8.5	ND	ND	ND	0.28
April 1994	ND	3.75	ND	ND	ND	ND	ND	ND
June 1994	ND	6.1	ND	2.28	ND	ND	ND	ND
Aug 1994	ND	2.66	ND	1.14	ND	ND	ND	ND
Dec 1994	ND	8.347	ND	ND	ND	ND	ND	ND
March 1995	0.686	0.968	0.836	2.5	0.91	1.21	0.324	ND
May 1995	0.638	0.816	ND	2.61	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	0.416	8.76	ND	ND	ND	ND
March 1996	ND	0.67	ND	ND	0.52	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	0.525	ND	ND
Aug 1996	ND	0.314	0.356	4.53	ND	0.246	0.746	0.391

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Dinitrobutyl Phenol** (µg/l)

1997, 1998, 1999, 2000

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	10	ND	ND	ND	ND
June 1997	ND	ND	ND	6.28	ND	ND	ND	ND
August 1997	ND	ND	ND	8.62	ND	ND	ND	ND
November 1997	ND	ND	ND	12.12	ND	ND	ND	ND
March 1998	ND	ND	ND	6.34	ND	ND	ND	ND
June 1998	ND	ND	ND	4.53	ND	ND	ND	ND
September 1998	ND	0.003	ND	14	ND	ND	ND	ND
December 1998	ND	ND	ND	29.0	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	7	ND	ND	ND	ND
September 1999	ND	ND	ND	2	ND	ND	ND	ND
December 1999	ND	ND	ND	10	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	1.85	ND	ND	4.08	ND
September 2000	ND	ND	ND	1.81	ND	ND	4.08	ND
December 2000	ND	ND	ND	ND	ND	ND	4.08	ND
March 2001	ND	ND	ND	ND	ND	ND	4.08	ND
June 2001	ND	ND	ND	ND	ND	ND	4.08	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Ethanol** (µg/l)								
Sampling Date	**MW 1A**	**MW 2**	**MW 3**	**MW 4**	**MW 5**	**MW 6**	**MW 7**	**MW 8**
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation Groundwater Monitoring for **Ethanol** (µg/l)								
Sampling Date	**MW 9**	**MW 10**	**MW 11**	**MW 12**	**MW 13**	**MW 14**	**MW 16**	**Detection Limit**
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	50
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethylbenzene** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	2	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethylbenzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethylbenzene** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethylbenzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethylbenzene** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethylbenzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethylbenzene** (µg/l)
2000, 2001
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethylbenzene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethyl Methacrylate** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethyl Methacrylate** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethyl Methacrylate** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Ethyl Methacrylate** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Iodomethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Iodomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Iodomethane** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Iodomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Iodomethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Iodomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Iodomethane** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Iodomethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Bromochloromethane** (µg/l)

1997, 1998, 1999, 2000, 2001

Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,2-Dibromoethane** (µg/l)
1997, 1998, 1999, 2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Methylene Chloride** (µg/l)

December 1981 - July 1993

Sampling Date	MW 1	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7
Dec 1981	NT	NT	NT	NT	NT	NT	NT	NT
Jan 1983	NT	NT	NT	NT	NT	NT	NT	NT
April 1983	NT	NT	NT	NT	NT	NT	NT	NT
Jan 1985	NT	NT	NT	NT	NT	NT	NT	NT
July 1985	**BDL**	**NT**	**BDL**	**8.0**	**BDL**	**15**	**11.4**	**14.6**
June 1987	**NT**	**NT**	**NT**	**NT**	**NT**	**NT**	**NT**	**NT**
Sept 1987	**NT**	**BDL**	**BDL**	**NT**	**BDL**	**BDL**	**BDL**	**BDL**
Nov 1987	NT	NT	NT	NT	NT	NT	NT	NT
Dec 1987	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Mar 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
June 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Aug 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Dec 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Mar 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
June 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Sept 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Nov 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Mar 1990	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
June 1990	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Sept 1990	NT	BDL	BDL	NT	BDL	NT	BDL	BDL
Dec 1990	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Mar 1991	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
June 1991	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Sept 1991	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Nov 1991	NT	BDL	BDL	NT	NT	BDL	BDL	NT
Nov 1991	NT	BDL	BDL	NT	NT	BDL	BDL	NT
Dec 1991	NT	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	NT	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Dec 1992	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
April 1993	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
July 1993	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Methylene Chloride** (µg/l)

September 1993 - August 1996

Detection Limit: 3 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7
Sept 1993	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitor Results for **Methylene Chloride** (µg/l)
1997, 1998, 1999, 2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7
March 1997	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Methylene Chloride** (µg/l)

December 1981 - July 1993

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 15	MW 16
Dec 1981	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan 1983	NT	NT	NT	NT	NT	NT	NT	NT	NT
April 1983	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan 1985	NT	NT	NT	NT	NT	NT	NT	NT	NT
July 1985	BDL	NT	NT	NT	NT	NT	NT	NT	NT
June 1987	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sept 1987	BDL	BDL	BDL	BDL	BDL	400	BDL	BDL	NT
Nov 1987	NT	NT	NT	NT	NT	7269	NT	NT	NT
Dec 1987	BDL	BDL	BDL	BDL	BDL	175	BDL	BDL	NT
Mar 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	13,000	NT
June 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	19,000	NT
Aug 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1989	BDL	BDL	BDL	BDL	BDL	0.1	BDL	NT	BDL
Sept 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Nov 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Nov 1991	NT	NT	NT	BDL	NT	BDL	NT	NT	NT
Nov 1991	NT	NT	NT	BDL	NT	BDL	NT	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Methylene Chloride** (µg/l)

September 1993 - August 1996

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	400	ND	ND
May 1995	ND	ND	ND	ND	ND	7269	ND	ND
Sept 1995	ND	ND	ND	ND	ND	175	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Methylene Chloride** (µg/l)

1997, 1998, 1999, 2000

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Styrene** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Styrene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	2
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Styrene** (µg/l)
September 1993 - August 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Styrene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Styrene** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Styrene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Styrene** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Styrene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **Tetrachloroethene** (µg/l)

September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation

Groundwater Monitoring for **Tetrachloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	1
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1

NOTES:

BDL Below Detection Limit

NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Tetrachloroethene** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Tetrachloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Tetrachloroethene** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Tetrachloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Tetrachloroethene** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Tetrachloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Toluene** (µg/l)
September 1991 - July 1993
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	BDL	NT	BDL	6	BDL	BDL	BDL
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Nov 1991	BDL	BDL	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	BDL	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Toluene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Toluene** (µg/l)
September 1993 - August 1996

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Toluene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	4.47	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Toluene** (µg/l)
1997, 1998, 1999, 2000

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Toluene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	4.47	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Toluene** (µg/l) 2000, 2001							
Sampling Date	**MW 1A**	**MW 2**	**MW 4**	**MW 5**	**MW 6**	**MW 7**	**MW 8**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation Groundwater Monitoring for **Toluene** (µg/l)							
Sampling Date	**MW 9**	**MW 10**	**MW 11**	**MW 12**	**MW 13**	**MW 14**	**MW 16**
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	4.47	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total 1,2-Dichloroethane** (µg/l)
September 1991 - July 1993

Sampling Date	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1991	BDL	12	NT	BDL	BDL	BDL	BDL	BDL
Nov 1991	BDL	10	NT	NT	BDL	BDL	NT	NT
Dec 1991	BDL	11	BDL	BDL	BDL	BDL	BDL	BDL
Mar 1992	BDL	8	BDL	BDL	BDL	BDL	BDL	BDL
Sept 1992	BDL	9	NT	BDL	BDL	BDL	BDL	BDL
Dec 1992	BDL	10	NT	BDL	BDL	BDL	BDL	BDL
April 1993	BDL	10	NT	BDL	BDL	BDL	BDL	BDL
July 1993	BDL	8	NT	BDL	BDL	BDL	BDL	BDL

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total 1,2-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16	Detection Limit
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Nov 1991	NT	NT	BDL	NT	BDL	NT	NT	5
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5

NOTES:

BDL Below Detection Limit
NT Not Tested

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total 1,2-Dichloroethane** (µg/l)
September 1993- August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	9	ND	ND	ND	ND	ND
Dec 1993	ND	11.6	ND	ND	ND	ND	ND
April 1994	ND	7.5	ND	ND	ND	ND	ND
June 1994	ND	8.4	ND	ND	ND	ND	ND
Aug 1994	ND	9.3	ND	ND	ND	ND	ND
Dec 1994	ND	10.6	ND	ND	ND	ND	ND
March 1995	ND	9.1	ND	ND	ND	ND	ND
May 1995	ND	9.9	ND	ND	ND	ND	ND
Sept 1995	ND	11.3	ND	ND	ND	ND	ND
Nov 1995	ND	9.4	ND	ND	ND	ND	ND
March 1996	ND	8.9	ND	ND	ND	ND	ND
June 1996	ND	7.6	ND	ND	ND	ND	ND
Aug 1996	ND	9.9	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total 1,2-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	1.12	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total 1,2-Dichloroethane** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total 1,2-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total 1,2-Dichloroethane** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Total 1,2-Dichloroethane** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitor Results for **Toxaphene** (µg/l)
December 1981 - July 1993

Sampling Date	MW 1	MW 1A	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7
Dec 1981	NT	NT	NT	NT	NT	NT	NT	NT
Oct 1983	BDL	NT	BDL	NT	NT	NT	BDL	BDL
Nov 1983	BDL	NT	BDL	NT	NT	NT	BDL	BDL
Jan 1985	NT	NT	NT	NT	NT	NT	NT	NT
June 1987	NT	NT	BDL	NT	BDL	BDL	BDL	BDL
Sept 1987	NT	BDL	BDL	NT	NT	BDL	BDL	BDL
Nov 1987	NT	BDL	NT	BDL	BDL	NT	NT	NT
Dec 1987	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Mar 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
June 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Aug 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Dec 1988	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Mar 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
June 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Sept 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Nov 1989	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Mar 1990	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
June 1990	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Sept 1990	NT	BDL	BDL	NT	BDL	NT	BDL	BDL
Dec 1990	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Mar 1991	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
June 1991	NT	BDL	BDL	NT	BDL	BDL	BDL	BDL
Sept 1991	NT	BDL	BDL	NT	BDL	BDL	**25**	BDL
Dec 1991	NT	BDL	BDL	NT	BDL	BDL	**18.8**	BDL
Mar 1992	NT	BDL	BDL	BDL	BDL	BDL	**12.3**	BDL
Sept 1992	NT	BDL	BDL	NT	BDL	BDL	**2.5**	BDL
Dec 1992	NT	BDL	BDL	NT	BDL	BDL	**4.7**	BDL
April 1993	NT	BDL	BDL	NT	BDL	BDL	**2.1**	BDL
July 1993	NT	BDL	BDL	NT	BDL	BDL	**14.0**	BDL

Vicksburg Chemical Corporation
Groundwater Monitor Results for **Toxaphene** (µg/l)
September 1993 - August 1996
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7
Sept 1993	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	4.94	ND
April 1994	ND	ND	ND	ND	10.8	ND
June 1994	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	2.89	ND
Dec 1994	ND	ND	ND	ND	1.96	ND
March 1995	ND	ND	ND	ND	2.76	ND
May 1995	ND	ND	ND	ND	1.66	ND
Sept 1995	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	5.99	ND
June 1996	ND	ND	ND	ND	0.631	ND
Aug 1996	ND	ND	ND	ND	1.404	ND

Vicksburg Chemical Corporation
Groundwater Monitor Results for **Toxaphene** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 1 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7
March 1997	ND	ND	ND	ND	4.16	ND
June 1997	ND	ND	ND	ND	4.94	2.77
August 1997	ND	ND	ND	ND	0.34	ND
November 1997	ND	ND	ND	ND	1.28	ND
March 1998	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	2.26	ND
March 2000	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	2.4	ND
June 2001	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Toxaphene** (µg/l)

December 1981 - July 1993

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 15	MW 16
Dec 1981	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct 1983	BDL	NT	NT	NT	NT	NT	NT	NT	NT
Nov 1983	BDL	NT	NT	NT	NT	NT	NT	NT	NT
Jan 1985	NT	NT	NT	NT	NT	NT	NT	NT	NT
June 1987	BDL	NT	NT	NT	NT	NT	NT	NT	NT
Sept 1987	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
Nov 1987	NT	NT	NT	NT	NT	NT	NT	NT	NT
Dec 1987	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
Mar 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
June 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT
Aug 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1988	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Nov 1989	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1990	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
June 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1991	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Mar 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Sept 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
Dec 1992	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
April 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL
July 1993	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NT	BDL

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Toxaphene** (µg/l)

September 1993 - August 1996

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	2.22	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitor Results for **Toxaphene** (µg/l)

1997, 1998, 1999, 2000

Sampling Date	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethene** (µg/l)
September 1993- October 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Oct 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethylene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Oct 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethene** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethene** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **1,1-Dichloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	1.25	ND	ND	ND	1.01	ND	ND
September 2000	1.25	ND	ND	ND	ND	ND	ND
December 2000	1.25	ND	ND	ND	ND	ND	ND
March 2001	1.25	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,2-Dichloroethene** (µg/l)
September 1993 - August 1996
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,2-Dichloroethylene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,2-Dichloroethene** (µg/l)
1997, 1998, 1999, 2000
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	6	ND	ND	ND	ND	ND
June 1997	ND	4.21	ND	ND	ND	ND	ND
August 1997	ND	5.7	ND	ND	ND	ND	ND
November 1997	ND	5.35	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	5	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	5	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,2-Dichloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,2-Dichloroethene** (µg/l)
2000, 2001
Detection Limit: 2 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	2.01	ND	ND	ND	ND	ND
September 2000	ND	1.72	ND	ND	ND	ND	ND
December 2000	ND	1.62	ND	ND	ND	ND	ND
March 2001	ND	7.26	ND	ND	ND	ND	ND
June 2001	ND	2.28	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **cis-1,2-Dichloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **trans-1,2-Dichloroethene** (µg/l)
September 1993 - August 1996
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	2.66	ND	ND	ND	ND	ND	ND
April 1994	2.75	ND	ND	ND	ND	ND	ND
June 1994	2.6	ND	ND	ND	ND	ND	ND
Aug 1994	2.1	ND	ND	ND	ND	ND	ND
Dec 1994	2.53	ND	ND	ND	ND	ND	ND
March 1995	2.26	ND	ND	ND	ND	ND	ND
May 1995	2.23	ND	ND	ND	ND	ND	ND
Sept 1995	2.2	ND	ND	ND	ND	ND	ND
Nov 1995	2.66	ND	ND	ND	ND	ND	ND
March 1996	2.24	ND	ND	ND	ND	ND	ND
June 1996	2.01	ND	ND	ND	ND	ND	ND
Aug 1996	2.12	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **trans-1,2-Dichloroethene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
Sept 1993	ND	ND	ND	ND	ND	ND	ND
Dec 1993	ND	ND	ND	ND	ND	ND	ND
April 1994	ND	ND	ND	ND	ND	ND	ND
June 1994	ND	ND	ND	ND	ND	ND	ND
Aug 1994	ND	ND	ND	ND	ND	ND	ND
Dec 1994	ND	ND	ND	ND	ND	ND	ND
March 1995	ND	ND	ND	ND	ND	ND	ND
May 1995	ND	ND	ND	ND	ND	ND	ND
Sept 1995	ND	ND	ND	ND	ND	ND	ND
Nov 1995	ND	ND	ND	ND	ND	ND	ND
March 1996	ND	ND	ND	ND	ND	ND	ND
June 1996	ND	ND	ND	ND	ND	ND	ND
Aug 1996	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **trans-1,2-Dichloroethene** (µg/l)

1997, 1998, 1999, 2000

Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	1.36	ND	ND	ND	ND	ND
August 1997	ND	1.36	ND	ND	ND	ND	ND
November 1997	ND	1.31	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **trans-1,2-Dichloroethylene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **trans-1,2-Dichloroethene** (µg/l)
2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	1.3	ND	ND	ND	ND	ND
June 2001	ND	1.1	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **trans-1,2-Dichloroethylene** (µg/l)

Sampling Date	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 16
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation
Groundwater Monitoring for **Dichlorobenzene** (µg/l)
1997, 1998, 1999, 2000, 2001
Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	1.64	ND	ND	ND	ND	ND	ND
August 1997	1.59	ND	ND	ND	ND	ND	ND
November 1997	1.87	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	1.21	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	1.36	ND	ND	ND	ND	ND
March 2001	ND	1.42	ND	ND	ND	ND	ND
June 2001	ND	1.18	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,1,2,2-Tetrachloroethane** (µg/l)

1997, 1998, 1999, 2000, 2001

Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,2-Dibromo-3-Chloropropane** (µg/l)

1997, 1998, 1999, 2000, 2001

Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

Vicksburg Chemical Corporation

Groundwater Monitoring for **1,2-Dichloropropane** (µg/l)

1997, 1998, 1999, 2000, 2001

Detection Limit: 5 µg/l

Sampling Date	MW 1A	MW 2	MW 4	MW 5	MW 6	MW 7	MW 8
March 1997	ND	ND	ND	ND	ND	ND	ND
June 1997	ND	ND	ND	ND	ND	ND	ND
August 1997	ND	ND	ND	ND	ND	ND	ND
November 1997	ND	ND	ND	ND	ND	ND	ND
March 1998	ND	ND	ND	ND	ND	ND	ND
June 1998	ND	ND	ND	ND	ND	ND	ND
September 1998	ND	ND	ND	ND	ND	ND	ND
December 1998	ND	ND	ND	ND	ND	ND	ND
March 1999	ND	ND	ND	ND	ND	ND	ND
June 1999	ND	ND	ND	ND	ND	ND	ND
September 1999	ND	ND	ND	ND	ND	ND	ND
December 1999	ND	ND	ND	ND	ND	ND	ND
March 2000	ND	ND	ND	ND	ND	ND	ND
June 2000	ND	ND	ND	ND	ND	ND	ND
September 2000	ND	ND	ND	ND	ND	ND	ND
December 2000	ND	ND	ND	ND	ND	ND	ND
March 2001	ND	ND	ND	ND	ND	ND	ND
June 2001	ND	ND	ND	ND	ND	ND	ND

D R A F T

AMENDED AND SUPPLEMENTAL GROUNDWATER ASSESSMENT WORKPLAN

REVISION 1 – JUNE 2001

Prepared for
Vicksburg Chemical
Vicksburg, Mississippi

June 2001

File No. 35-092B007C.00-04003

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Vicksburg Chemical Company (VCC) retained URS Corporation (URS) to perform activities associated with a RCRA corrective action program. The corrective action program is in response to a Consent Decree which became effective July 1, 1991. The Consent Decree requires that a RCRA Facility Investigation (RFI) be conducted at the Vicksburg, Mississippi manufacturing facility, and that it be followed up by corrective measures as needed.

The purpose of the RFI is to determine the nature and extent of releases of hazardous wastes and/or constituents from regulated units, solid waste management units (SWMUs), and other areas of concern (AOCs) at the facility and to gather all necessary data to support any corrective action required.

The RFI constitutes the second phase of the RCRA corrective action program. The program's first phase consists of the RCRA Facility Assessment (RFA) which is conducted by the EPA and precedes the RFI. The RFI itself is divided into several separate tasks. The tasks include the Preliminary Report, the RFI Work Plan, the Facility Investigation, and the Investigative Analysis Report (RFI Report). Subsequent phases of the RCRA corrective action program concern defining and implementing any needed measures that will protect human health and the environment. In addition, a Groundwater Assessment (GWA) Work Plan, a Closure Plan for SWMU 1 and SWMU 17, and Annual Groundwater Assessment Reports are required by the Consent Decree.

VCC submitted the Preliminary Report and Closure Plan for SWMU 1 and SWMU 17, and subsequently updated the Preliminary Report. The Preliminary Report and Closure Plan for SWMU 1 and SWMU 17 have been approved. VCC submitted the RFI Work Plan and the GWA Work Plan and has updated both plans. The RFI Work Plan was approved, and has been implemented in two phases in the field. The RFI effort is described in the Draft Final RFI Report which is submitted concurrently with this document.

