ARCADIS
Infrastructure, environment, facilities

JAN 1 1 2007

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Mr. Jere "Trey" Hess, P.E.
MDEQ – Office of Pollution Control
P.O. Box 10385
Jackson, Mississippi 39289-0385

ENVIRONMENTAL

COPY

Subject:
Drum Inventory
Former Vicksburg Chemical Company
Vicksburg, Mississippi

Date:
8 January 2007

Contact:
David R. Escudé

Extension:
245

Email:
descude@arcadis-us.com

Our ref:
LA002656.0001.00004
Mississippi Bluffs/2656.1.4/C/2/egp

Dear Mr. Hess:

On November 21, 27, and 29, 2006, ARCADIS conducted a drum inventory at the former Vicksburg Chemical Company (Vicksburg Chemical) located in Vicksburg, Mississippi (Figure 1). After Vicksburg Chemical filed for bankruptcy on March 8, 2002, drums that were used by the plant during operations were abandoned in place in various areas. The purpose of this drum inventory effort was to catalog the locations and pertinent characteristics of the drums remaining on the site.

During drum inventory activities, containers varying in size from 1 gallon to 55 gallons were inspected for structural integrity, amount of substance contained, and type of substance. Approximately 100 drums located in the Multicote Loading Rack, Drum Storage Area North, Drum Storage Area South, Drum Handling, and miscellaneous areas were evaluated (Figure 2). Other drums were located in miscellaneous areas including the shop laydown yard, behind the laboratory, near the vehicle maintenance shop, near the tall oil tank, near the ammonia tank, and areas west of the plant.

The drums were evaluated using a three-tiered rating system. Drums rated "A" were considered to be in good condition. These drums were evaluated as structurally sound. Drums rated "B" were observed to be in fair condition. Some rust was present on these drums; however, these drums do not pose an imminent threat of leaking. Drums rated "C" were determined to be in poor condition. This rating indicates that these drum were observed to be leaking.

Three drums containing a black oily liquid (most likely castor oil) located in the Multicote Loading Rack area were given a rating of "C". Additionally, these drums were not located within secondary containment. The Multicote Loading Rack area is

within the boundaries of proposed remedial activities. All of the other drums were given "A" or "B" ratings. The results of the drum inventory evaluation are contained in Attachment A. A log containing photographs representative of the observed drum conditions is contained in Attachment B.

It is recommended that the contents of all drums rated "C" be re-containerized and/or disposed of in an environmentally acceptable manner. Once the leaking drums have been emptied, they should be destroyed.

Should you have any questions about the findings presented in this letter, please contact one of the undersigned at (225) 292-1004.

Sincerely,

ARCADIS U.S., Inc.

Craig A. Derouen, P.E.
Project Engineer

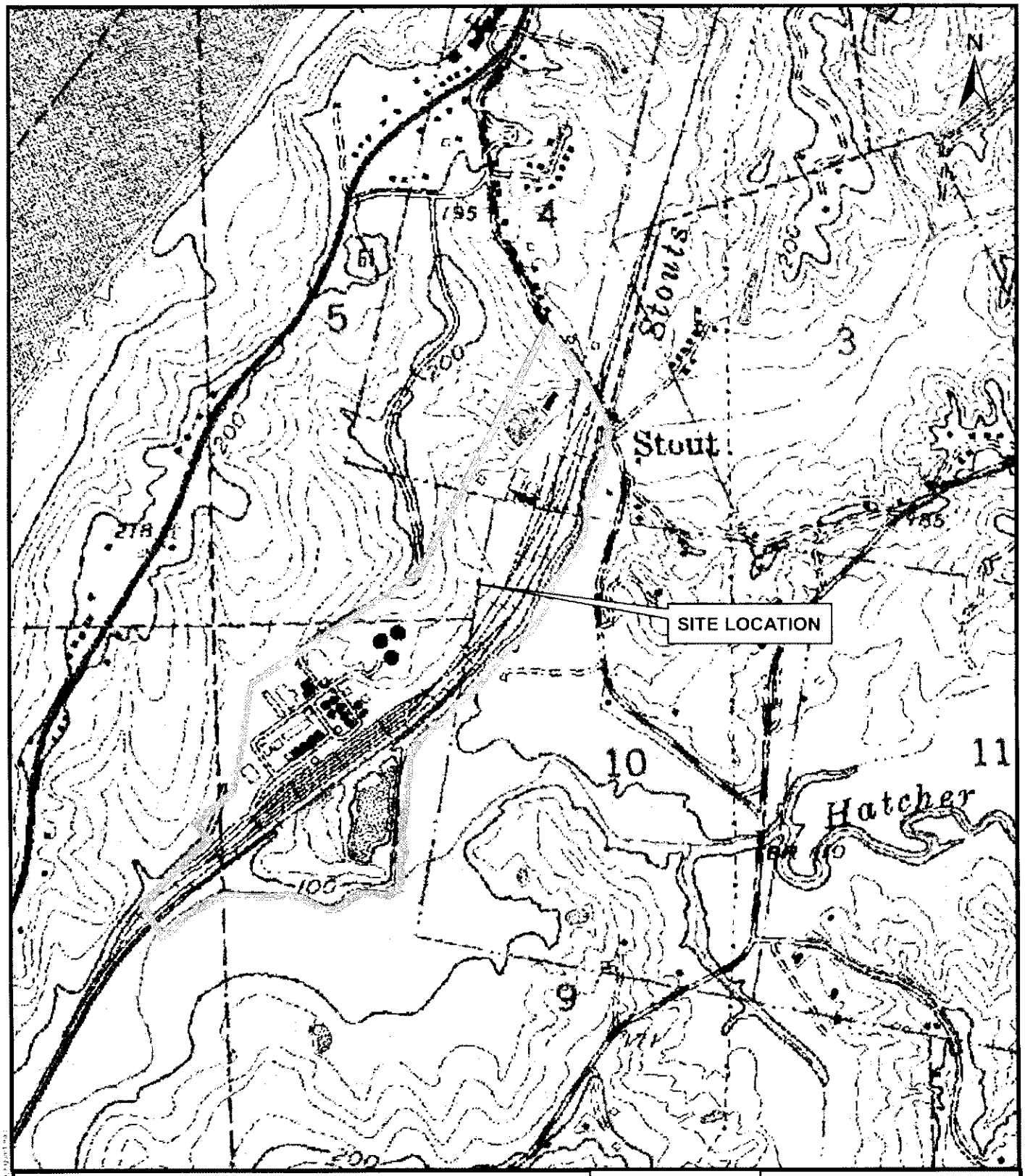
David R. Escudé, P.E.
Associate Vice President/Principal Engineer

Rudy J. Guichard
Vice President/Area Manager

CAD:DRE:RJG:egp

Attachments

FIGURES



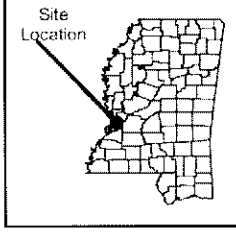
Former Plant Site

Note: Approximate Property Boundary

SITE LOCATION MAP

VICKSBURG CHEMICAL COMPANY

VICKSBURG, MISSISSIPPI



500 0 500 1,000
Feet

Project Manager: JE	Completed By: AB
Task Manager: CD	Date: 07/31/2006
Project No.: LA002656.0001	Figure No.: 1

10352 Plaza Americana Drive
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Tel: 225.292.1004 Fax: 225.218.9677

REFERENCE:

USGS, Vicksburg West Quadrangle, Mississippi
7.5 Minute Series (Topographic)

User Name : smen Path\Name : G:\APROJECT\Mississippi Bluffs\LA002656.0001\Figures\2456-D1-02--Drum.dwg

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DRAWN BY: S. WEN	CHECKED: CAD
PROJECT MANAGER: DRE	DEPARTMENT MANAGER: DRE
DATE: 1-5-07	TASK/PHASE NUMBER: 0004

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DRUM LOCATIONS

VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER: LA002656.0001

DRAWING NUMBER: 2

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MISSISSIPPI BLUFFS
VICKSBURG, MISSISSIPPI
DRUM INVENTORY

Project Number: LA002656.0001.00004
Date: 11/27/2006
Coordinate System: GPS

Drum Area Location: Multicote Loading Rack
Personnel: John Trahan

Area	ID #	Latitude	Longitude	Label Present (Y/N)	Secondary Containment (Y/N)	Substance (CAS #, if present)	Condition (A, B or C)	Vol (gal)	Notes
MCLR	1	N 32.29414°	W 90.90675°	N	N	Black Liquid	C		Black liquid, oily castor oil
MCLR	2	N 32.29414°	W 90.90675°	N	N	Black Liquid	C		Black liquid, oily castor oil
MCLR	3	N 32.29414°	W 90.90675°	N	N	Black Liquid	C		Black liquid, oily castor oil
MCLR	A1	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A2	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A3	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A4	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A5	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A6	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A7	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A8	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A9	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A10	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A11	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A12	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)
MCLR	A13	N 32.29414°	W 90.90675°	Y	N	Empty	A	0	Aluminum Drum (Keg)

MCLR Multicote Loading Rack.