This document is Revision 1 of an Amended and Supplemental Work Plan that defines and describes the Groundwater Assessment (GWA) to be executed by VCC. The purpose of GWA is to evaluate the groundwater quality, monitoring system and program, as well as the abatement system at the facility. Revision 1 is issued because of the additional field derived information and understanding of the site obtained since issuing prior versions.

The Groundwater Assessment program consists of the following tasks:

- Groundwater Assessment Work Plan
- Implementation of the Work Plan
- Publication of the results and conclusions
- Annual Groundwater Assessment Reports

The Groundwater Assessment program activities are intended to be executed immediately after a RCRA Facility Investigation. Data needed for Groundwater Assessment activities and requisite activities such as borings and well installations were in part obtained during the RFI implementation programs. As will be described subsequently, a portion of the RFI program has been expedited because of VCCs need to expand its manufacturing and storage capability in some of the SWMU areas.

The Groundwater Assessment Work Plan includes the following elements:

- Number, location, depth of wells, and the rationale for any new well placement
- Construction logs for each existing monitoring well
- List of the monitoring parameters
- Geologic cross-sections
- Sampling and analytical methods for those hazardous wastes or hazardous constituents at the facility
- Evaluation procedures, including any use of previously-gathered groundwater quality information
- Schedule of implementation of additional work

The GWA Work Plan is guided by the information contained in the Amended and Supplemental Preliminary Report (February 1994 with November 1995 Revisions) and by the RFI.

The following is a summary description of the SWMUs followed by a tabulation of SWMU activity at the site which was expedited because of VCC's plans to construct new manufacturing facilities and also utilize some of the SWMU areas for storage and for

transportation related activity. The summary discussion of the SWMUs is obtained from the RFI Report. For additional information, including data on soil contamination the RFI Report should be examined. Groundwater quality information in the SWMUs is found in Section 2 and Appendix H of this Groundwater Assessment Workplan.

SWMU 1 – Container Drum Storage Area, SWMU 16 – Former Atrazine Production Area, SWMU 17 – Returned Product Storage Area

SWMU 1 is a "less than ninety day hazardous waste drum storage area" that was located at the South Plant adjacent to the Former Atrazine Production Area (SWMU 16) across a walkway from the Returned Product Storage Area (SWMU 17). This area was diked. The roof over the area was destroyed by a windstorm during mid-1990. Spills were collected in a sump common to both this area and the Returned Product Storage Area (SWMU 17). The floor has been cleaned through sweeping, scraping, chipping, and reacting the dinoseb with hydrogen peroxide and a ferrous iron catalyst. A closure plan for the Container (Drum) Storage Area (SWMU 1) and the Returned Production Storage Area (SWMU 17) was developed by URS for VCC. The closure plan is consistent with RCRA rules and regulations. The closure plan was originally submitted in June 1992 as a 60-day deliverable to the EPA and MSDEQ by VCC.

A facility for the manufacture of potassium phosphate has been constructed on the SWMU 1 site.

The Former Atrazine Production Area (SWMU 16) is located adjacent to the Container (Drum) Storage Area (SWMU 1) and the Returned Product Storage Area (SWMU 17). In addition to producing atrazine, this process area manufactured the herbicide cyanazine under the packaged name Bladex. The former atrazine warehouse is located adjacent to the Former Atrazine Production Area (SWMU 16). The warehouse was used to store dinoseb as well as atrazine.

The warehouse continues in service in order to store various fertilizer products manufactured by VCC. The Atrazine Production Area was demolished and was reconstructed for the production of potassium phosphate.

The Returned Products Storage Area (SWMU 17) was located across a walkway from the Container (Drum) Storage Area (SWMU 1). Product formulations returned by consumers

and off-spec product were stored here until they could be reblended, re-containerized, and sold or disposed of as a hazardous waste. The floor has been cleaned through sweeping, scraping, chipping, and reacting the dinoseb with hydrogen peroxide and ferrous iron catalyst. A closure plan for the Container (Drum) Storage Area (SWMU 1) and the Returned Production Storage Area (SWMU 17) was submitted by VCC as a 60-day deliverable pursuant to the Consent Decree.

The SWMU 17 site was part of the site of a potassium phosphate manufacturing facility. As noted above the potassium phosphate groundwater facility encompasses SWMU 1, the production area of SWMU 16 and SWMU 17.

SWMU 2 – Inactive Landfill

SWMU 2 is a hill with a natural elevation approximately 30 feet above immediate surrounding areas. A landfill and four pits or ponds were constructed on the hill and utilized from 1972 to 1975. One pit was constructed to store dinoseb process wastewater. Three pits were used as disposal locations for pallets, empty fiber and steel drums. In 1977 many of the drums in the pits, but not the landfill, were removed and disposed off-site. The location of the closed pits and closed landfill are based on a March, 1979 aerial photograph. The boundary lines of the pits were partially destroyed during regrading efforts in late 1979. In 1979 all the pits were drained, regraded so the hill was flattened and covered with a soil cap. Some of the soil was obtained off-site and placed on the landfill area. In 1983, there was additional grading and capping of the entire area consistent with an engineered plan approved by the MSDNR. In 1988 the SWMU 3 wastewater ponds, which are adjacent to SWMU 2, were lined and a repository for pond sediments (SWACA) was constructed. The SWACA was constructed in a pond location. The sediments from the SWMU 3 wastewater ponds and most of the sediment of the pond are within the SWACA. The pond lining and SWACA construction is consistent with RCRA guidelines.

SWMU 4 – Activated Carbon Unit

The Activated Carbon (Adsorption) Treatment Unit treats wastewater from the Surface Impoundment (SWMU 3) to remove organic materials before the water is pumped to the Mississippi River in accordance with the NPDES permit. Secondary containment for the unit consists of a concrete pad approximately 100 feet long, 20 feet wide with 1-foot tall

containment curbs. The concrete containment unit is cracked and stained. There is visual evidence of spillage of carbon on the east side of the containment area.

SWMU 5 – South Plant Drainage System

The South Plant Drainage System was designed to transfer storm water and process water to the Surface Impoundment (SWMU 3) for containment prior to treatment. Sumps exist within the former MSMA, dinoseb and toxaphene production, packaging and shipping areas of the South Plant. At one time, some of the sumps carried water to the Surface Impoundment (SWMU 3); however, due to regulations which became effective in November 1985, sumps in the pesticide process and handling areas were blocked. This precluded the possibility of pesticide spills from entering the Surface Impoundment (SWMU 3) by gravity flow through the Drainage System.

SWMU 7 – Former Dinoseb Production Area

The Former Dinoseb Production Area is located near the railroad tracks. The production area and foundation have been demolished and removed and a portion treated in a CAMU. Some discolored soil has been removed. Due to the acid involved in the manufacturing of the herbicide, the concrete and cement in the process area had been badly corroded and etched. The dinoseb manufacturing process consisted of sulfonation and nitration reactors, two formulation blending tanks, and a settling tank. At one time, acidic process wastewater was neutralized with sodium hydroxide or ammonia and then discharged to the Surface Impoundment (SWMU 3) through carbon adsorption beds. Emission from the nitration reactor was controlled by a butane-fired flare. Flare failure required immediate plant shut down; however, the soil in the area surrounding the flare is suspected to be contaminated. The area is surrounded by the Railroad Area (SWMU 20) and is adjacent to the Toxaphene Area (SWMU 14).

SWMU 8 – Dinoseb Loading/Unloading Area

The Dinoseb Truck Loading/Unloading Area is located in the central section of the South Plant adjacent to the Dinoseb Drumming Area (SWMU 9). It is a concrete pad that used to contain spillage associated with the truck loading/unloading operations at the Former Dinoseb Drumming Area (SWMU 9). The pad is approximately 25 feet long and 15 feet wide.

The loading/unloading area is now covered with asphalt and within a warehouse/operations area for production of Multi Cote (coated fertilizers for slow release of nutrients). It continues to be used as a loading/unloading area.

SWMU 9 – Dinoseb Drumming Area

Drumming of the dinoseb and toxaphene formulations took place in the south end of a warehouse in the central section of the South Plant. In the drumming operation of the dinoseb and toxaphene, an absorbent was placed on the floor to prevent material reaching the Surface Impoundment from spills. Yellow stains were evident on the floor.

The SWMU 9 site is presently the site on which a facility to coat and then store various fertilizer mixtures has been constructed. Prior to the construction the area was sampled and cleaned up. The entire surface of the concrete in SWMU 9 was treated by grinding off a veneer of concrete then by placing a layer of compost atop it in an attempt to draw contaminants from the surface of the concrete into the compost where biological degradation would occur. The effort was experimental and results were uncertain. Subsequently, concrete and some soil were removed from a section comprising the middle third of SWMU 9. All concrete grindings, concrete debris, and soil removed were taken to the Treatment Unit for eventual biodegradation/composting within the provisions of the CAMU permit.

SWMU 11 – Former MSMA Production Area, SWMU 12 – Former MSMA Salt Unloading Area, SWMU 15 – Former Methyl Parathion Production Area

The MSMA Production Area (SWMU 11) was constructed over the remains of the Former Methyl Parathion facility (SWMU 15) in 1983. Subsequently, the MSMA process was shut down and equipment from the area was removed and the concrete foundation of the area was cleaned with high-pressure water equipment.

The MSMA Salt Unloading Unit was an integral part of the MSMA Production Area (SWMU 11). Salts were discharged directly from a centrifuge into containers located within the area.

The original process unit was constructed in the early 1970s to produce methyl parathion. The methyl parathion manufacturing facility was destroyed in an explosion and fire on March 7, 1978.

SWMU 13 – South Plant Drainage Ditch

There is one major Drainage Ditch which runs along the western border of the South Plant and empties into Hennessey's Bayou. No contaminated Drainage System (SWMU 5) water or NPDES permitted discharge is received by the major Drainage Ditch. However, some storm water runoff has discharged into the major Drainage Ditch from the South Plant. Additionally, drainage from a portion of SWMU 34 – The Junkyard discharges into the drainage ditch.

SWMU 14 – Former Toxaphene Production Area

The Former Toxaphene Production Area is adjacent to SWMU 7 - The Dinoseb Production Area and is surrounded by SWMU 20 – The Railroad Area.

Raw material used in the toxaphene manufacturing process included sodium hydroxide, xylene, epichlorohydrin, chlorine, carbon tetrachloride, and camphene. Caustic scrubber water from the toxaphene operation was discharged to the sump adjacent to the Former Dinoseb Processing.

The processing equipment from the Toxaphene plant has all been removed. The foundations and secondary containment concrete structure were in good repair and were not demolished. The foundation presently serves as a repository for soil excavated from various parts of the South Plant during construction activity. The soil is to be treated by a biological degradation composting process.

SWMU 18 – Former Blue Tank

The Former Blue Tank (SWMU 18) received unneutralized dinoseb process wastewater prior to off-site disposal by deep well injection. The unit was located northwest of the Former Dinoseb Production Area (SWMU 7) and adjacent to the Nitric Acid Production Area in the South Plant. A gravel covered area exists at the location of the Former Blue Tank (SWMU 18). The original 16,000-gallon tank was fiberglass. The fiberglass tank leaked. Two repair attempts failed in 1983 causing the fiberglass tank to be replaced by a stainless steel tank at the dinoseb plant. The fiberglass tank was demolished and removed from the site.

SWMU 20 – Railroad Area

The Railroad Area (SWMU 20) including the Railroad Car Loading/Unloading Station is located at the eastern boundary of the manufacturing portion of the South Plant. The railcar station was the primary area for the loading/unloading of materials for the various operations conducted at the South Plant. The area spans several hundred feet along the multiple-lane railyard. The ground in the surrounding area has received spillage from the loading/unloading operations. In addition to railyard operations, the flare for the dinoseb production area nitration reactor was located directly across the tracks from the railyard. Incomplete flaring discharged constituents onto the ground in the area surround the flare. The flare area is indistinguishable from the Railroad Area (SWMU 20).

SWMU 20 also surrounds SWMU 7 – The Former Dinoseb Production Area and SWMU 14 – The Former Toxaphene Production Area. SWMU 4 – The Activated Carbon Unit is on the eastern edge of SWMU 20.

SWMU 23 – Equalization/Neutralization Pond

This unlined pond also known as the North Pond was located on the North Plant site and was utilized for neutralization of acidic wastewater from the potassium nitrate production process. The neutralization of the water in the Neutralization Pond was achieved using limestone. The potassium nitrate production wastewater is no longer routed through the equalization and neutralization ponds. The pond at the North Plant is inactive. The pH of the rainwater in the pond has been checked and found to be near neutral. URS conducted an RFI in the North Pond Area in November and December 1993.

SWMU 30 – North Plant Waste Oil Accumulation Area

The Waste Oil Satellite Accumulation Area (SWMU 30) is an outdoor drum staging area located in the south section of the North Plant. The unit is downgradient from the Inactive North Plant Surface Impoundment (SWMU 23). The unit consists of a concrete pad with secondary containment in the form of concrete curbing used to stage drums of new and waste lubricant oils prior to of-site recycling. The area is situated in the vicinity of a lubricant storage area. The area is roofed.

SWMU 34 – Surplus Equipment Storage

The Surplus Equipment Storage Areas are located at the western edge of the South Plant at the head of the South Plant Drainage Ditch (SWMU 13) and at the western edge of the North Plant. The main storage area is the one located in the South Plant. The storage areas were used for temporary storage of old equipment, and other scrap material. Most items have been removed for recycling.

SWMU 29 – North Plant Oil Collection Unit, SWMU 31 – North Plant No. 6 Fuel Oil Area, SWMU 25 – North Plant Waste Water Pipes, SWMU 22 – North Plant Neutralization System

The four items are grouped together. They were mentioned in the RFA. In the Preliminary Report, it was suggested that inspections of the areas should be made during the field investigations of the RFI prior to determining if field sampling was required. Some cleaning effort was required prior to inspection.

SWMU 29 is a drum that collects oil drips from the potassium nitrate cooling cylinder. The oil collection system has been modified so that oil drips are now directly piped to the drum.

SWMU 31 is a concrete sump that formerly housed pumps to move fuel oil from tanks to boilers. The tanks and pumps had been removed prior to the writing of the Preliminary Report; however, deposits of soil in the sump made it impossible to observe whether there had been cracks in the concrete. The cracks would be potential avenues of escape of fuel oil in the event it leaked from pumps into the sumps.

SWMU 25 is the system of waste water pipes carrying waste water that can be acidic from the North Plant Manufacturing to a sump from which it is pumped to the neutralization system.

SWMU 22 is the sump collecting wastewater as noted above and the neutralization system itself. The neutralization system was not questionable in the Preliminary Report as a source of contamination into the soil and groundwater; however, the integrity of the sump was questioned. The old sump was removed and was replaced with a new sump in March 2001.

TABLE 1-1

SWMU ACTIVITY

Report	Date	Status	Comment
RFI Work Plan SWMUs 9 and 16	August 1994	Submitted	--
RFI Report SWMUs 9 and 16	September 1994	Submitted	--
SWMU 23 North Pond RFI Work Plan FRI Report	October 1994	Submitted	14 piezometers were installed.
Closure Plan SWMUs 1 and 17	February 1995 (Modified 10-26-95)	Approved by the U.S. EPA and MSDEQ	--
RFI Work Plan Entire Site	June 1996	Modified 12-16-99 and subsequently approved	Incorporated investigative phase of "Closure Plan SWMUs 1 and 17".
GWA Work Plan Entire Site	June 1996	Modified 12-16-99. To be revised after completion of Final RFI Report	--
RFI Expedited Work Plan SWMUs 12, 11, 15, 16, 1 and 17	January 1997	Submitted	VCC planned to expand manufacturing capability into SWMU 12, 11 and 15 area or SWMU 16, 1 and 17 area.
RFI Report, Corrective Measures Study, RCRA Corrective Measures Implementation Plan SWMUs 16, 1 and 17	June 1997	Approved by the U.S. EPA and MSDEQ	--
Corrective Action Management Unit Application	June 1997	Approved by the U.S. EPA and MSDEQ	--
RFI Report SWMUs 12, 11 and 15	April 1998	Submitted	--
Corrective Measures Implementation Plan SWMUs 12, 11 and 15	April 1998 (as amended July 15,1 998)	Submitted	To be revised by 11-15-00
Corrective Action Observation Confirmatory Sampling and Analysis SWMUs 1 and 17	July 1998	Submitted	--
Arsenic Data Sets Arsenic Data Sets – Addendum	October 15, 1998 October 26, 1998	Submitted Submitted	Evaluation of arsenic background data.

TABLE 1-1 (Continued)

SWMU ACTIVITY

Report	Date	Status	Comment
SWMU 9 Corrective Action Observation	March 11, 1999	Submitted	--
Observations and Sampling of Ditch	September 8, 1999	Submitted	Surficial dinoseb contamination of soil noted during excavation of a ditch for a new water drainage line.
Response to July 3, 1999 Comments by the U.S. EPA on the "Amended and Supplemental Groundwater Assessment Work Plan"	July 31, 2000	Submitted	Summarized previously written description of SWMUs and work accomplished at each SWMU. Additionally responded to questions.
RCRA Facility Investigation SWMU 2 – Inactive Landfill Interim Report	October 2000	Submitted	--
Interim Revised Corrective Measures Implementation Plan SWMU 12 – Former MSMA Salt Unloading Area SWMU 11 – Former MSMA Production Area SWMU 15 – Former Methyl Parathion Production Area	November 2000	Submitted	Need agreement of arsenic clean up standards based on background. Need completion of RFI and GWA to completely verify and define problem.
RCRA Facility Investigation Interim Report and Phase II Workplan	December 15, 2000	Submitted (Later revised by VCC)	Contained some analytical laboratory calculation errors.
RCRA Facility Investigation Interim Report and Phase II Workplan	March 16, 2001	Submitted and Approved	Corrected analytical errors and added results of a surface and soil pile sampling program completed on February 16, 2001
Final RFI Report	June, 2001	Submitted	Contains information on entire RFI program, including the Phase II effort.

The following information describes the environmental setting on a regional and local basis.

2.1 REGIONAL GEOLOGY

The Vicksburg area lies on the eastern flank, near the axis, of the Mississippi Embayment, containing unconsolidated sediments of Cretaceous to Quaternary Age, the sediments thicken in the structural trough toward the axis of the Embayment and the Gulf of Mexico.

Wind-borne silty sediments, named Pleistocene loess, were deposited in the Vicksburg area. The Pleistocene loess in the Vicksburg area is a homogeneous, massive silt with variable clay content. The loess underlies the ground surface through the local region. Loess generally is characterized by a higher vertical permeability in comparison to its horizontal permeability.

Underlying the Pleistocene loess is the Oligocene Vicksburg formation. This formation consists of alternating beds of sandy marl, clay marl, montmorillonitic clay and thin beds of limestone.

2.2 SITE GEOLOGIC FEATURES OF THE PLANT SITE

Developers International Services Corporation (DISC) provided the initial descriptions of the geology of the site in a November 1981 report "Hydrogeological Investigation." A second description was provided by IT Corporation in a January 1985 "Final Report: Groundwater Assessment Program". Both reports provided hydraulic conductivity data from laboratory testing on soil obtained from borings on site and supplemented the information by generalized descriptions obtained from U.S.G.S. publications.

It was observed in both reports that the loess with variable clay content extends from about 6 to 48 feet below the surface across the site. Immediately below the loess, a thin layer (1 to 2 feet) of greenish-gray sandy clay is usually present. Underlying the sandy clay is a marl from the Vicksburg formation called the Byram marl. The top of the marl varies across the site from 60 to 65 feet mean sea level (msl). This marl serves as the bottom of a shallow confined aquifer. Various cross sections of the geology beneath the South Plant are shown in Figures 2-1 through 2-7. The cross sections portray silt with variable clay content as interpreted by individual loggers; the formation is Pleistocene loess to approximately 60 feet msl.

The bedrock underlying the facility is a layer of Glendon limestone of the Vicksburg Formation and, beneath the limestone, is the Jackson Formation. The top of the Glendon limestone is expected to be 80 to 100 feet beneath the plant site and ranges from 25 to 65 feet thick. The Glendon is a dark gray to brown, dense, fine-grained limestone. The underlying non-permeable Jackson Formation is 40 to 150 feet thick.

Information in the 1965 Bulletin 105 "Mississippi Geological, Economic and Topographical Survey" by William H. Moore describes the Glendon limestone and the Byram marl which is located at the top of the highest hard limestone ledge of the Glendon:

> "The Glendon limestone consists of alternating beds of gray, fossiliferous, glauconitic, slightly sandy limestone and gray-green, glauconitic, fossiliferous, sandy marl. The Glendon weathers to a yellowish or buff color. The limestone beds in the Glendon are not constant with the number, thickness and stratigraphic position varying from place to place. A hard bed about 10 feet from the top of the Glendon is the most consistent and usually the thickest. On the outcrop the marls weather more rapidly and the limestone ledges tend to stand out. The Glendon weathers completely in places leaving a dark-brown residual clay. ... At some localities the residual clay contains white, partly weathered limestone and contains at other localities a white, waxy, clayey material. ... The material is a clay giving an x-ray pattern of major montmorillonite and halloysite in which kaolinite is still a trace constituent.
>
> Thick beds of bentonite are present between ledges of Glendon limestone in Smith County. In Warren and Yazoo Counties thin beds of bentonite are present in the same stratigraphic position. ...
>
> The Byram marl consists of gray-green, glauconitic, fossiliferous, clayey marl and gray-green, glauconitic, fossiliferous, limy clay."

The site is in a valley with process areas cut into the hillside. As a generalization the following is a table of notable elevations:

TABLE 2-1 NOTABLE ELEVATIONS	
Area	Approximate Elevation (feet MSL)
Surface of Inactive Disposal Area (SWMU 2)	135
North Pond Area (SWMU 23)	133
South Plant	120
North Plant	115
Railroad Track, Surface Pond Area, Area Surrounding Inactive Disposal Area	100-110
Stout's and Hennessey's Bayou	85

2.3 REGIONAL GROUNDWATER HYDROLOGY

A shallow confined loess aquifer underlying the VCC plant is on top of the Byram marl formation. Reported wells in the area are upgradient of the plant and are producing water from deeper, more productive aquifers such as the Catahoula and Forrest Hill formation. These deeper aquifers are apparently hydraulically separated from the shallow groundwater aquifer.

The shallow aquifer underlying the VCC plant is, however, hydraulically connected to Stout's Bayou and Hennessey's Bayou. Hatcher Bayou and Stouts Bayou merge southeast of the plant site to form Hennessey's Bayou, which flows to the Mississippi River. Noted as intermittent streams on USGS topographical maps these bayous are limited to fresh water fish and wildlife habitat. They are not drinking water or recreational water sources. The major use of the Mississippi River downstream of its confluence with Hennessey's Bayou is as a marine transportation route. There are no drinking water intakes in these waters within three miles downstream of the facility.

2.4 SHALLOW GROUNDWATER HYDROLOGY BENEATH THE PLANT

The Byram marl in the Vicksburg Formation constitutes the bottom of the uppermost water-bearing zone underlying the facility. The Byram marl is described as representing mixed clastic and carbonate sedimentation in an open shelf or platform environment. The argillaceous, massive and medium dense character of the marl would inhibit any significant movement of water through this unit, and there is no indication of secondary permeability. The uppermost water bearing zone is approximately 40 feet thick consisting almost exclusively of Pleistocene loess (silt). The clayey fill material placed atop the loess is acting as a "cap"

inhibiting the vertical migration of the groundwater. The presence of the marl on the bottom of the aquifer creates a slightly artesian confined aquifer which is not hydraulically connected to any potential water-bearing zones at greater depths. The artesian property is characteristic of an aquifer which is under pressure from above and below. The background water quality of this aquifer is marginally acceptable for drinking water; however, due to its low lateral flow and yield characteristics its usefulness as a domestic water supply is severely limited.

2.5 GEOLOGIC AND HYDROGEOLOGIC FEATURES

The following is a list of geologic cross sections that describe the site. Well screen and piezometric elevations have been added to the cross sections. The piezometric data was obtained in November 1993.

- Figure 2-1 – Potentiometric Contours with Cross Section Locations
- Figure 2-2 – Section A-A'; generally north/south at the railroad track elevation from the north plant to the south plant.
- Figure 2-3 – Section B-B'; generally east/west at the southern boundary of the south plant.
- Figure 2-4 – Section C-C'; generally east/west through the center of the south plant.
- Figure 2-5 – Section D-D'; generally east/west on the northern boundary of the south plant.
- Figure 2-6 – Section E-E'; generally east/west through the North Pond.
- Figure 2-7 – Section F-F'; generally north/south on the eastern boundary in the south plant.

The various cross sections depict the wind-borne deposited silty sediments, or Pleistocene loess, underlying the Vicksburg Chemical site. The Pleistocene loess is a homogeneous, massive silt with variable clay content. SWMU 2, historically called the "hill area", is

entirely a loess deposit. There may be less clay content in the SWMU 2 than is present in the loess underlying most of the plant.

Groundwater potentiometric contours are depicted on Figure 2-1. The temporary piezometers at SWMU 2, LS2, LS3, LS4, and LS5, were installed in the generally flat top elevation of SWMU which is 135 feet msl. LS1 was installed down slope about 5 feet at 130 feet msl. The groundwater levels in SWMU 2 are consistent with the levels projected from previous work in surrounding monitor wells (MW-2, MW-7, MW-5, MW-3, MW-11, MW-14, MW-12, MW-8, MW-10, MW-16). There does not appear to be any trapped water perched within the hill or mounding effects due to historic use of the pits, ponds, and landfill, which were drained and closed in 1979.

The shallow aquifer underlying the VCC plant site, is hydraulically connected to Stouts Bayou and Hennessey's Bayou. Hatcher Bayou and Stouts Bayou merge southeast of the plant site to form Hennessey's Bayou, which flows to the Mississippi River. Existing monitor wells MW-2, MW-8, MW-7, MW-6, MW-5, MW-12, MW-10, MW-16, MW-1A, MW-11, MW-14, PZ-25B, PZ-24B, along with monitor wells MW-12C, MW-10C, MW-16C, PZ-26A and PZ-26B, which were installed during the RFI Phase II, effectively intercept and monitor the shallow aquifer between the site and Hennessey's Bayou.

There are additional observations that can be made from the piezometric and well screen elevations on the geologic cross sections:

- Cross section A-A'. The piezometric elevations do not vary with the variations in screen elevations thus demonstrating the interconnectivity of the zones in the aquifer. Nonetheless, due to the proximity of SWMUs 4, 7, 14 and 20 to the line of wells in cross section A-A', shallow wells were installed at MW-12C, MW-10C and MW-16C locations during the RFI – Phase II to make certain that any potential plume be intercepted.

- Cross section B-B'. The cross section of the "valley" demonstrates the potential for seepage from spills in the southern edge of the south plant to discharge. Another observations is that the groundwater level observed in LS-5 is consistent with levels at MW-8 and MW-7 without mounding or any evidence of a perched zone.

- Cross section C-C'. The groundwater levels observed in LS-1, LS-2, LS-3 and LS-4 are consistent with levels at MW-12 and MW-6. Nested wells at MW-17A, MW-17B, MW-18A, and MW-18A were installed during the RFI – Phase II to intercept the entire aquifer.

- Cross section D-D'. Hennessey's Bayou is shown to be a likely location of contaminated groundwater discharge.

- Cross section E-E'. Evidence of a perched zone of groundwater is exhibited by the difference in groundwater elevations in shallow wells versus deeper wells. The perched groundwater may connect with the aquifer at locations PZ-22, PZ-23 and PZ-24. Wells PZ-26A and PZ-26B were added in the RFI – Phase II to yield additional information.

2.6 LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

This subsection is a summary that describes on Table 2-2 the sets of wells that monitor each SWMU. The contaminants that have been detected in the groundwater from each well have also been listed. During the fieldwork that is suggested in the GWA Workplan piezometric elevations will be obtained for the entire monitor well network. Additionally, groundwater samples will be obtained from each well and analyzed for arsenic, atrazine, cyanazine, dinoseb, toluene and volatiles. Existing groundwater data obtained from temporary wells is summarized on Tables 2-3 and 2-4. Table 2-3 is a summary of groundwater data obtained from temporary wells in investigations of SWMUs prior to the RFI – Phase II. Table 2-4 is a summary of groundwater data obtained from temporary wells during the RFI – Phase II.

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
1 – Hazardous Waste Storage 16 – Atrazine Manufacturing and Warehousing 17 – Returned Product Storage	Locations A, D, 1 and 2 Reference: Table 2-3 and Figures 2 and 3 Locations 16-1 and 16-2 Reference: Table 2-3 and Figures 2 and 3	Soil and concrete generally clean. Arsenic in groundwater at Location 2 was extremely localized.	**MW-2:** Arsenic (ND-0.026)/10 1,2-Dichloroethene (ND-7.36)/100 Trichloroethene (ND-2.0)/5.0 **MW-8:** Arsenic (ND-0.068)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5)/2.0
2 - Inactive Landfill	Locations LS1, LS2, LS3, LS4 and LS4 Reference: Table 3-2 and Figure 1 Location 2-15 Reference: Table 2-3 and Figure 1	The "Hill" area is contaminated. Study interception and treatment of groundwater.	**MW-5:** Arsenic (ND-0.07)/10 Dinoseb (ND-12.0)/7.0 Trichloroethene (ND-79)/5.0 Xylene (ND-10)/10,000 **MW-6:** Arsenic (ND-0.015)/10 Dinoseb (ND-75.0)/7.0 Toxaphene (ND-25.0)/3.0 Trichloroethene (ND-9.03)/5.0 Vinyl Chloride (ND-4)/2.0 Xylene (ND-7)/10,000 **MW-7:** Arsenic (ND-0.113)/10 Dinoseb (ND-4.5)/7.0 Toxaphene (ND-2.77)/3.0
4 – Activated Carbon Unit	Location 20-18 Reference: Table 2-3 and Figure 1	Analysis of groundwater at Location 20-18 will help determine necessity of monitor well for SWMU 4.	None
5 – South Plant Drainage System	None	The new wells (MW-17A, MW-17B, MW-18A, MW-18B, MW-12C, MW-10C, and MW-16C) in combination with MW-8, MW-12, MW-10, MW-16, and MW-9 effectively monitor the entire south plant drainage system.	**MW-8:** Arsenic (ND-0.068)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5.0)/2.0 **MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:**

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
5 – South Plant Drainage System (Continued)			**MW-10:** Arsenic (ND-0.015)10 Dinoseb (ND-0.836)/7.0 **MW-10C:** **MW-16:** Arsenic (ND-0.391)/10 Dinoseb (ND-0.391)/50 **MW-9:** Arsenic (ND-0.009)/10 Dinoseb (ND-11.4)/7.0
7 – Dinoseb Manufacturing Area	Locations 20-18, 20-19, 20-20, 20-21 and 20-22. Reference: Table 2-3 and Figure 1	The new wells (MW-12C and MW-10C), in combination with MW-12 and MW-10 effectively monitor SWMU 7.	**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** **MW-10:** Arsenic (ND-0.015)/10 Dinoseb (ND-0.836)/7.0 **MW-10C:**
8 – Dinoseb Loading/Unloading Area	None	Perhaps contaminated fill was used at some time underneath SWMU 8 and SWMU 9.	**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
9 – Dinoseb Drumming Area	Location TP-1 Reference: Figure 8-1, Table 2-3	MW-18A and MW-18B are immediately downgradient of area of contaminated soil underneath SWMU 9.	**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** **MW-10:** Arsenic (ND-0.015)/10 Dinoseb (ND-0.836)/7.0 **MW-10C:** **MW-18A:** **MW-18B:**
11 – MSMA Salt Unloading 12 – MSMA Manufacturing Area 15 – Methyl Parathion Manufacturing Area	Locations G-W-G, D-W-G, I-W-G, K-W-G, 12-W-G, X-W-G, Z-W-G, DD-W-G, V-V-G, WW-W-G, YY-W-G, ZZ-W-G, 7-W-G Reference: Table 2-3 and Figures 9-3 and 9-4	The new wells (MW-18A, MW-18B, MW-17A and MW-17B) are close to the source of arsenic. The monitor well network consisting of MW-8, MW-12, MW-12C, MW-10, MW-10C, MW-16, MW-16C and MW-9 are 400 to 800 feet away from the source but do cover the downgradient pathway.	**MW-8:** Arsenic (ND-0.068)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5.0)/2.0 **MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** **MW-10:** Arsenic (ND-0.015)10 Dinoseb (ND-0.836)/7.0 **MW-10C:**

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
11 – MSMA Salt Unloading 12 – MSMA Manufacturing Area 15 – Methyl Parathion Manufacturing Area (Continued)			**MW-16:** Arsenic (ND-0.391)/10 Dinoseb (ND-0.391)/7 **MW-16C:** **MW-9:** Arsenic (ND-0.009)/10 Dinoseb (ND-11.4)/7.0
13 – South Plant Drainage Ditch	Location 13-10 References: Table 2-3 and Figure 1	Trace contamination originating at SWMU 34.	None
14 – Toxaphene Manufacturing Area	Locations 20-18, 20-19, 20-20, 20-21 and 20-22 References: Table 2-3 and Figure 1	The new wells (MW-12C and MW-10C), in combination with MW-12 and MW-10 effectively monitor SWMU 14.	**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** **MW-10:** Arsenic (ND-0.015)10 Dinoseb (ND-0.836)/7.0 **MW-10C:**
18 – Blue Tank	Nonw	Monitored by MW-9.	**MW-9:** Arsenic (ND-0.009)/10 Dinoseb (ND-11.4)/7.0
20 – Railroad Area	Locations 20-18, 20-19, 20-20, 20-21 and 20-22 References: Table 2-3 and Figure 2-	The new wells (MW-12C, MW-10C and MW-16C), in combination with MW-2, MW-8, MW-12, MW-10, MW-16, MW-1A and MW-14 effectively monitor SWMU 20.	**MW-2:** Arsenic (ND-0.026)/10 1,2-Dichloroethene (ND-7.36)/100 Trichloroethene (ND-2.0)/5.0 **MW-8:** Arsenic (ND-0.068)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5.0)/2.0

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
20 – Railroad Area (Continued)			**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)/7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 MW-12C: **MW-10:** Arsenic (ND-0.015)10 Dinoseb (ND-0.836)/7.0 **MW-10C:** **MW-16:** Arsenic (ND-0.391)/10 Dinoseb (ND-0.391)/7 **MW-16C:** **MW-1A:** Arsenic (ND-0.054)/10 Dinoseb (2.34-5,500)/7 Chloroform (ND-4.0)/0.152 Dichlorobenzene (ND-2.75)/75 Trichloroethene (ND-13)/5.0 Xylene (ND-5)/10,000 **MW-14:** Arsenic (ND-0.007)/10 Dinoseb (ND-0.746)/7
23 – North Pond	None	The new wells (PZ-26A and PZ-26B), in combination with PZ-24B, PZ-20A, PZ-20B, PZ-23A, PZ-23B, PZ-22A, PZ-22B, and PZ-21A will effectively monitor the groundwater associated with SWMU 23.	**PZ-24B:** ND **PZ-20A:** ND

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
23 – North Pond (Continued)			**PZ-20B:** Bromodichloromethane (36)/1.08 Bromoform (18)/2.33 Carbon Tetrachloride (4)/5.0 Chloroform (1,700)/0.152 Chlorodibromomethane (18)/0.126 Trichloroethene (1.0)/5.0 **PZ-23A:** ND **PZ-23B:** Bromoform (8)/2.33 **PZ-22A:** ND**PZ-22B:** Bromodichloromethene (66)/1.08 Bromoform (160)/2.33 Chloroform (1,600)/0.152 Chlorobromomethane (78)/0.126 **PZ-21A:** ND
30 – North Plant Waste Oil Accumulation Area	None	Soil discoloration to be cleaned up.	None
34 – Surplus Equipment Storage	Location 13-10 References: Table 2-3 and Figure 1		None at present.
29 – North Plant Oil Collection System 31 – North Plant No. 6 Fuel Oil Area 25 – North Plant Waste Water Pipes 22 – North Plant Neutralization System	Location 22-1 and 22-2 References: Table 2-3 and Figure 1		None

NOTES:

* Concentrations are obtained from Table 5, page 4-2 of "Response to July 3, 200 Comments by the U. S. EPA on the "Amended and Supplemental Groundwater Assessment Work Plan, December 1999".

TABLE 2-3

SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS IN VARIOUS SWMU INVESTIGATIONS PRIOR TO 2001

SWMU 1, 16, 17	Sample Results µg/l (ppb)				
Compound	A-W-T	D-W-T	1-W-T	2-W-TA	MDEQ Tier 1 TRG Table µg/l (ppb)
Arsenic	--	--	--	538	10
Toxaphene	ND	ND		ND	3

SWMU 2	Sample Results µg/l (ppb)					
Compound	LS1-W	LS2-W	LS3-W	LS4-W	LS5-W	MDEQ Tier 1 TRG Table µg/l (ppb)
Chloroform	ND	221	ND	17	105	0.152
2-Butanone	ND	69.1	ND	126	63	1,910
Carbon Tetrachloride	ND	71.4	ND	126	ND	5 MCL
Ethylbenzene	ND	ND	ND	ND	12	700 MCL
Xylene (total)	ND	19.5	ND	ND	40.0	10,000 MCL
Acetaphenone	ND	ND	ND	ND	19	0.0416
Caprolactam	16	ND	12,200	39	11,476	18,300
Dimethylphthalate	ND	ND	ND	29	ND	365,000
4-Nitrophenol	ND	548	ND	ND	2,359	292
Diethylphthalate	11	11	22	16	8	29,200
Di-n-butyl-phthalate	44	161	133	54	150	3,540
Bis-(2-ethyl)hexylphthalate	213	35	474	42	131	6.0
Atrazine	ND	478	ND	ND	6	3 MCL
Dinoseb	ND	8,714	ND	597	797	7 MCL
Toxaphene	ND	ND	ND	ND	ND	3 MCL

TABLE 2-3 (Continued)

SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS IN VARIOUS SWMU INVESTIGATIONS PRIOR TO 2001

SWMU 9	Sample Results µg/l (ppb)	
Compound	TP-1	MDEQ Tier 1 TRG Table µg/l (ppb)
Antimony	12	6
Arsenic	378	50
Barium	220	2,000
Beryllium	ND	4
Cadmium	ND	5
Chromium	ND	100
Cobalt	60	2,190
Copper	ND	1,300
Lead	ND	15
Mercury	ND	2
Nickel	90	730
Selenium	ND	50
Silver	ND	183
Thallium	ND	2
Vanadium	ND	256
Zinc	70	11,000
Cyanide	ND	200
1,2-Dichlorobenzene	11	606
Cis-1,2-Dichloroethene	26	70
Trans-1,2-Dichloroethene	6	100
Trichloroethene	68	5
Xylenes	14	10,000
1,2-Dichlorobenzene	4	600
m-Nitrosodiphenyl amine	2	13.7
Atrazine	ND	3
Dinoseb	ND	7
Toxaphene	ND	3

TABLE 2-3 (Continued)

SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS IN VARIOUS SWMU INVESTIGATIONS PRIOR TO 2001

SWMU 11, 12, 15	Sample Results µg/l (ppb)													MDEQ Tier 1 TRG Table µg/L (ppb)
Compound	G-W-G	D-W-G	I-W-G	K-W-G	R-W-G	X-W-G	Z-W-G	DD-W-G	V-V-G	WW-W-G	YY-W-G	ZZ-W-G	7-W-G	
Arsenic	14,300	253	288,000	297	5,260	730	1,720	1,260	14	56	26	216	51,000	10

Compound	SWMU 1, 16, 17		SWMU 2	SWMU 7, 14, 20					SWMU 9	SWMU 13, 34	SWMU 22		MDEQ Tier 1 TRG Table µg/L (ppb)
	16-1	16-2	2-15	20-18	20-19	20-20	20-21	20-22	8-1	13-10	22-1	22-2	
Arsenic													10
Atrazine													3
Cyanazine													0.0797
Dinoseb													7
Toxaphene													3
Volatile Organics Component													
Choromethane													1.49
Bromomethane													8.52
Vinyl Chlroide													2.0
Chloroethane													3.64
Methylene Chloride													5.0
Acetone													3,650
Carbon Disulfide													1,040
1,1-Dichloroethene													7.0
1,1-Dichloroethane													798
1,2-Dichloroethene (total)													70
Chloroform													0.152
2-Butanone													1,910
1,2-Dichloroethane													5.0
1,1,1-Trichloroethane													200
Carbon Tetrachloride													5.00
Bromodichloromethane													1.08
1,2-Dichloropropane													5.0
c-1,3-Dichloropropene													0.765
Trichloroethene													5.0
Benzene													5.0

TABLE 2-3 (Continued)

SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS IN VARIOUS SWMU INVESTIGATIONS PRIOR TO 2001

Compound	SWMU 1, 16, 17		SWMU 2	SWMU 7, 14, 20					SWMU 9	SWMU 13, 34	SWMU 22		MDEQ Tier 1 TRG Table µg/L (ppb)
	16-1	16-2	2-15	20-18	20-19	20-20	20-21	20-22	8-1	13-10	22-1	22-2	
Dibromochloroemethane													5.0
t-1,3-Dichloropropene													0.0765
1,1,2-Trichloroethane													5.0
Bromoform													2.33
4-Methyl-2-pentanone													2,920
Tetrachloroethene													5.0
1,1,2,2-Tetrachloroethane													0.0527
2-Hexanone													1,460
Toluene													1,000
Chlorobenzene													100
Ethylbenzene													700
Styrene													100
Xylenes (total)													10,000

The following information is provided in this Groundwater Assessment Workplan:

- The location of existing wells is found on Figure 1. Potentiometric contours are also shown on the figure. No new wells are proposed.
- Construction logs for each permanent monitoring well and piezometer is found in Appendix D.
- The monitoring parameters have been established for the Vicksburg site to be: arsenic, atrazine, cyanazine, dinoseb, toxaphene and volatiles.
- Geologic cross-sections are found in the Figures section of this workplan.
- Sampling and analytical methods are found in Appendix E and Appendix F. The first pages in Appendix E are an addendum describing bailer purging of wells. The addendum is from page 17-1 of "Response to July 3, 2000 comments by the U.S. EPA on the 'Amended and Supplemental Groundwater Assessment Workplan', December 1999".
- Previously-gathered groundwater quality information from permanent wells and piezometers is included in Appendix H.
- Previously-gathered groundwater quality information from temporary wells is included in Table 2-3.
- The previously-gathered groundwater quality information is evaluated by comparing it to values presented in the MDEQ Tier 1 TRG Table and by examining the likely correspondence between wells and SWMUs as presented in Table 2-2.
- An overview of site wide soil contamination sources is presented on Figure 2.
- An overview of site wide groundwater contamination of indicator parameters is presented on Figure 3.