Category A - Good (structurally sound)
Category B - Fair (rust present, note degree of rusting)
Category C - Poor (leaking, needs immediate removal)

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MISSISSIPPI BLUFFS
VICKSBURG, MISSISSIPPI
DRUM INVENTORY

Project Number: LA002656.0001.00004
Date: 11/27/2006
Coordinate System: GPS

Drum Area Location: Drum Storage Area North
Personnel: John Trahan

Area	ID #	Latitude	Longitude	Label Present (Y/N)	Secondary Containment (Y/N)	Substance (CAS #, if present)	Condition (A, B or C)	Vol (gal)	Notes
DSAN	1	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	Exxon Zerice N 68 Sealed
DSAN	2	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	Exxon Zerice N 68 Sealed
DSAN	3	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	Exxon Zerice N 68 Sealed
DSAN	4	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	Exxon Zerice N 68 Sealed
DSAN	5	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	Exxon Zerice N 68 Sealed
DSAN	6	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	CPI Eng Solest 220 Sealed
DSAN	7	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	GX 80-90 wt Gear Oil Sealed
DSAN	8	N 32.29761°	W 90.90176°			Empty	B		
DSAN	9	N 32.29761°	W 90.90176°			Empty	B		
DSAN	10	N 32.29761°	W 90.90176°			Empty	B		
DSAN	11	N 32.29761°	W 90.90176°			Empty	B		
DSAN	12	N 32.29761°	W 90.90176°			Empty	B		
DSAN	13	N 32.29761°	W 90.90176°			Empty	B		
DSAN	14	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	Exxon Sparton EP-68 Sealed
DSAN	15	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	Exxon Sparton EP-68 Sealed
DSAN	16	N 32.29761°	W 90.90176°	Y	Y	Oil	B	55	Exxon Sparton EP-68 Sealed

Category A - Good (structurally sound)
Category B - Fair (rust present, note degree of rusting)
Category C - Poor (leaking, needs immediate removal)

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MISSISSIPPI BLUFFS
VICKSBURG, MISSISSIPPI
DRUM INVENTORY

Project Number: LA002656.0001.00004
Date: 11/27/2006
Coordinate System: GPS

Drum Area Location: Drum Storage Area North
Personnel: John Trahan

Area	ID #	Latitude	Longitude	Label Present (Y/N)	Secondary Containment (Y/N)	Substance (CAS #, if present)	Condition (A, B or C)	Vol (gal)	Notes
DSAN	17	N 32.29761°	W 90.90176°	Y	Y	Oil	B	0	Used Oil
DSAN	18	N 32.29761°	W 90.90176°	Y	Y	Oil	B	0	Used Oil
DSAN	19	N 32.29761°	W 90.90176°	Y	Y	Oil	B	5	Used Oil
DSAN	20	N 32.29761°	W 90.90176°	Y	Y	Oil	B	15	Used Oil
DSAN	21	N 32.29761°	W 90.90176°	N	Y	Oil	B	55	Oil Drum Sealed
DSAN	22	N 32.29761°	W 90.90176°	N	Y	Oil	B	10	Oil
DSAN	23	N 32.29761°	W 90.90176°	N	Y	Oil	B	5	Oil
DSAN	24	N 32.29761°	W 90.90176°	Y	Y	Unknown	B	15	Allied Signal Genesolve 24
DSAN	25	N 32.29761°	W 90.90176°	Y	Y	Oil	B	5	Oil
DSAN	26	N 32.29761°	W 90.90176°	Y	Y	Oil	B	5	Superflo ATF D/M
DSAN	27	N 32.29761°	W 90.90176°	Y	Y	Oil	B	0	Teresstic 68
DSAN	28	N 32.29761°	W 90.90176°	Y	Y	Oil	B	10	Motor Oil Visa Super
DSAN	29	N 32.29761°	W 90.90176°	N	Y	Empty	B	0	Empty
DSAN	30	N 32.29761°	W 90.90176°	N	N	Unknown	B	55	By Building

DSAN Drum Storage Area North.

Other Containers: 6 - 5-gallon Cans
20 - 5-gallon Cans located in Building

Category A - Good (structurally sound)
Category B - Fair (rust present, note degree of rusting)
Category C - Poor (leaking, needs immediate removal)

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MISSISSIPPI BLUFFS
VICKSBURG, MISSISSIPPI
DRUM INVENTORY

Project Number: LA002656.0001.00004
Date: 11/21/2006
Coordinate System: GPS

Drum Area Location: Drum Storage Area South
Personnel: John Trahan

Area	ID #	Latitude	Longitude	Label Present (Y/N)	Secondary Containment (Y/N)	Substance (CAS #, if present)	Condition (A, B or C)	Vol (gal)	Notes
DSAS	1	N 32.29498°	W 90.90764°		Y	Empty	A	0	Empty
DSAS	2	N 32.29498°	W 90.90764°		Y	Empty	B	0	Empty
DSAS	3	N 32.29498°	W 90.90764°		Y	Empty	B	0	Empty
DSAS	4	N 32.29498°	W 90.90764°		Y	Empty	B	0	Empty
DSAS	5	N 32.29498°	W 90.90764°		Y	Empty	B	0	Empty
DSAS	6	N 32.29498°	W 90.90764°		Y	Empty	B	0	Empty
DSAS	7	N 32.29498°	W 90.90764°	Y	Y	Oil	B	55	Exxon Diol 13RD 40
DSAS	8	N 32.29498°	W 90.90764°	Y	Y	Oil	B	15	Used Oil
DSAS	9	N 32.29498°	W 90.90764°	Y	Y	Oil	B	5	SAE 80-90 weight Waring Oil Company
DSAS	10	N 32.29498°	W 90.90764°	Y	Y	Oil	B	5	SAE 10 weight Waring Oil Company
DSAS	11	N 32.29498°	W 90.90764°	Y	Y	Oil	B	10	Used Oil
DSAS	12	N 32.29498°	W 90.90764°	Y	Y	Oil	B	10	Exxon Terrestic 100 weight
DSAS	13	N 32.29498°	W 90.90764°	Y	Y	Oil	B	55	Exxon Hydraul 56
DSAS	14	N 32.29498°	W 90.90764°	N	Y	Oil	B	55	Used Oil
DSAS	15	N 32.29498°	W 90.90764°	Y	Y	Used Coolant	B	40	Used Antifreeze Water
DSAS	16	N 32.29498°	W 90.90764°	Y	Y	Oil	B	25	#3 Oil

Category A - Good (structurally sound)
Category B - Fair (rust present, note degree of rusting)
Category C - Poor (leaking, needs immediate removal)

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MISSISSIPPI BLUFFS
VICKSBURG, MISSISSIPPI
DRUM INVENTORY

Project Number: LA002656.0001.00004
Date: 11/21/2006
Coordinate System: GPS

Drum Area Location: Drum Storage Area South
Personnel: John Trahan

Area	ID #	Latitude	Longitude	Label Present (Y/N)	Secondary Containment (Y/N)	Substance (CAS #, if present)	Condition (A, B or C)	Vol (gal)	Notes
DSAS	17	N 32.29498°	W 90.90764°	N	Y	Empty	B	0	
DSAS	18	N 32.29498°	W 90.90764°	Y	Y	Oil	B	55	Used Oil
DSAS	19	N 32.29498°	W 90.90764°	Y	Y	Oil	B	55	10W30
DSAS	20	N 32.29498°	W 90.90764°	Y	Y	Oil	B	55	10W40
DSAS	21	N 32.29498°	W 90.90764°	Y	Y	Oil	B	55	80 weight
DSAS	22	N 32.29498°	W 90.90764°	Y	Y	Unknown Oil	B	55	Tribol Partial Label

DSAS Drum Storage Area South.

Other Containers: 4 - 5-gallon Cans
1 - Used Oil Tank

Category A - Good (structurally sound)
Category B - Fair (rust present, note degree of rusting)
Category C - Poor (leaking, needs immediate removal)

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MISSISSIPPI BLUFFS
VICKSBURG, MISSISSIPPI
DRUM INVENTORY

Project Number: LA002656.0001.00004
Date: 11/29/2006
Coordinate System: GPS

Drum Area Location: Drum Handling Area
Personnel: John Trahan

Area	ID #	Latitude	Longitude	Label Present (Y/N)	Secondary Containment (Y/N)	Substance (CAS #, if present)	Condition (A, B or C)	Vol (gal)	Notes
DHA	1	N 32.29467°	W 90.90646°	N	N	Unknown	B	55	Solid
DHA	2	N 32.29467°	W 90.90646°	Y	N	Unknown	B	55	Solid Activated Alumina
DHA	3	N 32.29467°	W 90.90646°	N	N	Unknown	B	27.5	Solid Activated Alumina
DHA	4	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	55	
DHA	5	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	55	
DHA	6	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	55	
DHA	7	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	55	
DHA	8	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	55	
DHA	9	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	55	
DHA	10	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	10	
DHA	11	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	5	
DHA	12	N 32.29435°	W 90.90673°	Y	Y	Waste Oil	B	5	
DHA	13	N 32.29435°	W 90.90673°	Y	Y	New Oil Sealed	B	55	Delta Weslovaco SCTO
DHA	14	N 32.29435°	W 90.90673°	Y	Y	New Oil Sealed	B	55	Delta Weslovaco SCTO
DHA	15	N 32.29435°	W 90.90673°	Y	Y	New Oil Sealed	B	55	Delta Weslovaco SCTO
DHA	16	N 32.29435°	W 90.90673°	Y	Y	New Oil Sealed	B	55	Delta Weslovaco SCTO

DHA Drum Handling Area.