The field work remaining for the groundwater assessment will consist of:

- One round of measuring water levels in all the permanent wells and piezometers.

- One round of sampling the groundwater in all the permanent wells and piezometers. Samples will be run for arsenic, atrazine, dinoseb, toxaphene and volatiles.
- There will be hydraulic testing of the area adjacent to SWMU 11, 12, 15.

3.1 GROUNDWATER SAMPLING AND ANALYSIS

The initial groundwater monitoring program at the Vicksburg site involved several wells; however, only four compounds were included in the analysis. At the request of MSDEQ, VCC expanded their existing quarterly groundwater monitoring program to include analysis for methyl chloride, dinitrobutyl phenol, arsenic, and toxaphene. In the second quarter of 1991, VCC added four more compounds to be analyzed. These four compounds are carbon tetrachloride, chloroform, TCE, and Methyl Ethyl Ketone. More recent quarterly sampling has also tested for volatile compounds using the SW846b Method 8240 (GC/MS). The results of the sampling has been reported to the MSDEQ and is included in the Groundwater Analytical Data Summary provided as Appendix H. The TCL and TAL analyses for groundwater from piezometers PZ12-B, PZ-12B, PZ-20A, PZ-20B, PZ-21A, PZ-2B, PZ-22A, PZ23-A, PZ23-B, PZ-24B, PZ-25A and PZ-25B are also included in Appendix H. The water level data for permanent wells and piezometers are also included within Appendix H.

From the existing groundwater data and the existing soil contamination data, the monitoring parameters for the site have been established to be arsenic, atrazine, cyanazine, dinoseb, toxaphene and Volatiles. It is suggested that groundwater samples be obtained from all the existing permanent wells and piezometers and analyzed for the monitoring parameters. Prior to the sampling activity, water levels would be obtained at each of the permanent wells and piezometers.

3.2 HYDRAULIC TESTING

It was an observation in the DISC report, referred to in Section 2.1.2 of this report, that at a depth of 40 feet, the hydraulic conductivity ranged from 7.5×10^{-4} to 4.3×10^{-7} centimeters per second. Additional aquifer properties which were obtained by IT during various investigations prior to 1993 are summarized below:

TABLE 7

AQUIFER PROPERTIES – IT CORPORATION STUDY

Monitor Well No.	Porosity (%)	Standard Thickness (ft)	Hydraulic Gradient (ft/ft)	Hydraulic Conductivity (cm/sec)	Velocity (ft/day)	Transmissivity (gal/day)(ft)
1*	46	30	0.04	9.07×10^{-5}	0.022	58
6	45	20.5	0.025	9.26×10^{-5}	0.015	40
11	44	42	0.11	2.59×10^{-4}	0.184	232
12	42	41	0.011	1.3×10^{-4}	0.01	116

NOTES:

* MW-1 was replaced by MW-1A in 1986.

Understanding the basic lateral and vertical groundwater flow of the affected permeable zones is an essential element to characterization. Groundwater flow characteristics, including flow directions (patterns) and rates, are largely dependent upon hydraulic conductivities and gradients of the permeable zone. Contaminant transport characteristics will be greatly influenced by groundwater flow rates and pathways, because the contaminants of concern are dissolved in the groundwater.

The hydraulic test to be employed for the additional hydraulic testing will be a slug test. Slug tests will be performed on MW-17A and MW-17B which are two of the wells constructed in the South Plant process area near SWMU 11, 12, 15. Aquifer properties have not previously been obtained in that area.

Slug testing equipment consists of:

- Pressure transducer(s)
- Suspended weight of known volume (slug)
- Electric water level sensor
- Data logger (recorder)
- Field data printer

Slug testing of a well will be conducted according to the following general procedures:

- The magnitude of instantaneous head change resulting from introduction or removal of the slug shall not cause water to overflow the well casing. To assure meeting these requirements, magnitude of head change shall be determined prior to introduction of the slug. The magnitude determination shall be based on the calculated volume of the slug and the inside diameter of the casing. The test shall proceed only when these requirements are met.
- All equipment entering the well shall be decontaminated prior to placing into the well.
- The static water level shall be measured using an electronic water level sensor.
- When the transducer is lowered into the well and in place, the slug shall be introduced to the well as rapidly as possible without causing undue splashing or turbulence so as to produce an instantaneous head increase.

  Time (t) = 0 the instant the slug is in place.
- Water levels shall be measured continuously (millisecond intervals) with the transducer and recorded with the data logger unit. Measurements shall be terminated when the water level stabilizes or when the water level has reached a level within 10 percent of static level.
- Water level measurements recorded shall be checked for credibility before proceeding to the next testing stage (removal of the slug).
- When checking of data has been completed and the previous testing has been determined to be acceptable, the slug shall be removed from the well as rapidly as possible so as to produce an instantaneous head reduction.

  Time (t) = 0 the instant the slug has been removed from the water.
- Water levels shall be measured continuously (as in the previous testing stage) using the transducer and shall be recorded using the data logger unit. Measurements shall be terminated when the water level stabilizes or reaches a level within 10 percent of initial static water level.
- When measurements are terminated, the transducer shall be removed from the well.

- Water level measurements recorded shall be checked for credibility before proceeding to the next well.
- Any test or test stage shall be repeated if review of the recorded data indicates questionable validity.

The data from the slug test will be reduced to evaluate time versus change in water level using the methods of Cooper and Other (1967) or Bouwer and Rice (1976).

3.3 NATURE AND EXTENT OF CONTAMINATION

As noted in Section 3.2, samples of groundwater will be obtained from all of the existing permanent monitor wells and piezometers. The samples will be analyzed for arsenic, atrazine, cyanazine, dinoseb, toxaphene, and Volatiles. This data will be combined with the data in Appendix H.

3.3.1 Source of Groundwater Contamination

If by analysis of the groundwater sampling data a groundwater contamination plume is detected, the source of the plume will be identified if possible. Over the course of the South Plant's long history, various construction activities have occurred at the site. Contamination sources, such as broken pipes, which can easily be repaired have been corrected. The contamination of soil and groundwater caused by the break would remain. Additionally, there may have been routine chemical spills at facilities that are now dismantled and demolished. Only the contaminated soil and groundwater remain; therefore, the original cause or source may be difficult to identify.

An example of a former source is the surface impoundments (SWMU 3), which have been retrofitted with double geosynthetic liners. Prior to the retrofit contaminated sludge was removed, solidified, stabilized and placed in an aboveground vault constructed to RCRA standards; SWMU 3 was the source of contamination.

The study of SWMUs 12, 11 and 15 resulted in discovery of an area of soils contaminated with arsenic and a groundwater plume of arsenic contamination. The source of contamination presumably was waste handling activity at the former MSMA plant.

SWMU 2 is an area of the plant site where there are known deposits of waste. SWMU 2 is a hill with a natural elevation approximately 30 feet above immediate surrounding areas. A landfill and four pits or ponds were constructed on the hill and utilized from 1972 to 1975. One pit was constructed to store dinoseb process wastewater. Three pits were used as disposal locations for pallets, empty fiber and steel drums. In 1977 many of the drums in the pits, but not the landfill, were removed and disposed off-site. In 1979 all the pits were drained, regraded so the hill was flattened and covered with a soil cap. Some of the soil was obtained off-site and placed on the landfill area. In 1983, there was additional grading and capping of the entire area consistent with an engineered plan approved by the MSDNR. A discovery of the RFI was that the cap did not extend sufficiently far on the southwest edge. An area that was obscured by trees and dense overgrowth had eroded and allowed transport of contamination to a valley between the hill and adjacent railroad tracks. The cap will be extended as part of corrective action. In 1988 the SWMU 3 wastewater ponds, which are adjacent to SWMU 2, were lined and a repository for pond sediments (SWACA) was constructed. The SWACA was constructed in the location of one of the ponds. The sediments from the SWMU 3 wastewater ponds and most of the sediment of the pond are within the SWACA. The pond lining and SWACA construction is consistent with RCRA guidelines. There is evidence from temporary wells that groundwater immediately beneath SWMU 2 has been impacted. SWMU 2 is monitored by monitoring well s MW-5, MW-6 and MW-7.

Groundwater has additionally been impacted at SWMU 23, the North Pond. The North Pond is no longer in use but there are volatiles in the groundwater. SWMU 23 is monitored by monitoring wells PZ-21A, PZ-22A, PZ-22B, PZ-23A, PZ-23B, PZ-24B, PZ-26A and PZ-26B.

3.3.2 Contamination Plume

Sampling data will be used to construct additional maps of any contamination plumes in the uppermost aquifer. These maps will be developed from data obtained by sampling and analyzing groundwater. Any detected hazardous waste or hazardous waste constituents in the uppermost aquifer will be mapped to show the extent of the contamination plume and the concentration of each specific constituent in the groundwater. Based on the location and concentration of the hazardous waste or hazardous waste constituent and the direction of groundwater flow, the migration direction (flowpath) will be identified.

A separate site wide map will be constructed to show concentrations of each of the following:

- Arsenic,
- Dinoseb,
- Toxaphene, and
- Volatiles

Unless data obtained in the Groundwater Assessment field work is different from previous data, there is no need to construct maps showing atrazine or cyanazine.

4.1 GROUNDWATER ASSESSMENT PROJECT SCHEDULE

The Groundwater Assessment project schedule is a function of U.S. EPA schedule of review. VCC anticipates issuing a GWA report in August 2001.

4.2 REPORTING REQUIREMENTS

Several reports are mandated by the Consent Decree. Due dates for these reports are also mandated in the Consent Decree.

4.2.1 Progress Reports

Monthly progress reports dated the 10th of the month have been and will continue to be provided to EPA and MSDEQ containing:

- Description and estimate of the percentage of the RFI completed
- Summaries of all findings
- Summaries of all changes made in the RFI during the reporting
- Summaries of all contacts with representatives of the local community, public interest groups, or State government during the reporting period
- Actions being taken to rectify problems
- Changes in personnel during the reporting period
- Projected work for the next reporting period
- Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

4.2.2 Annual Groundwater Assessment Reports

VCC will begin submission of annual Groundwater Assessment Reports to EPA and MSDEQ on or before March 1 of each calendar year subsequent to the submittal of the initial GWA report. The GWA report will be written after the completion of the studies in the GWA Work Plan. This annual report will include the following information:

- Groundwater surface elevations measured on a quarterly basis, for each well specified in the Groundwater Assessment Program.
- Concentrations or values of the monitoring parameters obtained from quarterly analysis at each groundwater monitoring well.
- Evaluation of the monitoring parameter as outlined within the facility's Groundwater Assessment Program Work Plan.
- Plots showing concentrations of arsenic, dinoseb, toxaphene, and volatiles on maps of the site.
- Recalculations, as necessary
  - Hydraulic conductivity and effective porosity.
  - Determination of the rate of groundwater flow and direction in the uppermost aquifer.
- Summary of results.

The Project Management Plan consists of the following elements:

- Project task definition
- Specific personnel positions within the project organizational structure

5.1 PROJECT TASK DEFINITION

VCC has retained the services of URS to develop the RFI and GWA Work Plans to the satisfaction of the EPA and MSDEQ and assist VCC in implementing the work plans.

5.2 PROJECT PERSONNEL

Duties of key personnel are described below.

5.2.1 U.S. EPA and MSDEQ Project Coordinator

The U.S. EPA and MSDEQ project coordinators or designated agents will observe work plan activities to any extent deemed necessary to confirm that the requirements of the Consent Decree, and the RFI Work Plan are met.

5.2.2 Project Director

The Project Director is Mr. Steve Boswell. He is an employee of and is the official representative for VCC. He is in charge of administration of the work and the completion of the project.

5.2.3 URS Project Manager

The URS Project Manager develops the plans required by the Consent Decree and oversees work implementing the Work Plan on behalf of VCC, and is the primary contact with VCC. The URS Project Manager is Richard D. Karkkainen. Mr. Karkkainen is a Principal Environmental Engineer in URS.

5.2.4 URS Field Investigation Site Coordinator

The URS Field Investigation Site Coordinator will handle day to day activities and coordinate them with other RFI and GWA activities. He will coordinate efforts and oversee their implementation. The Project Manager is expected to fulfill this role. He will be assisted by Dean Lowe, a geologist with 40 years of experience. Mr. Lowe is a Principal Geologist associated with Petra Environmental the geo-probe subcontractor.

5.2.5 Health and Safety Officer

A Health and Safety (H & S) officer will be responsible for the administration and implementation of the site Health and Safety for Groundwater Assessment activities. The H & S Officer will coordinate efforts through a Site Safety Officer. The Site Safety Officer will coordinate effort with the VCC safety personnel. The Project Manager may fulfill this role. A Health and Safety Plan is found in Appendix C of the Amended and Supplemental RFI Work Plan, December 1999. The H & S officer will have the overall responsibility for safety and health and will:

- Ensure that and employee medial surveillance program which meets the requirements of 29 CFR 1910.120 is instituted and maintained.

- Be responsible for the initial pre-construction indoctrination of all on-site personnel with regard to the H & S Plan and other safety requirements to be observed during the construction, including but not limited to:

  - potential hazards
  - personal hygiene principles
  - personnel protective equipment
  - respiratory protection equipment usage and fit testing, and
  - emergency response including site evacuation, dealing with fire and medical situations

- Be responsible for the maintenance of separate exclusion, contamination reduction, and support zones if needed as described in the Contractor's H & S Plan and on the drawings.

- Ensure that personnel exposure air monitoring, if needed, is properly conducted and recorded.

- During on-site activity, maintain a recordkeeping system which will include daily records of all site activity, waste quantities produced, waste transportation activity information, laboratory results, and other information.

5.2.6 QA/QC Manager

The QA/QC Manager will be responsible for coordination with the analytical laboratory and for the validation of data. Mr. Rodney Culpeper, analytical chemist and manager of Magnolia Scientific Laboratory, is QA/QC Manager.

URS

March 30, 2001

Mr.Steve Boswell
Vicksburg Chemical
4280 Rifle Range Road
Vicksburg, Mississippi 39180

via: ***Federal Express***

Re: URS File Number 35-092B007C.00 04003
Draft Groundwater Assessment Workplan

Dear Steve:

Attached are two copies of the text of the draft of the "Groundwater Assessment Workplan - Revision 1 - June 2001" for your review. The groundwater data obtained during the RFI - Phase II needs to be inserted and the document submitted at the same time as the Final RFI Report.

In summary, what is suggested is:

- No new wells
- One round of water level measurements in all permanent wells and piezometers.
- One round of sampling groundwater in all permanent wells and piezometers and analysis for arsenic, atrazine, cyanazine, dinoseb, toxaphene and volatiles.
- Hydraulic testing (slug tests) in wells MW-17A and MW-17B.

I don't know if the EPA will buy off on not including semi-volatiles, pesticide-PCBs, and metals in the analytical work; however, I do not see the need to expend the extra money. Also if Dave Green is available, he can do the water level measurements and the water sampling for the Groundwater Assessment in order to save money. In essence, the Groundwater Assessment fieldwork is, at this point, not complex and, hopefully, the EPA will not make it complex.

Very truly yours,

Dick Karkkainen
URS Corporation
2822 O'Neal Lane
Baton Rouge, LA 70816
Tel: 225.751.1873
Fax: 225.753.3616

D R A F T

AMENDED AND SUPPLEMENTAL GROUNDWATER ASSESSMENT WORKPLAN

REVISION 1 – JUNE 2001

Prepared for
Vicksburg Chemical
Vicksburg, Mississippi

June 2001

File No. 35-092B007C.00-04003

URS Corporation
2822 O'Neal Lane
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Figure 2-6 Section E-E'; generally east/west through the North Pond.

Figure 2-7 Section F-F'; generally north/south on the eastern boundary in the south plant.

Vicksburg Chemical Company (VCC) retained URS Corporation (URS) to perform activities associated with a RCRA corrective action program. The corrective action program is in response to a Consent Decree which became effective July 1, 1991. The Consent Decree requires that a RCRA Facility Investigation (RFI) be conducted at the Vicksburg, Mississippi manufacturing facility, and that it be followed up by corrective measures as needed.

The purpose of the RFI is to determine the nature and extent of releases of hazardous wastes and/or constituents from regulated units, solid waste management units (SWMUs), and other areas of concern (AOCs) at the facility and to gather all necessary data to support any corrective action required.

The RFI constitutes the second phase of the RCRA corrective action program. The program's first phase consists of the RCRA Facility Assessment (RFA) which is conducted by the EPA and precedes the RFI. The RFI itself is divided into several separate tasks. The tasks include the Preliminary Report, the RFI Work Plan, the Facility Investigation, and the Investigative Analysis Report (RFI Report). Subsequent phases of the RCRA corrective action program concern defining and implementing any needed measures that will protect human health and the environment. In addition, a Groundwater Assessment (GWA) Work Plan, a Closure Plan for SWMU 1 and SWMU 17, and Annual Groundwater Assessment Reports are required by the Consent Decree.

VCC submitted the Preliminary Report and Closure Plan for SWMU 1 and SWMU 17, and subsequently updated the Preliminary Report. The Preliminary Report and Closure Plan for SWMU 1 and SWMU 17 have been approved. VCC submitted the RFI Work Plan and the GWA Work Plan and has updated both plans. The RFI Work Plan was approved, and has been implemented in two phases in the field. The RFI effort is described in the Draft Final RFI Report which is submitted concurrently with this document.

This document is Revision 1 of an Amended and Supplemental Work Plan that defines and describes the Groundwater Assessment (GWA) to be executed by VCC. The purpose of GWA is to evaluate the groundwater quality, monitoring system and program, as well as the abatement system at the facility. Revision 1 is issued because of the additional field derived information and understanding of the site obtained since issuing prior versions.