Other Containers: 4 - Salvage Drums (Trash)
10 - Open-Top Drums (Absorbent Material)
Multiple 5-gallon Cans
Multiple 1-gallon Cans

Category A - Good (structurally sound)
Category B - Fair (rust present, note degree of rusting)
Category C - Poor (leaking, needs immediate removal)

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MISSISSIPPI BLUFFS
VICKSBURG, MISSISSIPPI
DRUM INVENTORY

Project Number: LA002656.0001.00004
Date: 11/27/2006
Coordinate System: GPS

Drum Area Location: Miscellaneous
Personnel: John Trahan

Area	ID #	Latitude	Longitude	Label Present (Y/N)	Secondary Containment (Y/N)	Substance (CAS #, if present)	Condition (A, B or C)	Vol (gal)	Notes
SLDY	1	N 32.29449°	W 90.90740°	Y	N	Unknown	B	55	Na Ph product
SLDY	2	N 32.29449°	W 90.90740°	Y	N	Unknown	B	55	Na Ph product
WOP		N 32.29601°	W 90.90760°	N	N	Unknown	B	55	8 Full; 1 Empty
WOP		N 32.29588°	W 90.90764°	N	N	Unknown	B	55	5 Full Solids
BL	1&2	N 32.29514°	W 90.90655°	N	N	Carbon	B	Unknown	2 Carbon Drums (200 pounds in each)
BL	3	N 32.29520°	W 90.90643°	Y	N	Lab Pack	B	Unknown	
VMS	1	N 32.29514°	W 90.90717°	N	Y	Oil	B	27.5	Used Oil (tub of oil and drain can next to it)
TOT	1	N 32.29456°	W 90.90689°	N	N	Tall Oil	A	37	Tall Oil From Leaking Tank
AT	1	N 32.29478°	W 90.90563°	Y	N	Waste Oil	B	55	Plastic Open Top With Cover
MKU	1	N 32.29371°	W 90.90805°	N	N	Unknown	A	55	Bung Open Plastic
MKU	2	N 32.29288°	W 90.90808°	Y	N	Hyd Oil	B	55	Used Oil
MKU	3	N 32.29288°	W 90.90808°	N	N	Empty	B	0	
MKU	4	N 32.29266°	W 90.90799°	Y	N	Betz Continuum	A	15	(Plastic) Water Treatment Chem
MC	1	N 32.29420°	W 90.90618°	N	N	Polymer Covered	B	Unknown	Surrounded by Polymer (North side of warehouse)
MC	2	N 32.29424°	W 90.90565°	Y	N	Betz Continuum	B	15	(Metal) Water Treatment Chem
NA	1	N 32.29442°	W 90.90549°	Y	N	Betz Control	A	5	Plastic In Building
NA	2	N 32.29442°	W 90.90549°	N	N	Possible NH3	B	Unknown	Small Amount

SLDY	Shop Lay Down Yard	TOT	Tall Oil Tank
WOP	West of Plant	AT	Ammonia Tank
BL	Behind Lab	MKU	MK Unit
VMS	Vehicle Maintenance Shop	MC	Multicote Unit

12 drums of anti-foam product in Machine Shop
W 32.29476° W 90.90664°

Category A - Good (structurally sound)
Category B - Fair (rust present, note degree of rusting)
Category C - Poor (leaking, needs immediate removal)

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ATTACHMENT B

Photographic Log

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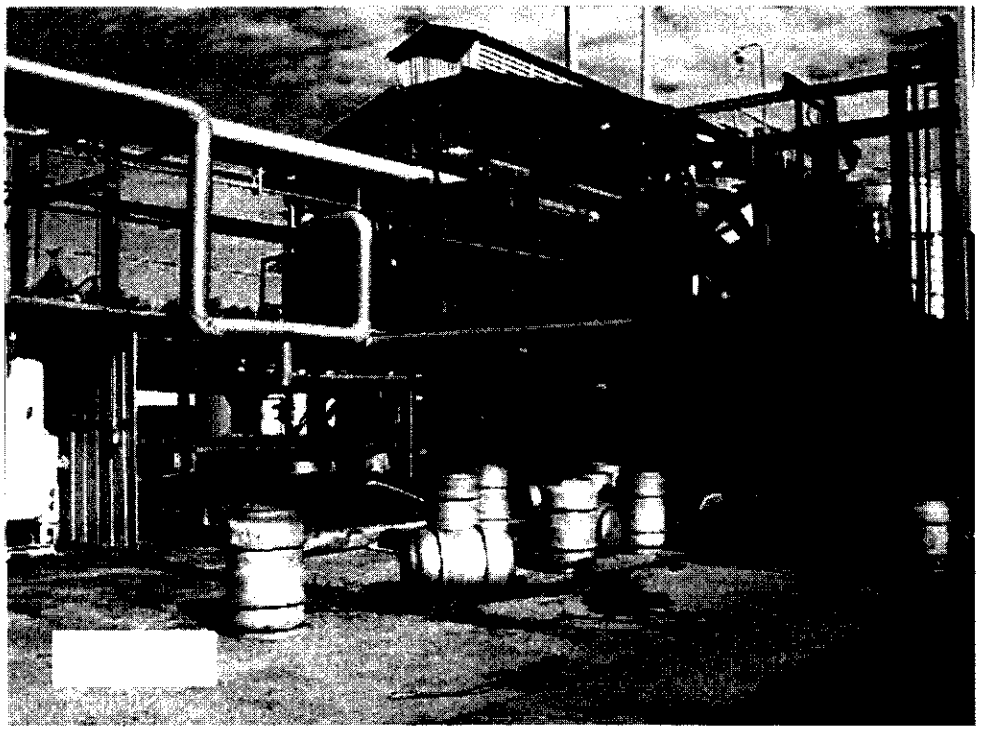
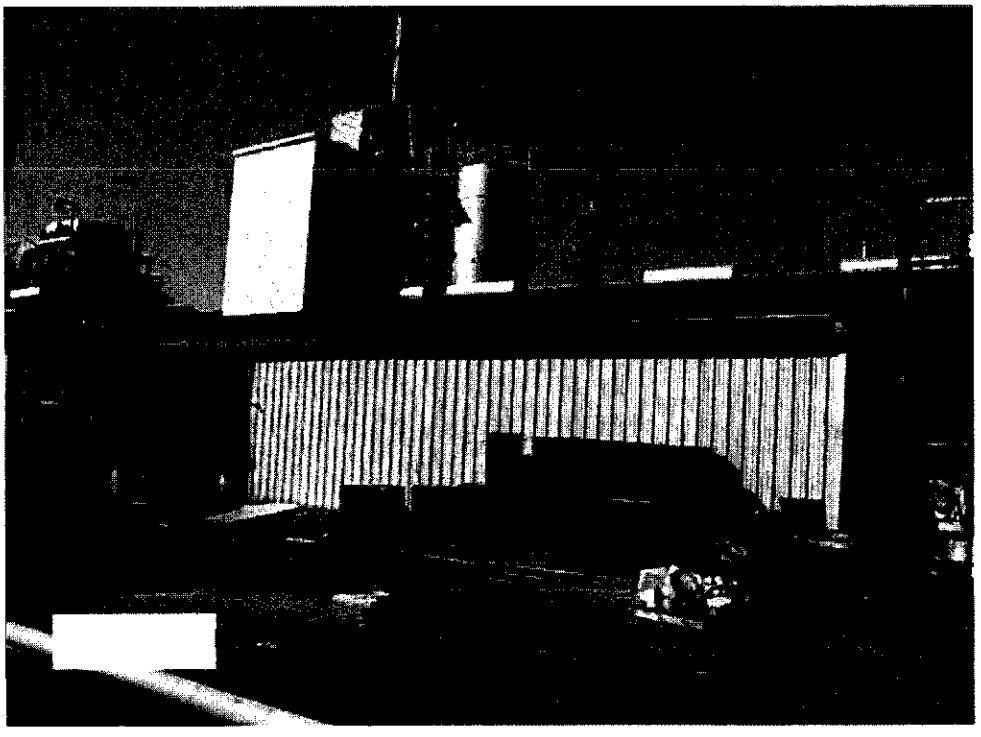
Photographic Log

Mississippi Bluffs –
Drum Inventory



Photograph 1: Multicote Loading Rack – Drums – Looking North.



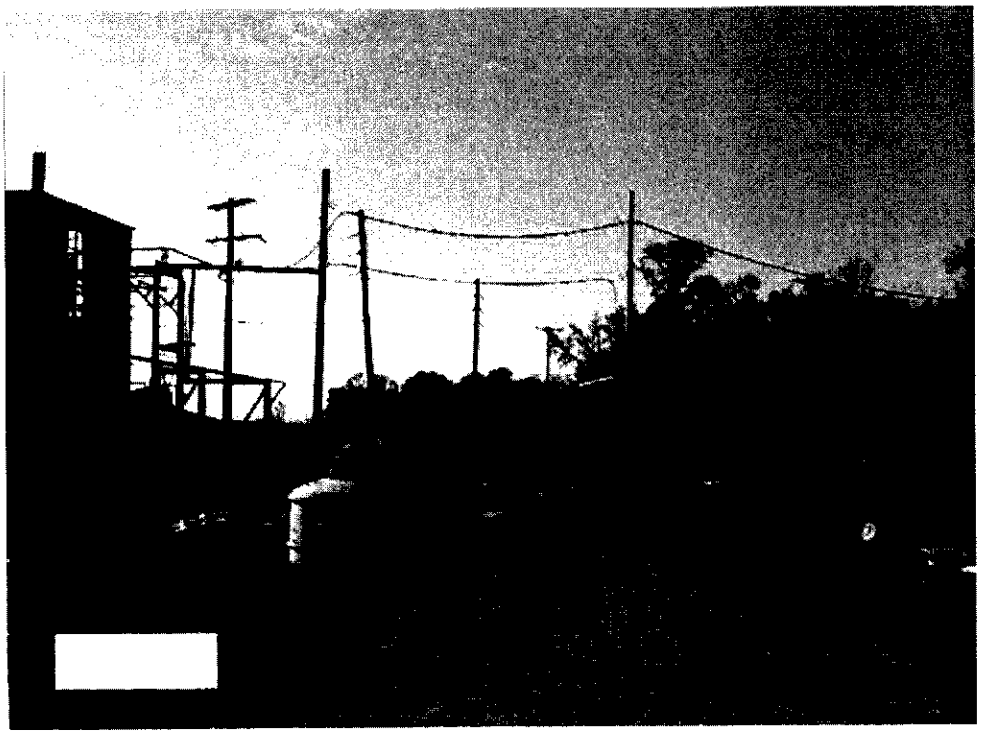
Photograph 2: Multicote Loading Rack – Castor Oil Drums – Looking Southwest.