The Groundwater Assessment program consists of the following tasks:

- Groundwater Assessment Work Plan
- Implementation of the Work Plan
- Publication of the results and conclusions
- Annual Groundwater Assessment Reports

The Groundwater Assessment program activities are intended to be executed immediately after a RCRA Facility Investigation. Data needed for Groundwater Assessment activities and requisite activities such as borings and well installations were in part obtained during the RFI implementation programs. As will be described subsequently, a portion of the RFI program has been expedited because of VCCs need to expand its manufacturing and storage capability in some of the SWMU areas.

The Groundwater Assessment Work Plan includes the following elements:

- Number, location, depth of wells, and the rationale for any new well placement
- Construction logs for each existing monitoring well
- List of the monitoring parameters
- Geologic cross-sections
- Sampling and analytical methods for those hazardous wastes or hazardous constituents at the facility
- Evaluation procedures, including any use of previously-gathered groundwater quality information
- Schedule of implementation of additional work

The GWA Work Plan is guided by the information contained in the Amended and Supplemental Preliminary Report (February 1994 with November 1995 Revisions) and by the RFI.

The following is a summary description of the SWMUs followed by a tabulation of SWMU activity at the site which was expedited because of VCC's plans to construct new manufacturing facilities and also utilize some of the SWMU areas for storage and for

transportation related activity. The summary discussion of the SWMUs is obtained from the RFI Report. For additional information, including data on soil contamination the RFI Report should be examined. Groundwater quality information in the SWMUs is found in Section 2 and Appendix H of this Groundwater Assessment Workplan.

SWMU 1 – Container Drum Storage Area, SWMU 16 – Former Atrazine Production Area, SWMU 17 – Returned Product Storage Area

SWMU 1 is a "less than ninety day hazardous waste drum storage area" that was located at the South Plant adjacent to the Former Atrazine Production Area (SWMU 16) across a walkway from the Returned Product Storage Area (SWMU 17). This area was diked. The roof over the area was destroyed by a windstorm during mid-1990. Spills were collected in a sump common to both this area and the Returned Product Storage Area (SWMU 17). The floor has been cleaned through sweeping, scraping, chipping, and reacting the dinoseb with hydrogen peroxide and a ferrous iron catalyst. A closure plan for the Container (Drum) Storage Area (SWMU 1) and the Returned Production Storage Area (SWMU 17) was developed by URS for VCC. The closure plan is consistent with RCRA rules and regulations. The closure plan was originally submitted in June 1992 as a 60-day deliverable to the EPA and MSDEQ by VCC.

A facility for the manufacture of potassium phosphate has been constructed on the SWMU 1 site.

The Former Atrazine Production Area (SWMU 16) is located adjacent to the Container (Drum) Storage Area (SWMU 1) and the Returned Product Storage Area (SWMU 17). In addition to producing atrazine, this process area manufactured the herbicide cyanazine under the packaged name Bladex. The former atrazine warehouse is located adjacent to the Former Atrazine Production Area (SWMU 16). The warehouse was used to store dinoseb as well as atrazine.

The warehouse continues in service in order to store various fertilizer products manufactured by VCC. The Atrazine Production Area was demolished and was reconstructed for the production of potassium phosphate.

The Returned Products Storage Area (SWMU 17) was located across a walkway from the Container (Drum) Storage Area (SWMU 1). Product formulations returned by consumers

and off-spec product were stored here until they could be reblended, re-containerized, and sold or disposed of as a hazardous waste. The floor has been cleaned through sweeping, scraping, chipping, and reacting the dinoseb with hydrogen peroxide and ferrous iron catalyst. A closure plan for the Container (Drum) Storage Area (SWMU 1) and the Returned Production Storage Area (SWMU 17) was submitted by VCC as a 60-day deliverable pursuant to the Consent Decree.

The SWMU 17 site was part of the site of a potassium phosphate manufacturing facility. As noted above the potassium phosphate groundwater facility encompasses SWMU 1, the production area of SWMU 16 and SWMU 17.

SWMU 2 – Inactive Landfill

SWMU 2 is a hill with a natural elevation approximately 30 feet above immediate surrounding areas. A landfill and four pits or ponds were constructed on the hill and utilized from 1972 to 1975. One pit was constructed to store dinoseb process wastewater. Three pits were used as disposal locations for pallets, empty fiber and steel drums. In 1977 many of the drums in the pits, but not the landfill, were removed and disposed off-site. The location of the closed pits and closed landfill are based on a March, 1979 aerial photograph. The boundary lines of the pits were partially destroyed during regrading efforts in late 1979. In 1979 all the pits were drained, regraded so the hill was flattened and covered with a soil cap. Some of the soil was obtained off-site and placed on the landfill area. In 1983, there was additional grading and capping of the entire area consistent with an engineered plan approved by the MSDNR. In 1988 the SWMU 3 wastewater ponds, which are adjacent to SWMU 2, were lined and a repository for pond sediments (SWACA) was constructed. The SWACA was constructed in a pond location. The sediments from the SWMU 3 wastewater ponds and most of the sediment of the pond are within the SWACA. The pond lining and SWACA construction is consistent with RCRA guidelines.

SWMU 4 – Activated Carbon Unit

The Activated Carbon (Adsorption) Treatment Unit treats wastewater from the Surface Impoundment (SWMU 3) to remove organic materials before the water is pumped to the Mississippi River in accordance with the NPDES permit. Secondary containment for the unit consists of a concrete pad approximately 100 feet long, 20 feet wide with 1-foot tall

containment curbs. The concrete containment unit is cracked and stained. There is visual evidence of spillage of carbon on the east side of the containment area.

SWMU 5 – South Plant Drainage System

The South Plant Drainage System was designed to transfer storm water and process water to the Surface Impoundment (SWMU 3) for containment prior to treatment. Sumps exist within the former MSMA, dinoseb and toxaphene production, packaging and shipping areas of the South Plant. At one time, some of the sumps carried water to the Surface Impoundment (SWMU 3); however, due to regulations which became effective in November 1985, sumps in the pesticide process and handling areas were blocked. This precluded the possibility of pesticide spills from entering the Surface Impoundment (SWMU 3) by gravity flow through the Drainage System.

SWMU 7 – Former Dinoseb Production Area

The Former Dinoseb Production Area is located near the railroad tracks. The production area and foundation have been demolished and removed and a portion treated in a CAMU. Some discolored soil has been removed. Due to the acid involved in the manufacturing of the herbicide, the concrete and cement in the process area had been badly corroded and etched. The dinoseb manufacturing process consisted of sulfonation and nitration reactors, two formulation blending tanks, and a settling tank. At one time, acidic process wastewater was neutralized with sodium hydroxide or ammonia and then discharged to the Surface Impoundment (SWMU 3) through carbon adsorption beds. Emission from the nitration reactor was controlled by a butane-fired flare. Flare failure required immediate plant shut down; however, the soil in the area surrounding the flare is suspected to be contaminated. The area is surrounded by the Railroad Area (SWMU 20) and is adjacent to the Toxaphene Area (SWMU 14).

SWMU 8 – Dinoseb Loading/Unloading Area

The Dinoseb Truck Loading/Unloading Area is located in the central section of the South Plant adjacent to the Dinoseb Drumming Area (SWMU 9). It is a concrete pad that used to contain spillage associated with the truck loading/unloading operations at the Former Dinoseb Drumming Area (SWMU 9). The pad is approximately 25 feet long and 15 feet wide.

The loading/unloading area is now covered with asphalt and within a warehouse/operations area for production of Multi Cote (coated fertilizers for slow release of nutrients). It continues to be used as a loading/unloading area.

SWMU 9 – Dinoseb Drumming Area

Drumming of the dinoseb and toxaphene formulations took place in the south end of a warehouse in the central section of the South Plant. In the drumming operation of the dinoseb and toxaphene, an absorbent was placed on the floor to prevent material reaching the Surface Impoundment from spills. Yellow stains were evident on the floor.

The SWMU 9 site is presently the site on which a facility to coat and then store various fertilizer mixtures has been constructed. Prior to the construction the area was sampled and cleaned up. The entire surface of the concrete in SWMU 9 was treated by grinding off a veneer of concrete then by placing a layer of compost atop it in an attempt to draw contaminants from the surface of the concrete into the compost where biological degradation would occur. The effort was experimental and results were uncertain. Subsequently, concrete and some soil were removed from a section comprising the middle third of SWMU 9. All concrete grindings, concrete debris, and soil removed were taken to the Treatment Unit for eventual biodegradation/composting within the provisions of the CAMU permit.

SWMU 11 – Former MSMA Production Area, SWMU 12 – Former MSMA Salt Unloading Area, SWMU 15 – Former Methyl Parathion Production Area

The MSMA Production Area (SWMU 11) was constructed over the remains of the Former Methyl Parathion facility (SWMU 15) in 1983. Subsequently, the MSMA process was shut down and equipment from the area was removed and the concrete foundation of the area was cleaned with high-pressure water equipment.

The MSMA Salt Unloading Unit was an integral part of the MSMA Production Area (SWMU 11). Salts were discharged directly from a centrifuge into containers located within the area.

The original process unit was constructed in the early 1970s to produce methyl parathion. The methyl parathion manufacturing facility was destroyed in an explosion and fire on March 7, 1978.

SWMU 13 – South Plant Drainage Ditch

There is one major Drainage Ditch which runs along the western border of the South Plant and empties into Hennessey's Bayou. No contaminated Drainage System (SWMU 5) water or NPDES permitted discharge is received by the major Drainage Ditch. However, some storm water runoff has discharged into the major Drainage Ditch from the South Plant. Additionally, drainage from a portion of SWMU 34 – The Junkyard discharges into the drainage ditch.

SWMU 14 – Former Toxaphene Production Area

The Former Toxaphene Production Area is adjacent to SWMU 7 - The Dinoseb Production Area and is surrounded by SWMU 20 – The Railroad Area.

Raw material used in the toxaphene manufacturing process included sodium hydroxide, xylene, epichlorohydrin, chlorine, carbon tetrachloride, and camphene. Caustic scrubber water from the toxaphene operation was discharged to the sump adjacent to the Former Dinoseb Processing.

The processing equipment from the Toxaphene plant has all been removed. The foundations and secondary containment concrete structure were in good repair and were not demolished. The foundation presently serves as a repository for soil excavated from various parts of the South Plant during construction activity. The soil is to be treated by a biological degradation composting process.

SWMU 18 – Former Blue Tank

The Former Blue Tank (SWMU 18) received unneutralized dinoseb process wastewater prior to off-site disposal by deep well injection. The unit was located northwest of the Former Dinoseb Production Area (SWMU 7) and adjacent to the Nitric Acid Production Area in the South Plant. A gravel covered area exists at the location of the Former Blue Tank (SWMU 18). The original 16,000-gallon tank was fiberglass. The fiberglass tank leaked. Two repair attempts failed in 1983 causing the fiberglass tank to be replaced by a stainless steel tank at the dinoseb plant. The fiberglass tank was demolished and removed from the site.

SWMU 20 – Railroad Area

The Railroad Area (SWMU 20) including the Railroad Car Loading/Unloading Station is located at the eastern boundary of the manufacturing portion of the South Plant. The railcar station was the primary area for the loading/unloading of materials for the various operations conducted at the South Plant. The area spans several hundred feet along the multiple-lane railyard. The ground in the surrounding area has received spillage from the loading/unloading operations. In addition to railyard operations, the flare for the dinoseb production area nitration reactor was located directly across the tracks from the railyard. Incomplete flaring discharged constituents onto the ground in the area surround the flare. The flare area is indistinguishable from the Railroad Area (SWMU 20).

SWMU 20 also surrounds SWMU 7 – The Former Dinoseb Production Area and SWMU 14 – The Former Toxaphene Production Area. SWMU 4 – The Activated Carbon Unit is on the eastern edge of SWMU 20.

SWMU 23 – Equalization/Neutralization Pond

This unlined pond also known as the North Pond was located on the North Plant site and was utilized for neutralization of acidic wastewater from the potassium nitrate production process. The neutralization of the water in the Neutralization Pond was achieved using limestone. The potassium nitrate production wastewater is no longer routed through the equalization and neutralization ponds. The pond at the North Plant is inactive. The pH of the rainwater in the pond has been checked and found to be near neutral. URS conducted an RFI in the North Pond Area in November and December 1993.

SWMU 30 – North Plant Waste Oil Accumulation Area

The Waste Oil Satellite Accumulation Area (SWMU 30) is an outdoor drum staging area located in the south section of the North Plant. The unit is downgradient from the Inactive North Plant Surface Impoundment (SWMU 23). The unit consists of a concrete pad with secondary containment in the form of concrete curbing used to stage drums of new and waste lubricant oils prior to of-site recycling. The area is situated in the vicinity of a lubricant storage area. The area is roofed.

SWMU 34 – Surplus Equipment Storage

The Surplus Equipment Storage Areas are located at the western edge of the South Plant at the head of the South Plant Drainage Ditch (SWMU 13) and at the western edge of the North Plant. The main storage area is the one located in the South Plant. The storage areas were used for temporary storage of old equipment, and other scrap material. Most items have been removed for recycling.

SWMU 29 – North Plant Oil Collection Unit, SWMU 31 – North Plant No. 6 Fuel Oil Area, SWMU 25 – North Plant Waste Water Pipes, SWMU 22 – North Plant Neutralization System

The four items are grouped together. They were mentioned in the RFA. In the Preliminary Report, it was suggested that inspections of the areas should be made during the field investigations of the RFI prior to determining if field sampling was required. Some cleaning effort was required prior to inspection.

SWMU 29 is a drum that collects oil drips from the potassium nitrate cooling cylinder. The oil collection system has been modified so that oil drips are now directly piped to the drum.

SWMU 31 is a concrete sump that formerly housed pumps to move fuel oil from tanks to boilers. The tanks and pumps had been removed prior to the writing of the Preliminary Report; however, deposits of soil in the sump made it impossible to observe whether there had been cracks in the concrete. The cracks would be potential avenues of escape of fuel oil in the event it leaked from pumps into the sumps.

SWMU 25 is the system of waste water pipes carrying waste water that can be acidic from the North Plant Manufacturing to a sump from which it is pumped to the neutralization system.

SWMU 22 is the sump collecting wastewater as noted above and the neutralization system itself. The neutralization system was not questionable in the Preliminary Report as a source of contamination into the soil and groundwater; however, the integrity of the sump was questioned. The old sump was removed and was replaced with a new sump in March 2001.

TABLE 1-1

SWMU ACTIVITY

Report	Date	Status	Comment
RFI Work Plan SWMUs 9 and 16	August 1994	Submitted	--
RFI Report SWMUs 9 and 16	September 1994	Submitted	--
SWMU 23 North Pond RFI Work Plan FRI Report	October 1994	Submitted	14 piezometers were installed.
Closure Plan SWMUs 1 and 17	February 1995 (Modified 10-26-95)	Approved by the U.S. EPA and MSDEQ	--
RFI Work Plan Entire Site	June 1996	Modified 12-16-99 and subsequently approved	Incorporated investigative phase of "Closure Plan SWMUs 1 and 17".
GWA Work Plan Entire Site	June 1996	Modified 12-16-99. To be revised after completion of Final RFI Report	--
RFI Expedited Work Plan SWMUs 12, 11, 15, 16, 1 and 17	January 1997	Submitted	VCC planned to expand manufacturing capability into SWMU 12, 11 and 15 area or SWMU 16, 1 and 17 area.
RFI Report, Corrective Measures Study, RCRA Corrective Measures Implementation Plan SWMUs 16, 1 and 17	June 1997	Approved by the U.S. EPA and MSDEQ	--
Corrective Action Management Unit Application	June 1997	Approved by the U.S. EPA and MSDEQ	--
RFI Report SWMUs 12, 11 and 15	April 1998	Submitted	--
Corrective Measures Implementation Plan SWMUs 12, 11 and 15	April 1998 (as amended July 15,1 998)	Submitted	To be revised by 11-15-00
Corrective Action Observation Confirmatory Sampling and Analysis SWMUs 1 and 17	July 1998	Submitted	--
Arsenic Data Sets Arsenic Data Sets – Addendum	October 15, 1998 October 26, 1998	Submitted Submitted	Evaluation of arsenic background data.

TABLE 1-1 (Continued)

SWMU ACTIVITY

Report	Date	Status	Comment
SWMU 9 Corrective Action Observation	March 11, 1999	Submitted	--
Observations and Sampling of Ditch	September 8, 1999	Submitted	Surficial dinoseb contamination of soil noted during excavation of a ditch for a new water drainage line.
Response to July 3, 1999 Comments by the U.S. EPA on the "Amended and Supplemental Groundwater Assessment Work Plan"	July 31, 2000	Submitted	Summarized previously written description of SWMUs and work accomplished at each SWMU. Additionally responded to questions.
RCRA Facility Investigation SWMU 2 – Inactive Landfill Interim Report	October 2000	Submitted	--
Interim Revised Corrective Measures Implementation Plan SWMU 12 – Former MSMA Salt Unloading Area SWMU 11 – Former MSMA Production Area SWMU 15 – Former Methyl Parathion Production Area	November 2000	Submitted	Need agreement of arsenic clean up standards based on background. Need completion of RFI and GWA to completely verify and define problem.
RCRA Facility Investigation Interim Report and Phase II Workplan	December 15, 2000	Submitted (Later revised by VCC)	Contained some analytical laboratory calculation errors.
RCRA Facility Investigation Interim Report and Phase II Workplan	March 16, 2001	Submitted and Approved	Corrected analytical errors and added results of a surface and soil pile sampling program completed on February 16, 2001
Final RFI Report	June, 2001	Submitted	Contains information on entire RFI program, including the Phase II effort.

The following information describes the environmental setting on a regional and local basis.

2.1 REGIONAL GEOLOGY

The Vicksburg area lies on the eastern flank, near the axis, of the Mississippi Embayment, containing unconsolidated sediments of Cretaceous to Quaternary Age, the sediments thicken in the structural trough toward the axis of the Embayment and the Gulf of Mexico.

Wind-borne silty sediments, named Pleistocene loess, were deposited in the Vicksburg area. The Pleistocene loess in the Vicksburg area is a homogeneous, massive silt with variable clay content. The loess underlies the ground surface through the local region. Loess generally is characterized by a higher vertical permeability in comparison to its horizontal permeability.

Underlying the Pleistocene loess is the Oligocene Vicksburg formation. This formation consists of alternating beds of sandy marl, clay marl, montmorillonitic clay and thin beds of limestone.

2.2 SITE GEOLOGIC FEATURES OF THE PLANT SITE

Developers International Services Corporation (DISC) provided the initial descriptions of the geology of the site in a November 1981 report "Hydrogeological Investigation." A second description was provided by IT Corporation in a January 1985 "Final Report: Groundwater Assessment Program". Both reports provided hydraulic conductivity data from laboratory testing on soil obtained from borings on site and supplemented the information by generalized descriptions obtained from U.S.G.S. publications.

It was observed in both reports that the loess with variable clay content extends from about 6 to 48 feet below the surface across the site. Immediately below the loess, a thin layer (1 to 2 feet) of greenish-gray sandy clay is usually present. Underlying the sandy clay is a marl from the Vicksburg formation called the Byram marl. The top of the marl varies across the site from 60 to 65 feet mean sea level (msl). This marl serves as the bottom of a shallow confined aquifer. Various cross sections of the geology beneath the South Plant are shown in Figures 2-1 through 2-7. The cross sections portray silt with variable clay content as interpreted by individual loggers; the formation is Pleistocene loess to approximately 60 feet msl.

The bedrock underlying the facility is a layer of Glendon limestone of the Vicksburg Formation and, beneath the limestone, is the Jackson Formation. The top of the Glendon limestone is expected to be 80 to 100 feet beneath the plant site and ranges from 25 to 65 feet thick. The Glendon is a dark gray to brown, dense, fine-grained limestone. The underlying non-permeable Jackson Formation is 40 to 150 feet thick.