Photograph 3: Drum Storage Area North – Looking West.

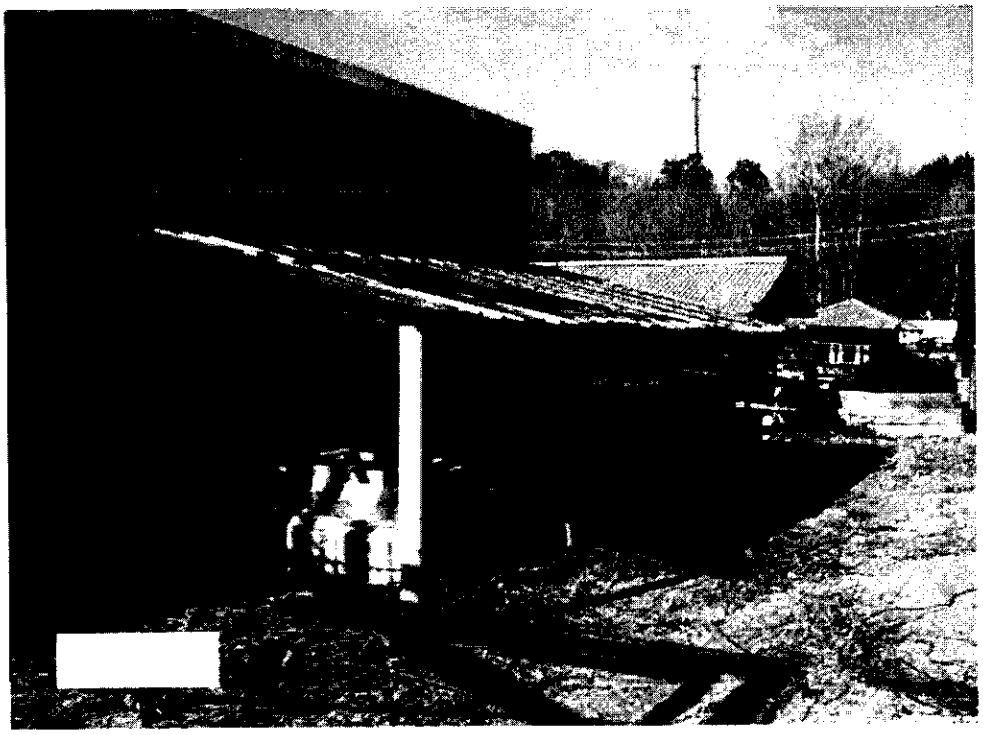
Photograph 4: Drum Storage Area South – Looking West.

Photograph 5: Drum Handling Area – Looking North.

Photograph 6: Drum Handling Area - Cans – Looking South.



Photograph 7: Shop Laydown Yard – Looking South.



Photograph 8: Behind Laboratory – Carbon Drums– Looking West.

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Imagine the result

COPY

Mississippi Department of Environmental Quality

and

MISSISSIPPI BLUFFS INDUSTRIAL PARK, LLC

Solidification/Stabilization Treatability Study Work Plan

Former Vicksburg Chemical Company
Vicksburg, Mississippi

4 January 2007

ARCADIS

Solidification/Stabilization Treatability Study Work Plan

Former Vicksburg Chemical Company
Vicksburg, Mississippi

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Prepared for:
Mississippi Department of Environmental Quality and Mississippi Bluffs Industrial Park, LLC

Prepared by:
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Our Ref.:
LA002656.0001.00008

Date:
4 January 2007

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Appendices

A RCRA Facility Investigation Soil and Groundwater Sample Locations

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DRAFT

1. Introduction and Work Plan Rationale

1.1 Objectives/Rationale

This Work Plan presents a scope of work for performing a solidification and stabilization treatability study at the former Vicksburg Chemical Company (Vicksburg Chemical). The site was formerly a pesticide and herbicide manufacturing facility divided into two areas called the North Plant and South Plant. The primary objective of the activities proposed in this document will be to collect and evaluate soil and sludge samples to determine the necessary amendments to adequately solidify and/or stabilize the materials. Solidification is a process that adds strength to material, while stabilization chemically fixates chemicals of concern (CoC) within a matrix. This treatability study will be performed in anticipation of the usage of solidification and/or stabilization as a component of the final remedy for on-site CoC.

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1.2 Summary of Solidification and Stabilization Processes and Applicability

Solidification, also referred to as fixation, denotes contaminant entrapment within a solid matrix of high structural integrity (a monolith). The chemical immobilization of contaminants is defined as stabilization. These terms are usually referred to interchangeably as solidification/stabilization. Solidification/stabilization is applicable to solid, liquid, or sludge wastes and can be performed in containers or in situ. The leachability of contaminants from a stabilized waste is reduced through the binding of the hazardous constituents into a solid mass of low permeability. The stabilized mass will resist leaching or extraction of contaminants by water.

Important aspects of this treatment approach include selection of stabilizing agents and other additives, the waste to additive ratio, the mixing, and curing conditions. All of these parameters depend on the chemical and physical characteristics of the waste. Bench scale treatability tests described in subsequent sections will be conducted to select the proper additives and determine an estimated curing time. Leaching tests and compressive strength tests will also be conducted to determine the integrity of the solid end product. In addition to the bench scale treatability studies, large scale field demonstrations are often necessary to confirm laboratory results.

It is anticipated that the sludge material removed from the North Pond (Area 5) will require solidification prior to the on-site consolidation within Solid Waste Management Unit (SWMU) 2 and capping. Increased strength achieved by solidification will dramatically improve the handling characteristics of the sludge material. However,

some areas within the site may only require stabilization (i.e., the areas with elevated or "hotspot" concentrations of CoC in the vicinity of the railroad tracks located in the South Plant).

1.3 Property Background

1.3.1 Property Location

Vicksburg Chemical was formerly owned by Cedar Chemical Corporation (Cedar Chemical). The facility is located south of Interstate 20 on Rifle Range Road and within the southwestern section of the city of Vicksburg in Warren County, Mississippi. The site is composed of approximately 535 acres located in Sections 4, 5, 8, 9, and 10, township 15 north, range 3 east (Latitude: North 32° 18' 01", Longitude: West 90° 53' 57"). The site location is shown on Figure 1.

1.3.2 Property History

The North Plant began operation in 1961 and produced potassium nitrate, liquid chlorine, and liquid nitrogen tetroxide. The raw materials for the North Plant included potassium chloride and nitric acid. The South Plant began operation in 1953 manufacturing chlorinated pesticides, nitrogen-based herbicides, and other agricultural chemicals. The only active operations at the South Plant after 1992 were the nitric acid unit constructed in 1986 and a potassium carbonate unit constructed in 1994. During various periods prior to 1987, the South Plant produced dinitro butyl phenol (dinoseb or DNBP), monosodium methane arsenate (MSMA) diethyl hexyl phosphoric acid (DEHPA), 1-hydroxy-ethylidene-1-1-diphosphonic acid (UNIHIB), toxaphene, methyl parathion, cyanazine (bladex), and atrazine. Toxaphene and methyl parathion are insecticides, while atrazine, dinoseb, and MSMA are herbicides. Raw materials for these operating processes included chlorine, camphene, ortho-secondary butyl phenol (OSBP), sodium arsenate, sodium hydroxide, methyl chloride, sulfuric acid, sodium paranitrophenolate, and phosphorus trichloride.

Originally, the two plants were completely separate, owned and operated by two different companies. The South Plant was originally constructed by Spencer Chemical in 1953. American Metal Climax Corporation (Amax) constructed the North Plant in 1961. After purchasing the South Plant in 1964, Gulf Chemical added a formaldehyde unit in 1966. According to historical environmental documents, Vicksburg Chemical was formed in early 1972 and purchased both the Gulf Oil and Amax facilities (except the formaldehyde plant) in July 1972. In 1978, Vicksburg Chemical was merged into

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Vertac, Inc., which merged into Vertac Chemical Corporation (VCC) in September 1979. *Cedar Chemical acquired* the Vicksburg Chemical plant from VCC in February 1986. Fermenta A.B. of Sweden acquired Cedar Chemical in June 1986. Nine West Corporation (Trans Resources, Inc.) acquired Cedar Chemical in January 1988.

In addition to the above-mentioned operations at the plant, the property was the location of two additional operations: 1) an operation by Reagent Chemical to produce aqueous hydrochloric acid from a by-product of the toxaphene operation; and 2) a Gulf formaldehyde plant. The formaldehyde unit owned and formerly operated by Borden Chemical is located inside the former boundary of the South Plant.

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1.4 Project History

1.4.1 Background

Vicksburg Chemical initiated a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) in 1994 and continued through 2001. Soil and groundwater sample locations evaluated in the RFI are shown in Appendix A. The *RCRA Facility Investigation Draft Final Report* (URS 2001a) and *Draft Groundwater Assessment Report* (URS 2001b) were completed in August 2001 and November 2001, respectively. Both reports were submitted to the U.S. Environmental Protection Agency (USEPA) and subsequently approved in December 2001. A draft Corrective Measures Study was developed in the spring of 2002.

On March 8, 2002, VCC and Cedar Chemical filed for bankruptcy in the United States Bankruptcy Court for the Southern District of New York. The bankruptcy was contested by the Mississippi Department of Environmental Quality (MDEQ), the Arkansas Department of Environmental Quality, USEPA Region 4, USEPA Region 6, and the U.S. Department of Justice. The court eventually approved an agreement allowing Vicksburg Chemical to abandon its properties and authorizing MDEQ to direct the transfer of the Vicksburg Chemical property to any entity identified by MDEQ. Since that time, MDEQ has kept the site under its control while structuring an agreement to clean up the plant site in a manner protective of human health and the environment. On December 19, 2005, MDEQ finalized an agreement for Mississippi Silvertip Development, LLC (Silvertip), to remediate the abandoned Vicksburg Chemical site. The developer, Silvertip, intends to create a Mississippi Bluffs Industrial Park to foster the sustainable reuse of the former chemical plant site and adjacent areas. It is anticipated that mixed use (i.e., light industrial, commercial, recreational, and residential) will be possible at the completion of the remedial action.

Harcros Chemicals, Inc., is currently leasing portions of the former North Plant to facilitate a chemical blending, mixing, and distribution facility. Concurrently, ARCADIS U.S., Inc. (ARCADIS), is performing the remediation services with MDEQ oversight and control. Silvertip plans to construct high-end commercial and residential sites and a championship golf course on a majority of the remaining acreage.

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1.4.2 Summary of Previous Investigation Activities

Previous investigation activities summarized below were conducted during the RFI process. The SWMUs and sampling locations discussed are shown in Appendix A.

High arsenic concentrations were detected during the RFI at SWMUs 1 (Container Drum Storage Area), 5 (South Plant Drainage System), 11 (Former Methyl SMA Production Area), 12 (Former MSMA Salt Unloading Area), 15 (Former Methyl Parathion Production Area), 16 (Former Atrazine Production Area), and 17 (Returned Product Storage Area).

RFI sampling for SWMUs 1, 16, and 17 was conducted in 1997. Concrete, shallow (0-1 foot below land surface [ft bls]), and deep (1-2 ft bls) samples were collected from each sample location. The samples were analyzed for arsenic, atrazine, benzene, cyanazine, dinoseb, dioxin, ethylbenzene, toluene, USEPA's target analyte list (TAL), USEPA's target compound list (TCL), toxaphene, toluene, xylene, and total petroleum hydrocarbons. The contaminant concentrations reported in the RFI were compared to February 2002 MDEQ target remediation goals (TRGs). The concentrations that exceed the TRGs are shown in Table 1.

The South Plant Drainage System transferred storm water and process water to the surface impoundment. Samples were collected from the 6-inch interval below the depth of the buried drainage pipes. The pipes were buried from 3 ft bls to 10 ft bls. These samples were analyzed for arsenic, atrazine, cyanazine, dinoseb, and toxaphene. The contaminant concentrations reported in the RFI were compared to February 2002 MDEQ TRGs. The concentrations that exceed the TRGs are shown in Table 1.

SWMUs 11, 12, and 15 were evaluated together during RFI activities. Concrete, asphalt, and soil samples were collected from land surface to a maximum depth of 12 ft bls. Additionally, sump samples were collected in these areas. The samples were analyzed for arsenic, atrazine, cyanazine, dinoseb, dioxin, USEPA's TAL, and

USEPA's TCL. The contaminant concentrations reported in the RFI were compared to February 2002 MDEQ TRGs. The concentrations that exceed the TRGs are shown in Table 1.

SWMU 20 is described in the RFI as the "Railroad Area." It encompasses SWMU 7 (Former Dinoseb Production Area) and SWMU 14 (Former Toxaphene Production Area). SWMU 20 is a former railroad car loading/unloading station located at the eastern boundary of the previous manufacturing activities in the South Plant. Sixteen borings were advanced in this area. Each boring was sampled at two distinct intervals, 2 to 4 ft bls and 6 to 8 ft bls. The samples were analyzed for atrazine, cyanazine, dinoseb, toxaphene, and arsenic. Subsequent to the advancement of the initial 16 borings, composite samples were obtained from surface soil and soil piles located in this area. These soil samples were obtained from the 0 to 0.5 ft bls interval. The composite samples were analyzed for dinoseb and toxaphene. The contaminant concentrations reported in the RFI were compared to February 2002 MDEQ TRGs. The concentrations that exceed the TRGs are shown in Table 1.

The above listed SWMUs are a part of Areas 1 and 4 as defined in Section 2.1. Based on the results of the sampling conducted in SWMU 20, stabilization activities are proposed in this area. The focus of remediation in these areas will be in-place stabilization of high CoC concentrations to prevent leaching to and transport via groundwater.

The North Pond area, designated SWMU 23 in the RFI, is comprised of an unlined pond and the surrounding area located in the North Plant. This pond was used to neutralize acidic wastewater from the potassium nitrate production process. The neutralization was accomplished through the introduction of limestone into the pond water. Toxicity characteristic leaching procedure (TCLP) testing was performed on the pond sludge during November and December 1993. The TCLP analysis determined that the sludge was nonhazardous. A soil and groundwater investigation was conducted in this area to assess the extent of a potential contaminant plume. As a part of this investigation, samples were collected from the locations surrounding SWMU 23. In addition, some of the sample locations advanced as a part of the investigation of SWMU 22 were located in close enough proximity to SWMU 23 to provide useful data in the RFI evaluation. SWMU 23 is a part of Area 5 as defined in Section 2.1. The focus of remediation in this area will be to solidify the pond sludges for transport and consolidation at the on-site landfill (SWMU 2).

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1.5 Data Needs and Objectives

Additional site data are needed to evaluate which solidification/stabilization agent or combination of agents is appropriate to either chemically fixate elevated concentrations of hotspot CoC in soils or provide sufficient strength during sludge consolidation to support an engineered cap. Data collected as part of the RFI process have been used to identify the hotspot locations and are considered valid and usable. The objective of this sampling effort is to collect soil and sludge samples for the performance of a laboratory treatability study to ascertain this technology's potential as part of an effective overall remediation strategy for this site.

1.6 Work Plan Approach

The general Work Plan strategy was developed to obtain samples representative of present site conditions. Personnel will be deployed to the Vicksburg Chemical site to collect soil and sludge samples from locations representative of areas known to require remediation. Samples will be containerized and submitted to geotechnical and analytical laboratories. The geotechnical laboratory will perform the solidification/stabilization analyses outlined in this Work Plan. The analytical laboratory will perform the leachability analyses outlined in this Work Plan. A summary of the proposed analyses is presented on Table 2.

2. Methodology

2.1 Sample Locations

The sample locations for this solidification/stabilization study are shown on Figure 2. These sample locations were selected because they contain high concentrations of site CoC or sludge material, based on data presented in the RFI. The RFI indicated five main impacted areas. These areas were defined in the *Quality Assurance Project Plan* (QAPP; ARCADIS 2006a) developed for this site. Four distinct areas were defined in the South Plant and one in the North Plant. The areas which were designated include:

- Area 1 – South Plant –SWMUs 1, 5, 7, 8, 9, 11, 12, 14, 15, 16, and 17;
- Area 2 – South Plant – Portion of Southwest Corner SWMU 20;
- Area 3 – South Plant – SWMU 2;

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- Area 4 – South Plant – Part of SWMU 20 Bounded by MW-1, MW-13, and MW-14; and

- Area 5 – North Plant Pond – SWMU 23.

Treatability study activities are proposed in Areas 1, 4, and 5 as presented in the QAPP. Soil samples will be collected from locations within these areas based on the RFI analytical results and/or visual indications of CoC (i.e., yellow stained soils from dinoseb releases).

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2.1.1 Stabilization Samples

Table 1 shows CoC concentrations detected during the RFI that exceed February 2002 MDEQ Tier 1 TRGs for restricted soil use. A subset of Table 1 is shown below. Chemical concentrations of particular concern for stabilization purposes in this area were measured in the following soil samples:

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units
Soil Samples						
1, 16, 17	I-1-B	0-1	Toxaphene	31,700	5,200	µg/kg
5	5-4	3-10	Arsenic	39,200	11,800	µg/kg
5	5-11	3-10	Arsenic	30,800	11,800	µg/kg
5	5-13	3-10	Arsenic	174,000	11,800	µg/kg
5	5-14	3-10	Arsenic	39,000	11,800	µg/kg
11, 12, 15	E-1-D (S/D)	0-1	Arsenic	345,000	11,800	µg/kg
11, 12, 15	BB-1-D (S/D)	0-1	Arsenic	2,870,000	11,800	µg/kg
11, 12, 15	Q-1-D (S/D)	0-1	Arsenic	2,080,000	11,800	µg/kg
11, 12, 15	EE-1-D (S/D)	0-1	Arsenic	456,000	11,800	µg/kg
11, 12, 15	V-1-D (S/D)	0-1	Arsenic	2,770,000	11,800	µg/kg
11, 12, 15	W-1-D (S/D)	0-1	Arsenic	145,000	11,800	µg/kg
11, 12, 15	C-1-G	0-1	Arsenic	216,000	11,800	µg/kg
11, 12, 15	C-2-G	1-2	Arsenic	501,000	11,800	µg/kg
11, 12, 15	D-2-G	1-2	Arsenic	309,000	11,800	µg/kg
11, 12, 15	I-4-G	4-6	Arsenic	241,000	11,800	µg/kg
11, 12, 15	J-2-G	1-2	Arsenic	205,000	11,800	µg/kg
11, 12, 15	K-6-G	8-10	Arsenic	55,100	11,800	µg/kg
11, 12, 15	O-1-G	0-1	Arsenic	254,000	11,800	µg/kg
11, 12, 15	Z-1-G	0-1	Arsenic	323,000	11,800	µg/kg

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration(1)	MDEQ Tier 1 TRG (Restricted)	Units
Composite Surface Samples (2 to 8 grab samples composited from each quartile of each section)						
20	20-C	0-0.5	Dinoseb	355,541	204,000	µg/kg
20	20-F	0-0.5	Dinoseb	1,078,068	204,000	µg/kg
20	20-I	0-0.5	Toxaphene	110,964	5,200	µg/kg

(1) Analytical data obtained from RFI process.
CoC Chemical of concern.
MDEQ Mississippi Department of Environmental Quality.
S/D Sump/drainage sample.
Tier 1 TRG (Restricted) MDEQ Tier 1 Target Remediation Goal for restricted soil use.
µg/kg Micrograms per kilogram.