Information in the 1965 Bulletin 105 "Mississippi Geological, Economic and Topographical Survey" by William H. Moore describes the Glendon limestone and the Byram marl which is located at the top of the highest hard limestone ledge of the Glendon:

> "The Glendon limestone consists of alternating beds of gray, fossiliferous, glauconitic, slightly sandy limestone and gray-green, glauconitic, fossiliferous, sandy marl. The Glendon weathers to a yellowish or buff color. The limestone beds in the Glendon are not constant with the number, thickness and stratigraphic position varying from place to place. A hard bed about 10 feet from the top of the Glendon is the most consistent and usually the thickest. On the outcrop the marls weather more rapidly and the limestone ledges tend to stand out. The Glendon weathers completely in places leaving a dark-brown residual clay. ... At some localities the residual clay contains white, partly weathered limestone and contains at other localities a white, waxy, clayey material. ... The material is a clay giving an x-ray pattern of major montmorillonite and halloysite in which kaolinite is still a trace constituent.
>
> Thick beds of bentonite are present between ledges of Glendon limestone in Smith County. In Warren and Yazoo Counties thin beds of bentonite are present in the same stratigraphic position. ...
>
> The Byram marl consists of gray-green, glauconitic, fossiliferous, clayey marl and gray-green, glauconitic, fossiliferous, limy clay."

The site is in a valley with process areas cut into the hillside. As a generalization the following is a table of notable elevations:

TABLE 2-1

NOTABLE ELEVATIONS

Area	Approximate Elevation (feet MSL)
Surface of Inactive Disposal Area (SWMU 2)	135
North Pond Area (SWMU 23)	133
South Plant	120
North Plant	115
Railroad Track, Surface Pond Area, Area Surrounding Inactive Disposal Area	100-110
Stout's and Hennessey's Bayou	85

2.3 REGIONAL GROUNDWATER HYDROLOGY

A shallow confined loess aquifer underlying the VCC plant is on top of the Byram marl formation. Reported wells in the area are upgradient of the plant and are producing water from deeper, more productive aquifers such as the Catahoula and Forrest Hill formation. These deeper aquifers are apparently hydraulically separated from the shallow groundwater aquifer.

The shallow aquifer underlying the VCC plant is, however, hydraulically connected to Stout's Bayou and Hennessey's Bayou. Hatcher Bayou and Stouts Bayou merge southeast of the plant site to form Hennessey's Bayou, which flows to the Mississippi River. Noted as intermittent streams on USGS topographical maps these bayous are limited to fresh water fish and wildlife habitat. They are not drinking water or recreational water sources. The major use of the Mississippi River downstream of its confluence with Hennessey's Bayou is as a marine transportation route. There are no drinking water intakes in these waters within three miles downstream of the facility.

2.4 SHALLOW GROUNDWATER HYDROLOGY BENEATH THE PLANT

The Byram marl in the Vicksburg Formation constitutes the bottom of the uppermost water-bearing zone underlying the facility. The Byram marl is described as representing mixed clastic and carbonate sedimentation in an open shelf or platform environment. The argillaceous, massive and medium dense character of the marl would inhibit any significant movement of water through this unit, and there is no indication of secondary permeability. The uppermost water bearing zone is approximately 40 feet thick consisting almost exclusively of Pleistocene loess (silt). The clayey fill material placed atop the loess is acting as a "cap"

inhibiting the vertical migration of the groundwater. The presence of the marl on the bottom of the aquifer creates a slightly artesian confined aquifer which is not hydraulically connected to any potential water-bearing zones at greater depths. The artesian property is characteristic of an aquifer which is under pressure from above and below. The background water quality of this aquifer is marginally acceptable for drinking water; however, due to its low lateral flow and yield characteristics its usefulness as a domestic water supply is severely limited.

2.5 GEOLOGIC AND HYDROGEOLOGIC FEATURES

The following is a list of geologic cross sections that describe the site. Well screen and piezometric elevations have been added to the cross sections. The piezometric data was obtained in November 1993.

- Figure 2-1 – Potentiometric Contours with Cross Section Locations
- Figure 2-2 – Section A-A'; generally north/south at the railroad track elevation from the north plant to the south plant.
- Figure 2-3 – Section B-B'; generally east/west at the southern boundary of the south plant.
- Figure 2-4 – Section C-C'; generally east/west through the center of the south plant.
- Figure 2-5 – Section D-D'; generally east/west on the northern boundary of the south plant.
- Figure 2-6 – Section E-E'; generally east/west through the North Pond.
- Figure 2-7 – Section F-F'; generally north/south on the eastern boundary in the south plant.

The various cross sections depict the wind-borne deposited silty sediments, or Pleistocene loess, underlying the Vicksburg Chemical site. The Pleistocene loess is a homogeneous, massive silt with variable clay content. SWMU 2, historically called the "hill area", is

entirely a loess deposit. There may be less clay content in the SWMU 2 than is present in the loess underlying most of the plant.

Groundwater potentiometric contours are depicted on Figure 2-1. The temporary piezometers at SWMU 2, LS2, LS3, LS4, and LS5, were installed in the generally flat top elevation of SWMU which is 135 feet msl. LS1 was installed down slope about 5 feet at 130 feet msl. The groundwater levels in SWMU 2 are consistent with the levels projected from previous work in surrounding monitor wells (MW-2, MW-7, MW-5, MW-3, MW-11, MW-14, MW-12, MW-8, MW-10, MW-16). There does not appear to be any trapped water perched within the hill or mounding effects due to historic use of the pits, ponds, and landfill, which were drained and closed in 1979.

The shallow aquifer underlying the VCC plant site, is hydraulically connected to Stouts Bayou and Hennessey's Bayou. Hatcher Bayou and Stouts Bayou merge southeast of the plant site to form Hennessey's Bayou, which flows to the Mississippi River. Existing monitor wells MW-2, MW-8, MW-7, MW-6, MW-5, MW-12, MW-10, MW-16, MW-1A, MW-11, MW-14, PZ-25B, PZ-24B, along with monitor wells MW-12C, MW-10C, MW-16C, PZ-26A and PZ-26B, which were installed during the RFI Phase II, effectively intercept and monitor the shallow aquifer between the site and Hennessey's Bayou.

There are additional observations that can be made from the piezometric and well screen elevations on the geologic cross sections:

- Cross section A-A'. The piezometric elevations do not vary with the variations in screen elevations thus demonstrating the interconnectivity of the zones in the aquifer. Nonetheless, due to the proximity of SWMUs 4, 7, 14 and 20 to the line of wells in cross section A-A', shallow wells were installed at MW-12C, MW-10C and MW-16C locations during the RFI – Phase II to make certain that any potential plume be intercepted.

- Cross section B-B'. The cross section of the "valley" demonstrates the potential for seepage from spills in the southern edge of the south plant to discharge. Another observations is that the groundwater level observed in LS-5 is consistent with levels at MW-8 and MW-7 without mounding or any evidence of a perched zone.

- Cross section C-C'. The groundwater levels observed in LS-1, LS-2, LS-3 and LS-4 are consistent with levels at MW-12 and MW-6. Nested wells at MW-17A, MW-17B, MW-18A, and MW-18A were installed during the RFI – Phase II to intercept the entire aquifer.

- Cross section D-D'. Hennessey's Bayou is shown to be a likely location of contaminated groundwater discharge.

- Cross section E-E'. Evidence of a perched zone of groundwater is exhibited by the difference in groundwater elevations in shallow wells versus deeper wells. The perched groundwater may connect with the aquifer at locations PZ-22, PZ-23 and PZ-24. Wells PZ-26A and PZ-26B were added in the RFI – Phase II to yield additional information.

2.6 LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

This subsection is a summary that describes on Table 2-2 the sets of wells that monitor each SWMU. The contaminants that have been detected in the groundwater from each well have also been listed. During the fieldwork that is suggested in the GWA Workplan piezometric elevations will be obtained for the entire monitor well network. Additionally, groundwater samples will be obtained from each well and analyzed for arsenic, atrazine, cyanazine, dinoseb, toluene and volatiles. Existing groundwater data obtained from temporary wells is summarized on Tables 2-3 and 2-4. Table 2-3 is a summary of groundwater data obtained from temporary wells in investigations of SWMUs prior to the RFI – Phase II. Table 2-4 is a summary of groundwater data obtained from temporary wells during the RFI – Phase II.

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
1 – Hazardous Waste Storage 16 – Atrazine Manufacturing and Warehousing 17 – Returned Product Storage	Locations A, D, 1 and 2 Reference: Table 2-3 and Figures 2 and 3 Locations 16-1 and 16-2 Reference: Table 2-3 and Figures 2 and 3	Soil and concrete generally clean. Arsenic in groundwater at Location 2 was extremely localized.	**MW-2:** Arsenic (ND-0.026)/10 1,2-Dichloroethene (ND-7.36)/100 Trichloroethene (ND-2.0)/5.0 **MW-8:** Arsenic (ND-0.068)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5)/2.0
2 - Inactive Landfill	Locations LS1, LS2, LS3, LS4 and LS4 Reference: Table 3-2 and Figure 1 Location 2-15 Reference: Table 2-3 and Figure 1	The "Hill" area is contaminated. Study interception and treatment of groundwater.	**MW-5:** Arsenic (ND-0.07)/10 Dinoseb (ND-12.0)/7.0 Trichloroethene (ND-79)/5.0 Xylene (ND-10)/10,000 **MW-6:** Arsenic (ND-0.015)/10 Dinoseb (ND-75.0)/7.0 Toxaphene (ND-25.0)/3.0 Trichloroethene (ND-9.03)/5.0 Vinyl Chloride (ND-4)/2.0 Xylene (ND-7)/10,000 **MW-7:** Arsenic (ND-0.113)/10 Dinoseb (ND-4.5)/7.0 Toxaphene (ND-2.77)/3.0
4 – Activated Carbon Unit	Location 20-18 Reference: Table 2-3 and Figure 1	Analysis of groundwater at Location 20-18 will help determine necessity of monitor well for SWMU 4.	None
5 – South Plant Drainage System	None	The new wells (MW-17A, MW-17B, MW-18A, MW-18B, MW-12C, MW-10C, and MW-16C) in combination with MW-8, MW-12, MW-10, MW-16, and MW-9 effectively monitor the entire south plant drainage system.	**MW-8:** Arsenic (ND-0.068)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5.0)/2.0 **MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:**

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
5 – South Plant Drainage System (Continued)			**MW-10:** Arsenic (ND-0.015)10 Dinoseb (ND-0.836)/7.0 **MW-10C:** **MW-16:** Arsenic (ND-0.391)/10 Dinoseb (ND-0.391)/50 **MW-9:** Arsenic (ND-0.009)/10 Dinoseb (ND-11.4)/7.0
7 – Dinoseb Manufacturing Area	Locations 20-18, 20-19, 20-20, 20-21 and 20-22. Reference: Table 2-3 and Figure 1	The new wells (MW-12C and MW-10C), in combination with MW-12 and MW-10 effectively monitor SWMU 7.	**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** **MW-10:** Arsenic (ND-0.015)/10 Dinoseb (ND-0.836)/7.0 **MW-10C:**
8 – Dinoseb Loading/Unloading Area	None	Perhaps contaminated fill was used at some time underneath SWMU 8 and SWMU 9.	**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	*Comments*	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
9 – Dinoseb Drumming Area	Location TP-1 Reference: Figure 8-1, Table 2-3	MW-18A and MW-18B are immediately downgradient of area of contaminated soil underneath SWMU 9.	**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** **MW-10:** Arsenic (ND-0.015)/10 Dinoseb (ND-0.836)/7.0 **MW-10C:** **MW-18A:** **MW-18B:**
11 – MSMA Salt Unloading 12 – MSMA Manufacturing Area 15 – Methyl Parathion Manufacturing Area	Locations G-W-G, D-W-G, I-W-G, K-W-G, 12-W-G, X-W-G, Z-W-G, DD-W-G, V-V-G, WW-W-G, YY-W-G, ZZ-W-G, 7-W-G Reference: Table 2-3 and Figures 9-3 and 9-4	The new wells (MW-18A, MW-18B, MW-17A and MW-17B) are close to the source of arsenic. The monitor well network consisting of MW-8, MW-12, MW-12C, MW-10, MW-10C, MW-16, MW-16C and MW-9 are 400 to 800 feet away from the source but do cover the downgradient pathway.	**MW-8:** Arsenic (ND-0.068)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5.0)/2.0 **MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** **MW-10:** Arsenic (ND-0.015)10 Dinoseb (ND-0.836)/7.0 **MW-10C:**

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
11 – MSMA Salt Unloading 12 – MSMA Manufacturing Area 15 – Methyl Parathion Manufacturing Area (Continued)			**MW-16:** Arsenic (ND-0.391)/10 Dinoseb (ND-0.391)/7 **MW-16C:** **MW-9:** Arsenic (ND-0.009)/10 Dinoseb (ND-11.4)/7.0
13 – South Plant Drainage Ditch	Location 13-10 References: Table 2-3 and Figure 1	Trace contamination originating at SWMU 34.	None
14 – Toxaphene Manufacturing Area	Locations 20-18, 20-19, 20-20, 20-21 and 20-22 References: Table 2-3 and Figure 1	The new wells (MW-12C and MW-10C), in combination with MW-12 and MW-10 effectively monitor SWMU 14.	**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 **MW-12C:** **MW-10:** Arsenic (ND-0.015)10 Dinoseb (ND-0.836)/7.0 **MW-10C:**
18 – Blue Tank	Nonw	Monitored by MW-9.	**MW-9:** Arsenic (ND-0.009)/10 Dinoseb (ND-11.4)/7.0
20 – Railroad Area	Locations 20-18, 20-19, 20-20, 20-21 and 20-22 References: Table 2-3 and Figure 2-	The new wells (MW-12C, MW-10C and MW-16C), in combination with MW-2, MW-8, MW-12, MW-10, MW-16, MW-1A and MW-14 effectively monitor SWMU 20.	**MW-2:** Arsenic (ND-0.026)/10 1,2-Dichloroethene (ND-7.36)/100 Trichloroethene (ND-2.0)/5.0 **MW-8:** Arsenic (ND-0.068)/10 Dinoseb (ND-0.686)/7.0 Vinyl Chloride (ND-5.0)/2.0

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
20 – Railroad Area (Continued)			**MW-12:** Arsenic (ND-0.02)/10 Dinoseb (ND-0.91)/7.0 Chloroform (ND-1.37)/0.152 Xylenes (ND-5.0)/10,000 MW-12C: **MW-10:** Arsenic (ND-0.015)10 Dinoseb (ND-0.836)/7.0 **MW-10C:** **MW-16:** Arsenic (ND-0.391)/10 Dinoseb (ND-0.391)/7 **MW-16C:** **MW-1A:** Arsenic (ND-0.054)/10 Dinoseb (2.34-5,500)/7 Chloroform (ND-4.0)/0.152 Dichlorobenzene (ND-2.75)/75 Trichloroethene (ND-13)/5.0 Xylene (ND-5)/10,000 **MW-14:** Arsenic (ND-0.007)/10 Dinoseb (ND-0.746)/7
23 – North Pond	None	The new wells (PZ-26A and PZ-26B), in combination with PZ-24B, PZ-20A, PZ-20B, PZ-23A, PZ-23B, PZ-22A, PZ-22B, and PZ-21A will effectively monitor the groundwater associated with SWMU 23.	**PZ-24B:** ND **PZ-20A:** ND

TABLE 2-2

LIKELY CORRESPONDENCE BETWEEN WELLS AND SWMUS

SWMU Numbers	Groundwater Sampled at Temporary Wells	Comments	Monitored by Permanent Monitor Wells, Containment Detected (Concentration* ppb)/MDEQ Tier 1 TRG Table Value
23 – North Pond (Continued)			**PZ-20B:** Bromodichloromethane (36)/1.08 Bromoform (18)/2.33 Carbon Tetrachloride (4)/5.0 Chloroform (1,700)/0.152 Chlorodibromomethane (18)/0.126 Trichloroethene (1.0)/5.0 **PZ-23A:** ND **PZ-23B:** Bromoform (8)/2.33 **PZ-22A:** **NDPZ-22B:** Bromodichloromethene (66)/1.08 Bromoform (160)/2.33 Chloroform (1,600)/0.152 Chlorobromomethane (78)/0.126 **PZ-21A:** ND
30 – North Plant Waste Oil Accumulation Area	None	Soil discoloration to be cleaned up.	None
34 – Surplus Equipment Storage	Location 13-10 References: Table 2-3 and Figure 1		None at present.
29 – North Plant Oil Collection System 31 – North Plant No. 6 Fuel Oil Area 25 – North Plant Waste Water Pipes 22 – North Plant Neutralization System	Location 22-1 and 22-2 References: Table 2-3 and Figure 1		None

NOTES:

* Concentrations are obtained from Table 5, page 4-2 of "Response to July 3, 200 Comments by the U. S. EPA on the "Amended and Supplemental Groundwater Assessment Work Plan, December 1999".

TABLE 2-3

SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS IN VARIOUS SWMU INVESTIGATIONS PRIOR TO 2001

SWMU 1, 16, 17	Sample Results µg/l (ppb)				
Compound	A-W-T	D-W-T	1-W-T	2-W-TA	MDEQ Tier 1 TRG Table µg/l (ppb)
Arsenic	--	--	--	538	10
Toxaphene	ND	ND		ND	3

SWMU 2	Sample Results µg/l (ppb)					
Compound	LS1-W	LS2-W	LS3-W	LS4-W	LS5-W	MDEQ Tier 1 TRG Table µg/l (ppb)
Chloroform	ND	221	ND	17	105	0.152
2-Butanone	ND	69.1	ND	126	63	1,910
Carbon Tetrachloride	ND	71.4	ND	126	ND	5 MCL
Ethylbenzene	ND	ND	ND	ND	12	700 MCL
Xylene (total)	ND	19.5	ND	ND	40.0	10,000 MCL
Acetaphenone	ND	ND	ND	ND	19	0.0416
Caprolactam	16	ND	12,200	39	11,476	18,300
Dimethylphthalate	ND	ND	ND	29	ND	365,000
4-Nitrophenol	ND	548	ND	ND	2,359	292
Diethylphthalate	11	11	22	16	8	29,200
Di-n-butyl-phthalate	44	161	133	54	150	3,540
Bis-(2-ethyl)hexylphthalate	213	35	474	42	131	6.0
Atrazine	ND	478	ND	ND	6	3 MCL
Dinoseb	ND	8,714	ND	597	797	7 MCL
Toxaphene	ND	ND	ND	ND	ND	3 MCL

TABLE 2-3 (Continued)

SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS IN VARIOUS SWMU INVESTIGATIONS PRIOR TO 2001

SWMU 9	Sample Results µg/l (ppb)	
Compound	TP-1	MDEQ Tier 1 TRG Table µg/l (ppb)
Antimony	12	6
Arsenic	378	50
Barium	220	2,000
Beryllium	ND	4
Cadmium	ND	5
Chromium	ND	100
Cobalt	60	2,190
Copper	ND	1,300
Lead	ND	15
Mercury	ND	2
Nickel	90	730
Selenium	ND	50
Silver	ND	183
Thallium	ND	2
Vanadium	ND	256
Zinc	70	11,000
Cyanide	ND	200
1,2-Dichlorobenzene	11	606
Cis-1,2-Dichloroethene	26	70
Trans-1,2-Dichloroethene	6	100
Trichloroethene	68	5
Xylenes	14	10,000
1,2-Dichlorobenzene	4	600
m-Nitrosodiphenyl amine	2	13.7
Atrazine	ND	3
Dinoseb	ND	7
Toxaphene	ND	3

TABLE 2-3 (Continued)

SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS IN VARIOUS SWMU INVESTIGATIONS PRIOR TO 2001

SWMU 11, 12, 15	Sample Results µg/l (ppb)													MDEQ Tier 1 TRG Table µg/L (ppb)
Compound	G-W-G	D-W-G	I-W-G	K-W-G	R-W-G	X-W-G	Z-W-G	DD-W-G	V-V-G	WW-W-G	YY-W-G	ZZ-W-G	7-W-G	
Arsenic	14,300	253	288,000	297	5,260	730	1,720	1,260	14	56	26	216	51,000	10