These locations are of particular concern due to the magnitude of the exceedance of MDEQ Tier 1 TRGs.

2.1.2 Solidification Samples

Presently anticipated remediation in the North Plant Pond area will require the removal and transport of the pond sludges to the on-site landfill area (SWMU 2) for consolidation. Prior to transport, the volume of sludge in the pond must be determined. Additionally, an evaluation of the transportability of the pond sludges using conventional construction equipment is needed. The collection and analysis of the solidification samples will aid in the determination of the most efficient and cost-effective path forward for remediation in this area.

2.2 Sample Collection Procedures

Some of the tasks that will be conducted during sampling activities have been outlined in detail in the QAPP. The pertinent sections are listed below and incorporated by reference. A summary of sample methods, containers, preservatives, and hold times for the analyses discussed below is included as Table 3.

2.2.1 Sampling Equipment and Procedures

Soil and sludge samples will be collected for geotechnical and Synthetic Precipitate Leaching Procedure (SPLP) analyses. Sampling equipment for the surficial samples

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will consist of a hand auger, shovel, or trowel. The proper use of a hand auger in the collection of samples representative of site conditions is detailed in Section 11.3 (Soil Sampling – Hand Auger) in the QAPP. Decontamination procedures for the shovel and trowel equipment shall be the same procedures used for the hand auger as described in Section 10.3 of the QAPP. The proposed surficial soil sampling locations are shown on Figure 2.

The method used to collect sludge samples will depend on the amount of water in Area 5 at the time of sampling. In the event that water is present in the pond, sampling personnel will enter the pond in a boat to collect samples. If water is not present in the pond, sludge samples will be collected either from the shore or by using plywood mats to enter at the edge of the pond. Sludge samples will be collected using lengths of a hollow sampling device. All coring equipment shall be new and unused, or decontaminated prior to sample collection. The coring equipment will be inserted to the bottom of the pond and retrieved to the surface. For either case, sampling personnel will wear life preservers while conducting sludge sampling. Additionally, for safety reasons there will be more than one person on site during sludge sampling. Safety precautions to protect workers during sludge sampling will be appended to the *Health and Safety Plan* (ARCADIS 2006b). The proposed sludge sampling locations are shown on Figure 2.

The samples collected for analytical testing will be containerized immediately and placed into an ice chest with wet ice. Samples collected for geotechnical analysis will be placed into 5-gallon plastic buckets and covered with a self-sealing lid. The geotechnical samples will remain at ambient temperature until relinquished to the laboratory.

2.2.2 Sample Handling and Analysis

Sample handling and analysis were discussed in detail in Chapters 10 and 11 of the QAPP. These procedures will be followed during the implementation of this Work Plan. Table 6 (Summary of Methods, Containers, Preservatives, and Holding Times) of the QAPP contains information relative to specific analyses. This table was revised to include only the analytical SPLP analyses discussed in Section 2.4 and additional information required for the Unconfined Compressive Strength of Cohesive Soil (UCS) analyses (ASTM D2166). The revised table is included as Table 2 of this Work Plan.

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2.2.3 Quality Assurance/Quality Control Samples (QA/QC)

QA/QC samples consisting of trip blanks, field blanks, and field duplicates will be collected as a part of the SPLP analyses because the sample results will be used for design purposes. In addition, control samples will be collected prior to the addition of solidification/stabilization amendments. The results of the control samples will be used to determine the effectiveness of the solidification/stabilization program. In the event that the soil amendments tested do not impart the desired characteristics to the soil and sludge samples, additional reagents and methodologies will be considered.

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2.3 Solidification/Stabilization Amendments

Various reagents can be used to achieve the desired solidification/stabilization of the on-site materials. A literature review indicated that the constituents present in the subsurface at Vicksburg Chemical are amenable to solidification/stabilization processes. Due to the varied contaminant combinations found in the subsurface (i.e., organics, pesticides, herbicides, metals), more than one amendment may be required to achieve solidification/stabilization of the multiple compounds present. The goal of solidification/stabilization study is to determine an acceptable amendment mixture for implementation in the field.

Portland cement, fly ash, and lime are commonly used amendments and will be included in the solidification/stabilization study. These reagents are successful in solidification/stabilization for a wide range of constituents due to their effectiveness, ease of use, ability to scale up from laboratory efforts to field operations, and cost. However, additional amendments and/or combinations may be required. While guided by information obtained during the literature review and through the laboratory's experience, the actual volumetric ratios of soil sample to reagents will be determined during laboratory mixing based on the behavior exhibited by each material during the mixing process.

The solidification study will be conducted as follows:

- Samples collected for the solidification study will be containerized as described in Section 2.2 and submitted to a geotechnical laboratory for analysis;
- Two control samples will be containerized in UCS molds. The molded material will be obtained from the sludge composite samples. The two control sample locations

will be chosen at random and strength tested by ASTM Method D2166. These samples will be labeled "Solidification Control 1" and "Solidification Control 2";

- Reagents will be added to the remaining sludge collected from each sample location. Four UCS molds will be filled from each resultant mixture. Each UCS mold will be labeled with the sample location and the percentage of reagents added by weight followed by "3 days", "7 days", "14 days", or "28 days"; and

- The UCS molds labeled "3 days", "7 days", "14 days", and "28 days" will be analyzed by ASTM Method D2166 (Unconfined Compressive Strength of Cohesive Soil), USEPA SW-846 Method 8260 (volatile organic compounds), USEPA SW-846 Method 8151 (herbicides), and/or USEPA SW-846 Method 6020 (metals) at the time interval indicated on the sample label. The results of the testing will be reported to ARCADIS.

The stabilization study will be conducted as follows:

- Samples collected for the stabilization study will be containerized as described in Section 2.2 and submitted to a geotechnical laboratory for analysis;

- Two control samples will be molded from the soil samples collected in the field. One of the control sample locations will be randomly selected from Area 1 and the other will be randomly selected from Area 4. The control samples will be labeled "Stabilization Control 1" and "Stabilization Control 4" according to where the sample was collected. The two control samples will be strength tested by ASTM Method D2166;

- Reagents will be added to the remaining soil collected from each sample location. Four UCS molds will be filled from each resultant mixture. Each UCS mold will be labeled with the sample location and the percentage of reagents added by weight followed by "3 days", "7 days", "14 days", or "28 days";

- The UCS molds labeled "3 days", "7 days", "14 days", and "28 days" will be analyzed by ASTM Method D2166 at the time interval indicated on the sample label. The results of the compressive strength testing will be reported to ARCADIS;

- After the samples are tested by ASTM Method D2166, the remains of each mold will be segregated and containerized;

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- The segregated remains of each mold will be submitted to an analytical laboratory for SPLP sampling. Each sample will be labeled with the sample location followed by "SPLP (3 days)", "SPLP (7 days)", "SPLP (14 days)", or "SPLP (28 days)" depending on the time interval in which the UCS sample was analyzed; and

- The samples will be containerized and shipped to an analytical laboratory under proper chain-of-custody procedures. The samples will be analyzed by the SPLP method for the CoC listed in Table 2. The results of the SPLP testing will be reported to ARCADIS.

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2.4 Laboratory Testing

The sample collected during the implementation of this Work Plan will be containerized and submitted to an analytical laboratory and a geotechnical laboratory for analyses. Table 2 contains a summary of the required analyses. The results of the testing procedures discussed below will be utilized in the development of the final remedy for known CoC concentrations in excess of MDEQ Tier 1 TRGs. All investigative sampling proposed in this Work Plan will be conducted in accordance with MDEQ's Brownfields program.

2.4.1 Unconfined Compressive Strength of Cohesive Soil Analyses

A control sample consisting of site material without amendments and material samples from the treatability study will be submitted to a laboratory for UCS analyses (ASTM D2166) as a part of the treatability study. The samples will be collected in containers that meet laboratory requirements for this analysis. Proper chain-of-custody procedures will be followed during the transport and relinquishment of sample volumes. Each sample will be described in the field upon collection. The observed characteristics will be documented on a Soil/Sediment Sampling Log or Sample/Core Log (Appendix B) completed by sampling personnel.

The remaining sample volumes will be used to conduct a solidification/stabilization study on the material. The solidification/stabilization study will be conducted by mixing various combinations of Portland cement, fly ash, lime, and other reagents with the site samples. The mixtures will be molded into sample cores. The resultant sample cores will be subjected to compressive strength testing to determine strength characteristics of the mixture. In order for the solidified material to support an engineered cap, the solidified material must have an unconfined compressive strength of 8 pounds per

square inch after 3 days. The material remaining after compressive strength testing will be packaged and submitted to an analytical laboratory for leachability analyses.

2.4.2 Leachabilty Analyses

SPLP analyses will be conducted on the control and test samples provided by SW-846 Method 1312. The SPLP analyses will provide a measure of the potential for CoC bound in the solidified/stabilized material to leach into the soil. SPLP analyses will be conducted on the material samples at four intervals: 3 days, 7 days, 14 days, and 28 days. SPLP results will be compared to quantitative risk-based remediation goals developed in accordance with guidance provided in Chapter 6 of the *Final Brownfield Regulations, Subpart H*, February 28, 2002. Fate and transport modeling will be used to determine acceptable groundwater concentrations in the stabilized areas. The results of SPLP testing will give an indication of the long-term stabilization of CoC in the resultant solidified matrix.

The SPLP samples will be collected in containers that meet laboratory requirements for this analysis. Proper chain-of-custody procedures will be followed during the transport and relinquishment of sample volumes.

2.5 Survey

The locations of the samples collected during this evaluation will be marked. A topographic survey of the sample locations will be conducted. The survey will include the collection of location and elevation data. All surveying activities will be conducted by a surveyor licensed by the State of Mississippi.