Compound	SWMU 1, 16, 17		SWMU 2	SWMU 7, 14, 20					SWMU 9	SWMU 13, 34	SWMU 22		MDEQ Tier 1 TRG Table µg/L (ppb)
	16-1	16-2	2-15	20-18	20-19	20-20	20-21	20-22	8-1	13-10	22-1	22-2	
Arsenic													10
Atrazine													3
Cyanazine													0.0797
Dinoseb													7
Toxaphene													3
Volatile Organics Component													
Choromethane													1.49
Bromomethane													8.52
Vinyl Chlroide													2.0
Chloroethane													3.64
Methylene Chloride													5.0
Acetone													3,650
Carbon Disulfide													1,040
1,1-Dichloroethene													7.0
1,1-Dichloroethane													798
1,2-Dichloroethene (total)													70
Chloroform													0.152
2-Butanone													1,910
1,2-Dichloroethane													5.0
1,1,1-Trichloroethane													200
Carbon Tetrachloride													5.00
Bromodichloromethane													1.08
1,2-Dichloropropane													5.0
c-1,3-Dichloropropene													0.765
Trichloroethene													5.0
Benzene													5.0

TABLE 2-3 (Continued)

SUMMARY OF GROUNDWATER DATA OBTAINED FROM TEMPORARY WELLS IN VARIOUS SWMU INVESTIGATIONS PRIOR TO 2001

Compound	SWMU 1, 16, 17		SWMU 2	SWMU 7, 14, 20					SWMU 9	SWMU 13, 34	SWMU 22		MDEQ Tier 1 TRG Table
	16-1	16-2	2-15	20-18	20-19	20-20	20-21	20-22	8-1	13-10	22-1	22-2	µg/L (ppb)
Dibromochloroemethane													5.0
t-1,3-Dichloropropene													0.0765
1,1,2-Trichloroethane													5.0
Bromoform													2.33
4-Methyl-2-pentanone													2,920
Tetrachloroethene													5.0
1,1,2,2-Tetrachloroethane													0.0527
2-Hexanone													1,460
Toluene													1,000
Chlorobenzene													100
Ethylbenzene													700
Styrene													100
Xylenes (total)													10,000

The following information is provided in this Groundwater Assessment Workplan:

- The location of existing wells is found on Figure 1. Potentiometric contours are also shown on the figure. No new wells are proposed.
- Construction logs for each permanent monitoring well and piezometer is found in Appendix D.
- The monitoring parameters have been established for the Vicksburg site to be: arsenic, atrazine, cyanazine, dinoseb, toxaphene and volatiles.
- Geologic cross-sections are found in the Figures section of this workplan.
- Sampling and analytical methods are found in Appendix E and Appendix F. The first pages in Appendix E are an addendum describing bailer purging of wells. The addendum is from page 17-1 of "Response to July 3, 2000 comments by the U.S. EPA on the 'Amended and Supplemental Groundwater Assessment Workplan', December 1999".
- Previously-gathered groundwater quality information from permanent wells and piezometers is included in Appendix H.
- Previously-gathered groundwater quality information from temporary wells is included in Table 2-3.
- The previously-gathered groundwater quality information is evaluated by comparing it to values presented in the MDEQ Tier 1 TRG Table and by examining the likely correspondence between wells and SWMUs as presented in Table 2-2.
- An overview of site wide soil contamination sources is presented on Figure 2.
- An overview of site wide groundwater contamination of indicator parameters is presented on Figure 3.

The field work remaining for the groundwater assessment will consist of:

- One round of measuring water levels in all the permanent wells and piezometers.

- One round of sampling the groundwater in all the permanent wells and piezometers. Samples will be run for arsenic, atrazine, dinoseb, toxaphene and volatiles.
- There will be hydraulic testing of the area adjacent to SWMU 11, 12, 15.

3.1 GROUNDWATER SAMPLING AND ANALYSIS

The initial groundwater monitoring program at the Vicksburg site involved several wells; however, only four compounds were included in the analysis. At the request of MSDEQ, VCC expanded their existing quarterly groundwater monitoring program to include analysis for methyl chloride, dinitrobutyl phenol, arsenic, and toxaphene. In the second quarter of 1991, VCC added four more compounds to be analyzed. These four compounds are carbon tetrachloride, chloroform, TCE, and Methyl Ethyl Ketone. More recent quarterly sampling has also tested for volatile compounds using the SW846b Method 8240 (GC/MS). The results of the sampling has been reported to the MSDEQ and is included in the Groundwater Analytical Data Summary provided as Appendix H. The TCL and TAL analyses for groundwater from piezometers PZ12-B, PZ-12B, PZ-20A, PZ-20B, PZ-21A, PZ-2B, PZ-22A, PZ23-A, PZ23-B, PZ-24B, PZ-25A and PZ-25B are also included in Appendix H. The water level data for permanent wells and piezometers are also included within Appendix H.

From the existing groundwater data and the existing soil contamination data, the monitoring parameters for the site have been established to be arsenic, atrazine, cyanazine, dinoseb, toxaphene and Volatiles. It is suggested that groundwater samples be obtained from all the existing permanent wells and piezometers and analyzed for the monitoring parameters. Prior to the sampling activity, water levels would be obtained at each of the permanent wells and piezometers.

3.2 HYDRAULIC TESTING

It was an observation in the DISC report, referred to in Section 2.1.2 of this report, that at a depth of 40 feet, the hydraulic conductivity ranged from 7.5×10^{-4} to 4.3×10^{-7} centimeters per second. Additional aquifer properties which were obtained by IT during various investigations prior to 1993 are summarized below:

TABLE 7

AQUIFER PROPERTIES – IT CORPORATION STUDY

Monitor Well No.	Porosity (%)	Standard Thickness (ft)	Hydraulic Gradient (ft/ft)	Hydraulic Conductivity (cm/sec)	Velocity (ft/day)	Transmissivity (gal/day)(ft)
1*	46	30	0.04	9.07×10^{-5}	0.022	58
6	45	20.5	0.025	9.26×10^{-5}	0.015	40
11	44	42	0.11	2.59×10^{-4}	0.184	232
12	42	41	0.011	1.3×10^{-4}	0.01	116

NOTES:

* MW-1 was replaced by MW-1A in 1986.

Understanding the basic lateral and vertical groundwater flow of the affected permeable zones is an essential element to characterization. Groundwater flow characteristics, including flow directions (patterns) and rates, are largely dependent upon hydraulic conductivities and gradients of the permeable zone. Contaminant transport characteristics will be greatly influenced by groundwater flow rates and pathways, because the contaminants of concern are dissolved in the groundwater.

The hydraulic test to be employed for the additional hydraulic testing will be a slug test. Slug tests will be performed on MW-17A and MW-17B which are two of the wells constructed in the South Plant process area near SWMU 11, 12, 15. Aquifer properties have not previously been obtained in that area.

Slug testing equipment consists of:

- Pressure transducer(s)
- Suspended weight of known volume (slug)
- Electric water level sensor
- Data logger (recorder)
- Field data printer

Slug testing of a well will be conducted according to the following general procedures:

- The magnitude of instantaneous head change resulting from introduction or removal of the slug shall not cause water to overflow the well casing. To assure meeting these requirements, magnitude of head change shall be determined prior to introduction of the slug. The magnitude determination shall be based on the calculated volume of the slug and the inside diameter of the casing. The test shall proceed only when these requirements are met.
- All equipment entering the well shall be decontaminated prior to placing into the well.
- The static water level shall be measured using an electronic water level sensor.
- When the transducer is lowered into the well and in place, the slug shall be introduced to the well as rapidly as possible without causing undue splashing or turbulence so as to produce an instantaneous head increase.

  Time (t) = 0 the instant the slug is in place.
- Water levels shall be measured continuously (millisecond intervals) with the transducer and recorded with the data logger unit. Measurements shall be terminated when the water level stabilizes or when the water level has reached a level within 10 percent of static level.
- Water level measurements recorded shall be checked for credibility before proceeding to the next testing stage (removal of the slug).
- When checking of data has been completed and the previous testing has been determined to be acceptable, the slug shall be removed from the well as rapidly as possible so as to produce an instantaneous head reduction.

  Time (t) = 0 the instant the slug has been removed from the water.
- Water levels shall be measured continuously (as in the previous testing stage) using the transducer and shall be recorded using the data logger unit. Measurements shall be terminated when the water level stabilizes or reaches a level within 10 percent of initial static water level.
- When measurements are terminated, the transducer shall be removed from the well.

- Water level measurements recorded shall be checked for credibility before proceeding to the next well.
- Any test or test stage shall be repeated if review of the recorded data indicates questionable validity.

The data from the slug test will be reduced to evaluate time versus change in water level using the methods of Cooper and Other (1967) or Bouwer and Rice (1976).

3.3 NATURE AND EXTENT OF CONTAMINATION

As noted in Section 3.2, samples of groundwater will be obtained from all of the existing permanent monitor wells and piezometers. The samples will be analyzed for arsenic, atrazine, cyanazine, dinoseb, toxaphene, and Volatiles. This data will be combined with the data in Appendix H.

3.3.1 Source of Groundwater Contamination

If by analysis of the groundwater sampling data a groundwater contamination plume is detected, the source of the plume will be identified if possible. Over the course of the South Plant's long history, various construction activities have occurred at the site. Contamination sources, such as broken pipes, which can easily be repaired have been corrected. The contamination of soil and groundwater caused by the break would remain. Additionally, there may have been routine chemical spills at facilities that are now dismantled and demolished. Only the contaminated soil and groundwater remain; therefore, the original cause or source may be difficult to identify.

An example of a former source is the surface impoundments (SWMU 3), which have been retrofitted with double geosynthetic liners. Prior to the retrofit contaminated sludge was removed, solidified, stabilized and placed in an aboveground vault constructed to RCRA standards; SWMU 3 was the source of contamination.

The study of SWMUs 12, 11 and 15 resulted in discovery of an area of soils contaminated with arsenic and a groundwater plume of arsenic contamination. The source of contamination presumably was waste handling activity at the former MSMA plant.

SWMU 2 is an area of the plant site where there are known deposits of waste. SWMU 2 is a hill with a natural elevation approximately 30 feet above immediate surrounding areas. A landfill and four pits or ponds were constructed on the hill and utilized from 1972 to 1975. One pit was constructed to store dinoseb process wastewater. Three pits were used as disposal locations for pallets, empty fiber and steel drums. In 1977 many of the drums in the pits, but not the landfill, were removed and disposed off-site. In 1979 all the pits were drained, regraded so the hill was flattened and covered with a soil cap. Some of the soil was obtained off-site and placed on the landfill area. In 1983, there was additional grading and capping of the entire area consistent with an engineered plan approved by the MSDNR. A discovery of the RFI was that the cap did not extend sufficiently far on the southwest edge. An area that was obscured by trees and dense overgrowth had eroded and allowed transport of contamination to a valley between the hill and adjacent railroad tracks. The cap will be extended as part of corrective action. In 1988 the SWMU 3 wastewater ponds, which are adjacent to SWMU 2, were lined and a repository for pond sediments (SWACA) was constructed. The SWACA was constructed in the location of one of the ponds. The sediments from the SWMU 3 wastewater ponds and most of the sediment of the pond are within the SWACA. The pond lining and SWACA construction is consistent with RCRA guidelines. There is evidence from temporary wells that groundwater immediately beneath SWMU 2 has been impacted. SWMU 2 is monitored by monitoring well s MW-5, MW-6 and MW-7.

Groundwater has additionally been impacted at SWMU 23, the North Pond. The North Pond is no longer in use but there are volatiles in the groundwater. SWMU 23 is monitored by monitoring wells PZ-21A, PZ-22A, PZ-22B, PZ-23A, PZ-23B, PZ-24B, PZ-26A and PZ-26B.

3.3.2 Contamination Plume

Sampling data will be used to construct additional maps of any contamination plumes in the uppermost aquifer. These maps will be developed from data obtained by sampling and analyzing groundwater. Any detected hazardous waste or hazardous waste constituents in the uppermost aquifer will be mapped to show the extent of the contamination plume and the concentration of each specific constituent in the groundwater. Based on the location and concentration of the hazardous waste or hazardous waste constituent and the direction of groundwater flow, the migration direction (flowpath) will be identified.

A separate site wide map will be constructed to show concentrations of each of the following:

- Arsenic,
- Dinoseb,
- Toxaphene, and
- Volatiles

Unless data obtained in the Groundwater Assessment field work is different from previous data, there is no need to construct maps showing atrazine or cyanazine.

4.1 GROUNDWATER ASSESSMENT PROJECT SCHEDULE

The Groundwater Assessment project schedule is a function of U.S. EPA schedule of review. VCC anticipates issuing a GWA report in August 2001.

4.2 REPORTING REQUIREMENTS

Several reports are mandated by the Consent Decree. Due dates for these reports are also mandated in the Consent Decree.

4.2.1 Progress Reports

Monthly progress reports dated the 10th of the month have been and will continue to be provided to EPA and MSDEQ containing:

- Description and estimate of the percentage of the RFI completed
- Summaries of all findings
- Summaries of all changes made in the RFI during the reporting
- Summaries of all contacts with representatives of the local community, public interest groups, or State government during the reporting period
- Actions being taken to rectify problems
- Changes in personnel during the reporting period
- Projected work for the next reporting period
- Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

4.2.2 Annual Groundwater Assessment Reports

VCC will begin submission of annual Groundwater Assessment Reports to EPA and MSDEQ on or before March 1 of each calendar year subsequent to the submittal of the initial GWA report. The GWA report will be written after the completion of the studies in the GWA Work Plan. This annual report will include the following information:

- Groundwater surface elevations measured on a quarterly basis, for each well specified in the Groundwater Assessment Program.
- Concentrations or values of the monitoring parameters obtained from quarterly analysis at each groundwater monitoring well.
- Evaluation of the monitoring parameter as outlined within the facility's Groundwater Assessment Program Work Plan.
- Plots showing concentrations of arsenic, dinoseb, toxaphene, and volatiles on maps of the site.
- Recalculations, as necessary
  - Hydraulic conductivity and effective porosity.
  - Determination of the rate of groundwater flow and direction in the uppermost aquifer.
- Summary of results.

The Project Management Plan consists of the following elements:

- Project task definition
- Specific personnel positions within the project organizational structure

5.1 PROJECT TASK DEFINITION

VCC has retained the services of URS to develop the RFI and GWA Work Plans to the satisfaction of the EPA and MSDEQ and assist VCC in implementing the work plans.

5.2 PROJECT PERSONNEL

Duties of key personnel are described below.

5.2.1 U.S. EPA and MSDEQ Project Coordinator

The U.S. EPA and MSDEQ project coordinators or designated agents will observe work plan activities to any extent deemed necessary to confirm that the requirements of the Consent Decree, and the RFI Work Plan are met.

5.2.2 Project Director

The Project Director is Mr. Steve Boswell. He is an employee of and is the official representative for VCC. He is in charge of administration of the work and the completion of the project.

5.2.3 URS Project Manager

The URS Project Manager develops the plans required by the Consent Decree and oversees work implementing the Work Plan on behalf of VCC, and is the primary contact with VCC. The URS Project Manager is Richard D. Karkkainen. Mr. Karkkainen is a Principal Environmental Engineer in URS.

5.2.4 URS Field Investigation Site Coordinator

The URS Field Investigation Site Coordinator will handle day to day activities and coordinate them with other RFI and GWA activities. He will coordinate efforts and oversee their implementation. The Project Manager is expected to fulfill this role. He will be assisted by Dean Lowe, a geologist with 40 years of experience. Mr. Lowe is a Principal Geologist associated with Petra Environmental the geo-probe subcontractor.

5.2.5 Health and Safety Officer

A Health and Safety (H & S) officer will be responsible for the administration and implementation of the site Health and Safety for Groundwater Assessment activities. The H & S Officer will coordinate efforts through a Site Safety Officer. The Site Safety Officer will coordinate effort with the VCC safety personnel. The Project Manager may fulfill this role. A Health and Safety Plan is found in Appendix C of the Amended and Supplemental RFI Work Plan, December 1999. The H & S officer will have the overall responsibility for safety and health and will:

- Ensure that and employee medial surveillance program which meets the requirements of 29 CFR 1910.120 is instituted and maintained.

- Be responsible for the initial pre-construction indoctrination of all on-site personnel with regard to the H & S Plan and other safety requirements to be observed during the construction, including but not limited to:

  - potential hazards
  - personal hygiene principles
  - personnel protective equipment
  - respiratory protection equipment usage and fit testing, and
  - emergency response including site evacuation, dealing with fire and medical situations

- Be responsible for the maintenance of separate exclusion, contamination reduction, and support zones if needed as described in the Contractor's H & S Plan and on the drawings.

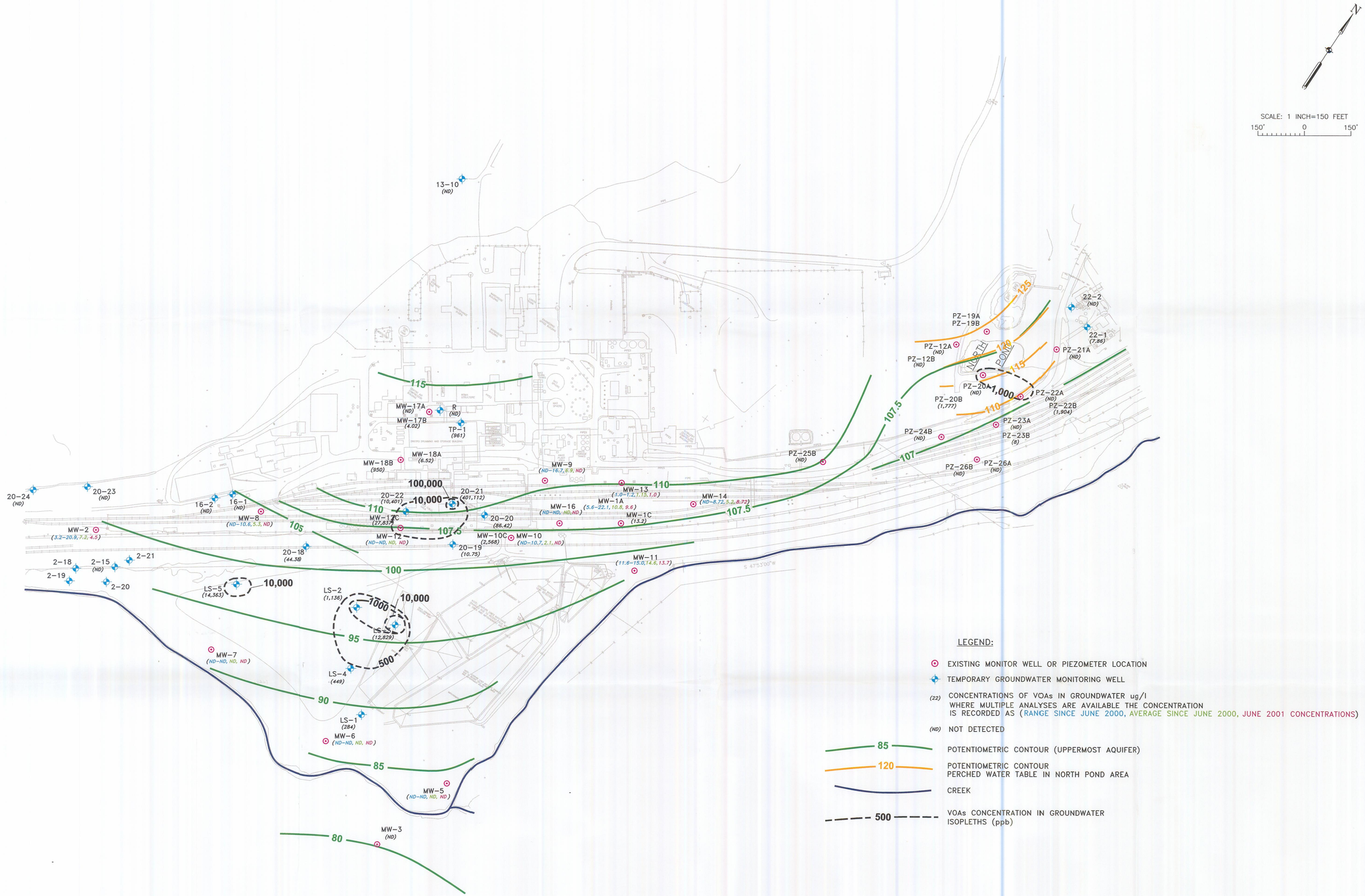
- Ensure that personnel exposure air monitoring, if needed, is properly conducted and recorded.

- During on-site activity, maintain a recordkeeping system which will include daily records of all site activity, waste quantities produced, waste transportation activity information, laboratory results, and other information.

5.2.6 QA/QC Manager

The QA/QC Manager will be responsible for coordination with the analytical laboratory and for the validation of data. Mr. Rodney Culpeper, analytical chemist and manager of Magnolia Scientific Laboratory, is QA/QC Manager.

DRAWING:



LEGEND:

- EXISTING MONITOR WELL OR PIEZOMETER LOCATION
- TEMPORARY GROUNDWATER MONITORING WELL
- (22) CONCENTRATIONS OF VOAs IN GROUNDWATER ug/l WHERE MULTIPLE ANALYSES ARE AVAILABLE THE CONCENTRATION IS RECORDED AS (RANGE SINCE JUNE 2000, AVERAGE SINCE JUNE 2000, JUNE 2001 CONCENTRATIONS)
- (ND) NOT DETECTED
- 85 POTENTIOMETRIC CONTOUR (UPPERMOST AQUIFER)
- 120 POTENTIOMETRIC CONTOUR PERCHED WATER TABLE IN NORTH POND AREA
- CREEK
- 500 VOAs CONCENTRATION IN GROUNDWATER ISOPLETHS (ppb)

K:\CEDAR\03013\03013-92B007CBASE2.DWG (VOA'S)

REV	DESCRIPTION OF REVISION	BY	DATE
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△			

VICKSBURG CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

URS
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

REFERENCE DRAWINGS

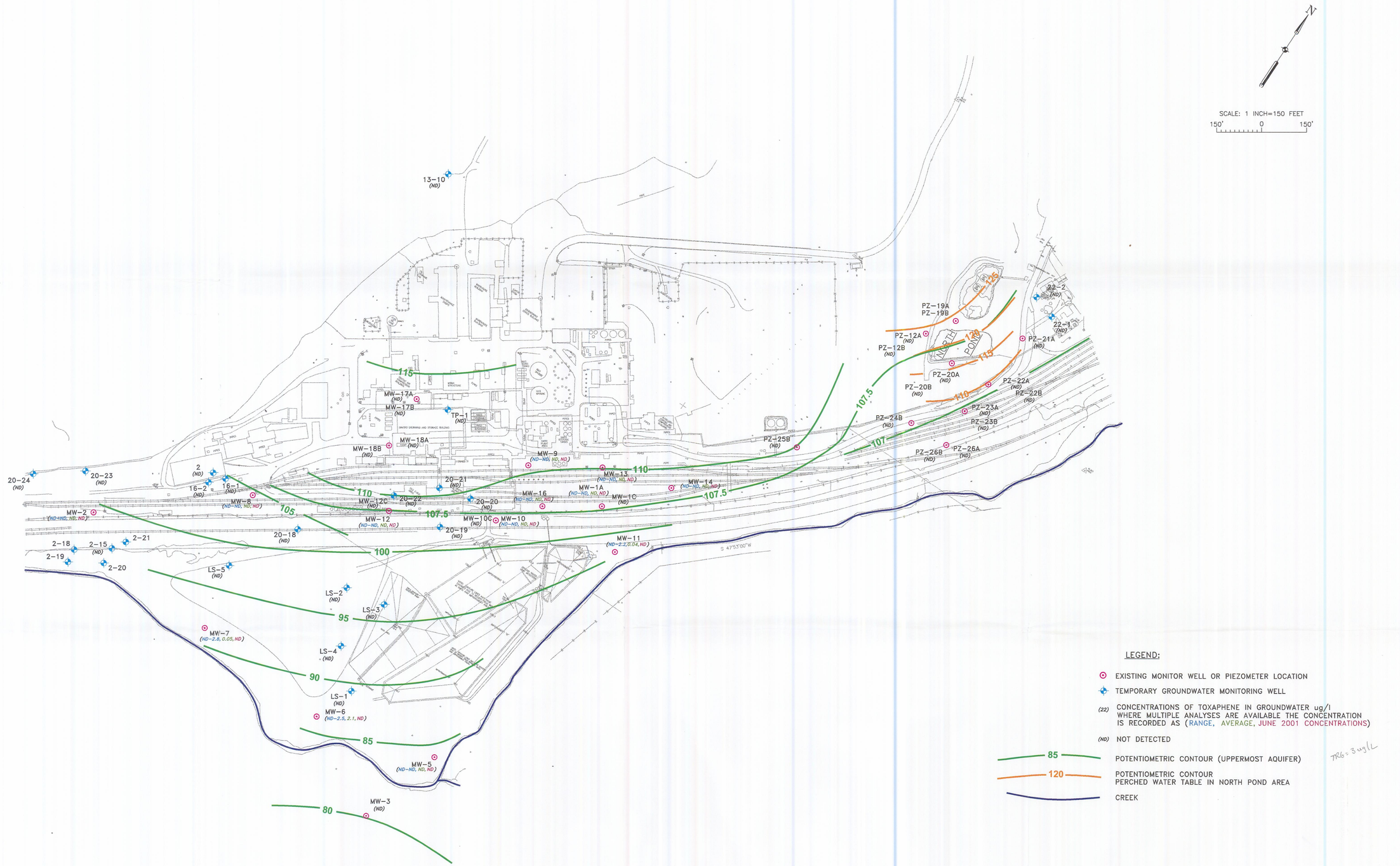
SCALE: 1"=150'
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/17/01

GROUNDWATER ASSESSMENT

OVERVIEW OF SITE WIDE VOAs
GROUNDWATER CONTAMINATION

REVISION: △
PROJECT: 35092B007C
DRAWING: 4-4

DRAWING



K:\CEDAR\03013\03013-92B007CBASE2.DWG (TOXAPHENE)

REV	DESCRIPTION OF REVISION	BY	DATE
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URS
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

REFERENCE DRAWINGS

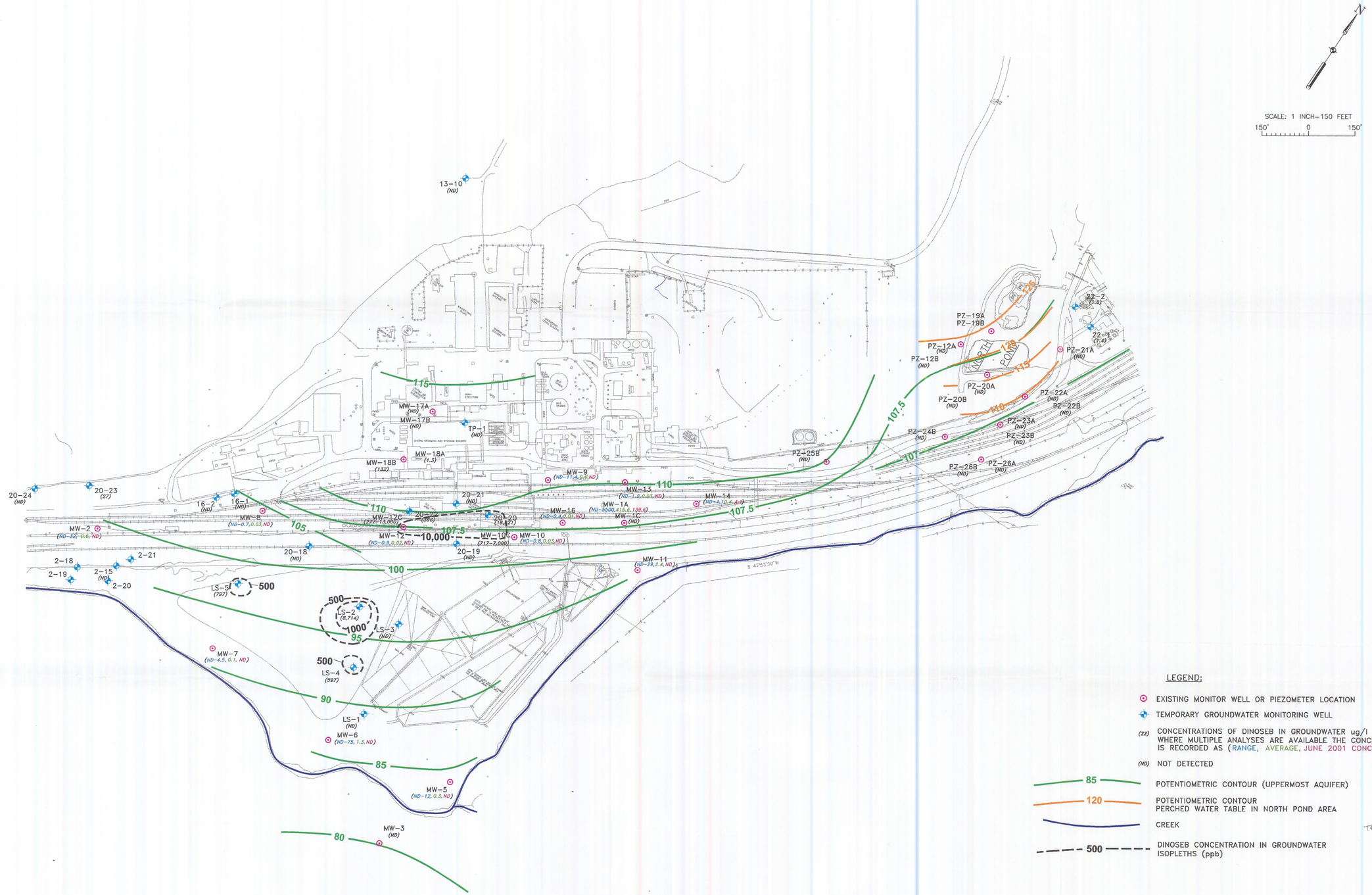
SCALE: 1"=150'
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/17/01

GROUNDWATER ASSESSMENT

OVERVIEW OF SITE WIDE TOXAPHENE GROUNDWATER CONTAMINATION

REVISION: △
PROJECT: 35092B007C
DRAWING: 4-3

DRAWING:



LEGEND:

- EXISTING MONITOR WELL OR PIEZOMETER LOCATION
- TEMPORARY GROUNDWATER MONITORING WELL
- (22) CONCENTRATIONS OF DINOSEB IN GROUNDWATER ug/l WHERE MULTIPLE ANALYSES ARE AVAILABLE THE CONCENTRATION IS RECORDED AS (RANGE, AVERAGE, JUNE 2001 CONCENTRATIONS)
- (ND) NOT DETECTED
- 85 POTENTIOMETRIC CONTOUR (UPPERMOST AQUIFER)
- 120 POTENTIOMETRIC CONTOUR PERCHED WATER TABLE IN NORTH POND AREA
- CREEK
- 500 DINOSEB CONCENTRATION IN GROUNDWATER ISOPLETHS (ppb)

TRG = 7 µg/L

K:\CEDAR\03013\03013-92B007CBASE2.DWG (DINOSEB)

REV	DESCRIPTION OF REVISION	BY	DATE
1	PLUME AT RAILROAD AREA MODIFIED	PCG	11/14/01

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VICKSBURG, MISSISSIPPI

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Baton Rouge, Louisiana 70816
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REFERENCE DRAWINGS

SCALE: 1"=150'
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/17/01

GROUNDWATER ASSESSMENT

OVERVIEW OF SITE WIDE DINOSEB GROUNDWATER CONTAMINATION

REVISION: 1
PROJECT: 35092B007C
DRAWING: 4-2

LEGEND:

- EXISTING MONITOR WELL OR PIEZOMETER LOCATION
- TEMPORARY GROUNDWATER MONITORING WELL
- (22) CONCENTRATIONS OF ARSENIC IN GROUNDWATER ug/l WHERE MULTIPLE ANALYSES ARE AVAILABLE THE CONCENTRATION IS RECORDED AS (RANGE, AVERAGE, JUNE 2001 CONCENTRATIONS)
- (ND) NOT DETECTED
- (NT) SAMPLE NOT OBTAINED
- 85 POTENTIOMETRIC CONTOUR (UPPERMOST AQUIFER)
- 120 POTENTIOMETRIC CONTOUR PERCHED WATER TABLE IN NORTH POND AREA
- CREEK
- 500 ARSENIC CONCENTRATION IN GROUNDWATER ISOPLETHS (ppb)

K:\CEDAR\03013\03013-92B007CBASE2.DWG (ARSENIC CONCENTRATIONS)

REV	DESCRIPTION OF REVISION	BY	DATE
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△			
△			
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△			
△			

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VICKSBURG, MISSISSIPPI

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2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

REFERENCE DRAWINGS

SCALE: 1"=150'
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/17/01

GROUNDWATER ASSESSMENT

OVERVIEW OF SITE WIDE ARSENIC GROUNDWATER CONTAMINATION

REVISION: △
PROJECT: 35092B007C
DRAWING: 4-1

FIGURE

SWMU NUMBER — SOUTH PLANT

1	CONTAINER (DRUM) STORAGE AREA
2	INACTIVE LANDFILL
3	SURFACE IMPOUNDMENT (SOUTH PLANT)
4	ACTIVATED CARBON TREATMENT UNITS
5	SOUTH PLANT DRAINAGE SYSTEMS
6	WASTEWATER STORAGE (HILL) TANKS
7	FORMER DINOSEB PRODUCTION AREA
8	DINOSEB LOADING/UNLOADING AREA
9	DINOSEB DRUMMING AREA
11	FORMER MSMA PRODUCTION AREA
12	FORMER MSMA SALT UNLOADING AREA
13	SOUTH PLANT DRAINAGE DITCHES
14	FORMER TOXAPHENE PRODUCTION AREA
15	FORMER METHYL PARATHION PRODUCTION AREA
16	FORMER ATRAZINE PRODUCTION AREA
17	RETURNED PRODUCT STORAGE AREA
18	FORMER BLUE TANK AREA
20	RAILROAD CAR UNLOADING STATION

NORTH PLANT

22	NORTH PLANT NEUTRALIZATION SYSTEM
23	EQUALIZATION/NEUTRALIZATION POND (NORTH POND)
25	NORTH PLANT WASTEWATER PIPES
26	C-10 SCRUBBER
29	OIL COLLECTION UNIT
30	NORTH PLANT WASTE OIL ACCUMULATION AREA
31	NO. 6 FUEL OIL AREA
33	NORTH PLANT DRAINAGE DITCHES

BOTH PLANTS

34	SURPLUS EQUIPMENT STORAGE (JUNKYARD)

LEGEND

- DEEP BORINGS LS-1, LS-2, LS-3, LS-4, LS-5
- BORINGS FOR SOIL SAMPLES AND CHEMICAL ANALYSIS
- PERMANENT MONITOR WELLS AND PIEZOMETERS
- PHASE II (MAY 2001) BORINGS TO GROUNDWATER (3 SOIL & 1 GROUNDWATER SAMPLE PER BORING)
- PHASE II (MAY 2001) SOIL SAMPLE (0.5-1.0 FOOT)
- SEPTEMBER 2001 BORING TO GROUNDWATER (1 GROUNDWATER SAMPLE PER BORING)
- CLOSED PONDS & CLOSED LANDFILLS

NOTES:

1) SEE FIGURE 2 FOR MAGNIFIED VIEW OF SWMU 4, 7, & 14 AREA
2) SEE FIGURES 3 & 4 FOR COMPOSITE SURFACE SOIL AND SOIL PILE SAMPLING LOCATIONS

SCALE
200 0 200 400 FEET

K:\CEDAR\0083\92B007C2-0013.DWG (SWMU LOCATIONS-RFI)

REV	DESCRIPTION OF REVISION	BY	DATE
8	AS EXECUTED THROUGH MAY 2001	PCG	7/19/01
7	MODIFIY PER SURFACE SOIL & SOIL PILE COMPOSITE SAMPLING RESULTS	PCG	3/9/01
6	MODIFY PER REVISED TOXAPHENE, DINOSEB AND ATRAZINE ANALYSES	PCG	1/18/01
5	ADD PHASE II BORINGS	PCG	12/14/00
4	ADD MW-16C AND REMOVE MW-1C	PCG	11/3/00
3	SHOW RFI INVESTIGATION OCTOBER 2000	PCG	10/20/00
2	SHOW SWMU 2 INVESTIGATION AUGUST 2000	PCG	8/11/00
1	SHOW NORTH POND WELLS; RELOCATE MW-18A/MW-18B, ADD MW-1C, PZ-26A/PZ-26B	PCG	7/18/00

VICKSBURG CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI

URS
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

REFERENCE DRAWINGS

SCALE: 1"=200'
DESIGNED:
DRAWN: PCG
CHECKED: RDK
PEER REVIEWED:
DATE: 7/20/01

GROUNDWATER ASSESSMENT

SWMU LOCATIONS, RFI SOIL AND CONCRETE SAMPLE POINTS, GWA MONITOR WELL LOCATIONS

REVISION: 8
PROJECT: 35092B007C
FIGURE: 1-1

DRAWING:

N

SCALE: 1 INCH=150 FEET

150' 0 150'

13-10 (ND/ND)

MW-17A (ND/ND) R (ND/ND)

MW-17B (ND/ND) TP-1 (ND/ND)

MW-18A (ND/ND)

MW-18B (ND/ND)

20-24 (ND/ND)

20-23 (30/ND)

2 (ND/ND)

16-2 (ND/ND)

16-1 (ND/ND)

MW-8 (1.1/ND)

MW-2 (ND/ND)

2-18 (ND/ND)

2-15 (123/ND)

2-21 (ND/ND)

2-19 (ND/ND)

2-20 (ND/ND)

20-18 (65/ND)

20-22 (146/ND)

20-21 (140/ND)

MW-12C (ND/ND)

MW-12 (ND/ND)

20-19 (ND/ND)

20-20 (ND/ND)

MW-10C (ND/ND)

MW-10 (ND/ND)

MW-9 (3.12/ND)

MW-13 (ND/ND)

MW-16 (ND/ND)

MW-1A (0.15/1.59)

MW-1C (ND/ND)

MW-14 (ND/ND)

MW-11 (ND/ND)

LS-5 (6/ND)

LS-2 (478/ND)

LS-3 (ND/ND)

LS-4 (ND/ND)

LS-1 (ND/ND)

MW-7 (0.4/ND)

MW-6 (ND/ND)

MW-5 (ND/ND)

MW-3 (ND/ND)

PZ-25B (ND/ND)

PZ-24B (ND/ND)

PZ-19A

PZ-19B

PZ-12A (ND/ND)

PZ-12B (ND/ND)

PZ-20A (ND/ND)

PZ-20B (ND/ND)

PZ-23A (ND/ND)

PZ-23B (ND/ND)

PZ-22A (ND/ND)

PZ-22B (ND/ND)

PZ-21A (ND/ND)

22-2 (ND/ND)

22-1 (ND/ND)

PZ-26B (ND/ND)

PZ-26A (ND/ND)

NORTH POND

125

120

115

110

107.5

107

105

100

95

90

85

80

S 47°57'00" W

LEGEND:

- EXISTING MONITOR WELL OR PIEZOMETER LOCATION
- TEMPORARY GROUNDWATER MONITORING WELL
- (22) CONCENTRATIONS OF ATRAZINE/CYANZINE IN GROUNDWATER ug/l (HIGHEST CONCENTRATION RECORDED AT WELL)
- (ND) NOT DETECTED
- 85 POTENTIOMETRIC CONTOUR (UPPERMOST AQUIFER)
- 120 POTENTIOMETRIC CONTOUR PERCHED WATER TABLE IN NORTH POND AREA
- CREEK
- 500 ATRAZINE CONCENTRATION IN GROUNDWATER ISOPLETHS (ppb)

K:\CEDAR\03013\03013-92B007CBASE2.DWG (ATRAZINE-CYANAZINE)

REV	DESCRIPTION OF REVISION	BY	DATE
△			
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△			
△			
△			
△			

VICKSBURG CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

URS
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

REFERENCE DRAWINGS

SCALE: 1"=150'
DESIGNED:
DRAWN: PCG
CHECKED:
PEER REVIEWED:
DATE: 7/17/01

GROUNDWATER ASSESSMENT

OVERVIEW OF SITE WIDE ATRAZINE AND CYANAZINE GROUNDWATER CONTAMINATION

REVISION: △
PROJECT: 35092B007C
DRAWING: 4-5