2.6 Investigation Derived Wastes

Waste materials generated during this investigation and corrective action will include soil, sludge, used sampling equipment, decontamination water, and used personal protective equipment. Waste materials will be containerized in 55-gallon drums or similar appropriate containers or will be placed back into the North Pond. The drums will be staged in a secure location and will be incorporated into the remediation to be conducted at the site. Waste characterization and on-site disposal will be completed in accordance with MDEQ-approved methodology specific to this site.

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2.7 Regulatory Involvement

All site activities will be conducted after receiving approval from MDEQ of this Solidification/Stabilization Treatability Study Work Plan. MDEQ will have oversight on all aspects of remediation activities conducted at this site as per the Agreed Order. Future sampling frequencies, parameter lists, methodology, etc., will be approved by MDEQ prior to field implementation.

3. Reporting

Following the completion of all field activities, the results of the Stabilization/ Solidification Treatability Study activities will be included in the Solidification/ Stabilization Study report that will be prepared for submittal to MDEQ. The report will document all field activities and present an interpretation of surface and subsurface conditions. Appropriate historical and new data tables, figures, and appendices will be included in the report to support the text. The report will conclude by presenting recommendations for a path forward to obtain site closure.

4. Schedule

The sampling program will be initiated within 3 weeks of receiving written authorization to proceed from MDEQ. It is anticipated that the planned field activities can be completed within 2 to 3 weeks. Analytical data should be received within 6 weeks of completing the Solidification/Stabilization Treatability Study. A report will be prepared and submitted to MDEQ within 8 weeks of receipt of the analytical results. If field activities are delayed or if additional field activities are required to completely define the nature and extent of subsurface impacts, MDEQ will be promptly notified.

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Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Solification/Stabilization Treatability Study Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Soil Samples							
1, 16, 17	D-1-B	0-1	Arsenic	12,500	11,800	µg/kg	Yes
1, 16, 17	I-1-B	0-1	Toxaphene	31,700	5,200	µg/kg	Yes
1, 16, 17	I-1-B	0-1	Arsenic	27,000	11,800	µg/kg	Yes
1, 16, 17	L-1-A	0-1	Arsenic	14,500	11,800	µg/kg	Yes
1, 16, 17	2-C-C	Concrete	Arsenic	36,000	11,800	µg/kg	Yes
1, 16, 17	11-C-C	Concrete	Atrazine	52,800	25,800	µg/kg	Yes
1, 16, 17	12-2-A	1-2	Arsenic	13,300	11,800	µg/kg	Yes
1, 16, 17	15-2-A	1-2	Arsenic	12,900	11,800	µg/kg	Yes
1, 16, 17	16-C-A	Concrete	Arsenic	13,700	11,800	µg/kg	Yes
1, 16, 17	18-C-A	Concrete	Arsenic	27,000	11,800	µg/kg	Yes
1, 16, 17	19-C-A	Concrete	Arsenic	18,800	11,800	µg/kg	Yes
4	4-4	0.5-1	Arsenic	15,700	11,800	µg/kg	Yes
5	5-4	3-10	Arsenic	39,200	11,800	µg/kg	Yes
5	5-11	3-10	Arsenic	30,800	11,800	µg/kg	Yes
5	5-13	3-10	Arsenic	174,000	11,800	µg/kg	Yes
5	5-14	3-10	Arsenic	39,000	11,800	µg/kg	Yes
9	8S	0.5-1	Arsenic	61,000	11,800	µg/kg	Yes
9	8D	1.5-2	Arsenic	60,000	11,800	µg/kg	Yes
9	A-1 Result		Benzo(a)pyrene	1,160	784	µg/kg	Yes
11, 12, 15	B-1-D (Sump/Drainage)	0-1	Arsenic	39,400	11,800	µg/kg	Yes
11, 12, 15	E-1-D (Sump/Drainage)	0-1	Arsenic	345,000	11,800	µg/kg	Yes
11, 12, 15	BB-1-D (Sump/Drainage)	0-1	Arsenic	2,870,000	11,800	µg/kg	Yes
11, 12, 15	Q-1-D (Sump/Drainage)	0-1	Arsenic	2,080,000	11,800	µg/kg	Yes
11, 12, 15	EE-1-D (Sump/Drainage)	0-1	Arsenic	456,000	11,800	µg/kg	Yes
11, 12, 15	EE-1-D (Sump/Drainage)	0-1	PCDD/PCDF (Dioxin)	0.344	0.0763	µg/kg	Yes
11, 12, 15	V-1-D (Sump/Drainage)	0-1	Arsenic	2,770,000	11,800	µg/kg	Yes
11, 12, 15	W-1-D (Sump/Drainage)	0-1	Arsenic	145,000	11,800	µg/kg	Yes
11, 12, 15	Y-1-D (Sump/Drainage)	0-1	Arsenic	60,200	11,800	µg/kg	Yes
11, 12, 15	M-1-D (Sump/Drainage)	0-1	Arsenic	35,600	11,800	µg/kg	Yes
11, 12, 15	1-C-D	Concrete	Arsenic	18,400	11,800	µg/kg	Yes
11, 12, 15	5-C-D	Concrete	Arsenic	70,600	11,800	µg/kg	Yes
11, 12, 15	6-1-D	0-1	Arsenic	24,900	11,800	µg/kg	Yes
11, 12, 15	6-2-D	1-2	Arsenic	14,100	11,800	µg/kg	Yes

Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Solifification/Stabilization Treatability Study Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Soil Samples (continued)							
11, 12, 15	C-1-G	0-1	Arsenic	216,000	11,800	µg/kg	Yes
11, 12, 15	C-2-G	1-2	Arsenic	501,000	11,800	µg/kg	Yes
11, 12, 15	C-3-G	2-4	Arsenic	76,000	11,800	µg/kg	Yes
11, 12, 15	C-4-G	4-6	Arsenic	109,000	11,800	µg/kg	Yes
11, 12, 15	C-5-G	6-8	Arsenic	114,000	11,800	µg/kg	Yes
11, 12, 15	D-1-G	0-1	Arsenic	48,800	11,800	µg/kg	Yes
11, 12, 15	D-2-G	1-2	Arsenic	309,000	11,800	µg/kg	Yes
11, 12, 15	D-4-G	4-6	Arsenic	27,600	11,800	µg/kg	Yes
11, 12, 15	D-5-G	6-8	Arsenic	14,700	11,800	µg/kg	Yes
11, 12, 15	H-1-G	0-1	Arsenic	22,300	11,800	µg/kg	Yes
11, 12, 15	I-1-G	0-1	Arsenic	72,800	11,800	µg/kg	Yes
11, 12, 15	I-2-G	1-2	Arsenic	57,500	11,800	µg/kg	Yes
11, 12, 15	I-3-G	2-4	Arsenic	185,000	11,800	µg/kg	Yes
11, 12, 15	I-4-G	4-6	Arsenic	241,000	11,800	µg/kg	Yes
11, 12, 15	I-5-G	6-8	Arsenic	138,000	11,800	µg/kg	Yes
11, 12, 15	J-1-G	0-1	Arsenic	101,000	11,800	µg/kg	Yes
11, 12, 15	J-2-G	1-2	Arsenic	205,000	11,800	µg/kg	Yes
11, 12, 15	K-1-G	0-1	Arsenic	38,800	11,800	µg/kg	Yes
11, 12, 15	K-2-G	1-2	Arsenic	31,500	11,800	µg/kg	Yes
11, 12, 15	K-3-G	2-4	Arsenic	14,600	11,800	µg/kg	Yes
11, 12, 15	K-4-G	4-6	Arsenic	46,000	11,800	µg/kg	Yes
11, 12, 15	K-6-G	8-10	Arsenic	55,100	11,800	µg/kg	Yes
11, 12, 15	L-1-G	0-1	Arsenic	132,000	11,800	µg/kg	Yes
11, 12, 15	L-2-G	1-2	Arsenic	80,600	11,800	µg/kg	Yes
11, 12, 15	O-1-G	0-1	Arsenic	254,000	11,800	µg/kg	Yes
11, 12, 15	O-2-G	1-2	Arsenic	41,400	11,800	µg/kg	Yes
11, 12, 15	T-2-G	1-2	Arsenic	14,400	11,800	µg/kg	Yes
11, 12, 15	X-1-G	0-1	Arsenic	64,400	11,800	µg/kg	Yes
11, 12, 15	X-2-G	1-2	Arsenic	63,300	11,800	µg/kg	Yes
11, 12, 15	Z-1-G	0-1	Arsenic	323,000	11,800	µg/kg	Yes
11, 12, 15	Z-2-G	1-2	Arsenic	51,200	11,800	µg/kg	Yes
11, 12, 15	Z-3-G	2-4	Arsenic	22,300	11,800	µg/kg	Yes
11, 12, 15	DD-1-G	0-1	Arsenic	24,300	11,800	µg/kg	Yes
11, 12, 15	DD-2-G	1-2	Arsenic	59,600	11,800	µg/kg	Yes
11, 12, 15	ZZ-1-G	0-1	Arsenic	11,900	11,800	µg/kg	Yes
11, 12, 15	ZZ-2-G	1-2	Arsenic	18,100	11,800	µg/kg	Yes
11, 12, 15	7-C-G	Concrete	Arsenic	68,200	11,800	µg/kg	Yes
18	18-1	0.5-1	Arsenic	17,500	11,800	µg/kg	Yes
18	18-3	0.5-1	Arsenic	12,800	11,800	µg/kg	Yes
20	20-21C		Chloroform	2,186	478	µg/kg	Yes
23	22-B		Chloroform	830	478	µg/kg	Yes
30	30-1	0.5-1	TPH (conservative)	4,433,000	300,000	µg/kg	Yes
30	30-2	0.5-1	TPH (conservative)	699,000	300,000	µg/kg	Yes
30	30-3	0.5-1	TPH (conservative)	15,431,000	300,000	µg/kg	Yes

Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Solidification/Stabilization Treatability Study Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Composite Surface Samples (2 to 8 grab samples from each quartile of each section composited)							
20	20-A	0-0.5	Toxaphene	8,240	5,200	µg/kg	Yes
20	20-B	0-0.5	Toxaphene	18,989	5,200	µg/kg	Yes
20	20-C	0-0.5	Dinoseb	355,541	204,000	µg/kg	Yes
20	20-C	0-0.5	Toxaphene	8,401	5,200	µg/kg	Yes
20	20-D	0-0.5	Toxaphene	14,200	5,200	µg/kg	Yes
20	20-F	0-0.5	Dinoseb	1,078,068	204,000	µg/kg	Yes
20	20-F	0-0.5	Toxaphene	10,318	5,200	µg/kg	Yes
20	20-G	0-0.5	Toxaphene	22,981	5,200	µg/kg	Yes
20	20-H	0-0.5	Toxaphene	19,052	5,200	µg/kg	Yes
20	20-I	0-0.5	Toxaphene	110,964	5,200	µg/kg	Yes
20	20-J	0-0.5	Toxaphene	41,652	5,200	µg/kg	Yes
20	20-K	0-0.5	Toxaphene	6,098	5,200	µg/kg	Yes
20	20-N	0-0.5	Toxaphene	9,263	5,200	µg/kg	Yes
20	20-O	0-0.5	Toxaphene	6,727	5,200	µg/kg	Yes
20	20-T	0-0.5	Arsenic	12,100	11,800	µg/kg	Yes
20	20-T	0-0.5	Toxaphene	7,617	5,200	µg/kg	Yes
Composite Soil Pile Samples (8 grab samples composited)							
20	20-BB	0-0.5	Toxaphene	37,036	5,200	µg/kg	Yes
20	20-CC	0-0.5	Toxaphene	6,852	5,200	µg/kg	Yes
20	20-DD	0-0.5	Toxaphene	14,691	5,200	µg/kg	Yes
20	20-EE	0-0.5	Toxaphene	16,815	5,200	µg/kg	Yes
20	20-FF	0-0.5	Toxaphene	76,683	5,200	µg/kg	Yes
20	20-II	0-0.5	Toxaphene	17,413	5,200	µg/kg	Yes
20	20-LL	0-0.5	Toxaphene	14,673	5,200	µg/kg	Yes
20	20-MM	0-0.5	Toxaphene	11,152	5,200	µg/kg	Yes

(1) Analytical data obtained from RFI process.
MDEQ Mississippi Department of Environmental Quality.
SWMU Solid Waste Management Unit.
Tier 1 TRG (Restricted) MDEQ Tier 1 TRG for the restricted use of soil.
TPH Total Petroleum Hydrocarbon.
TRG Target Remediation Goal.
µg/kg Micrograms per Kilogram.

Table 2. Summary of Required Analyses, Solidificaton/Stabilization Treatability Study Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Area	Material	Number of Sample Locations [1]	Unconfined Compressive Strength Samples (ASTM D2166)	SPLP Samples (Method 1312)[2][3]
1	Surficial Soil	15	2 Controls + 15 Samples (3 days) 15 Samples (7 days) 15 Samples (14 days) 15 Samples (28 days)	1 Control + 15 Samples 15 Samples 15 Samples 15 Samples
4	Surficial Soil	6	1 Control + 6 Samples (3 days) 6 Samples (7 days) 6 Samples (14 days) 6 Samples (28 days)	1 Control + 6 Samples 6 Samples 6 Samples 6 Samples
5	Sludge	6	1 Control + 6 Samples (3 days) 6 Samples (7 days) 6 Samples (14 days) 6 Samples (28 days)	Not Analyzed Not Analyzed Not Analyzed Not Analyzed

(1) Sample locations shown on Figure 2.
(2) Samples obtained from sample remaining after UCS break, except the control sample. Control sample to be submitted for analyses upon collection.
(3) Analyzed for SPLP-Arsenic, SPLP-Chloroform, SPLP-Dinoseb, and SPLP-Toxaphene.

SPLP Synthetic Precipitation Leaching Procedure

Table 3. Summary of Methods, Containers, Preservatives, and Holding Times, Solidification/Stabilization Treatability Study Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

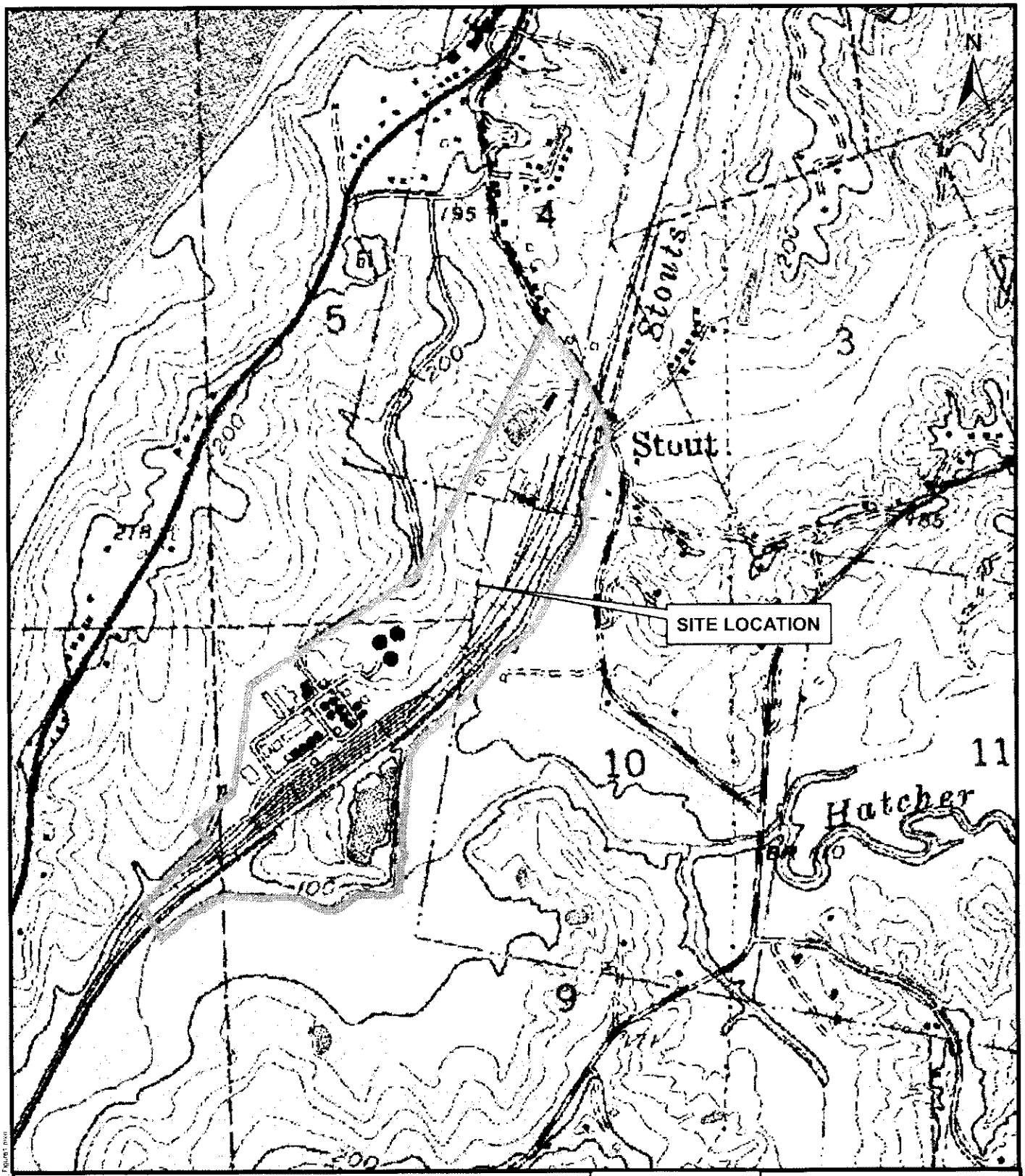
Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
Analytical Parameters						
VOCs	Water	5030, 5032	8260/624	3 x 40-mL vial with Teflon lined septum	pH < 2 with HCl, Cool 4°C	14 days
	Water	5030, 5032	8260/624	3 x 40-mL vial with Teflon lined septum	If effervescence is observed, eliminate HCl preservative and Cool 4°C	7 days
	Solid	5035	8260	3 x Encore™ OR 2 x Sodium Bisulfate vial	Cool 4°C	48 hours to preservation for Encore™, then 14 days to analysis
SPLP	Solid	1312 to Generate Leachate	Above Methods for Determination of CoCs in Leachate	1 x 4-oz G packed full for VOCs and 1 x 8-oz wide-mouth G for other parameters	Cool 4°C	14 days from collection to Leach
Geotechnical Parameters						
UCS	Solid	Not Applicable	ASTM D2166	2 x 5-gallon plastic bucket	None	None

(a) The 8000 series methods will be used for assessment and remediation; the 600 series methods will be used only for wastewater or storm water analyses performed in accordance with discharge permits.

(b) Sample volumes may be combined for MNA parameters where preservatives are the same and adequate sample volume is supplied to the laboratory. Volumes listed are based on sample containers and not minimum volumes required for some of the General Chemistry Parameters listed under the MNA heading only. All other volumes are minimum volumes required to be submitted to the laboratory.

(c) Maximum holding time allowed from date of collection.

ASTM American Society for Testing and Materials.
°C Degrees Centigrade.
CoC Chemical of Concern.
G Glass.
GPC Gel Permeation Chromatography.
HCl Hydrochloric Acid.
HDPE High Density Polyethylene.
mL Milliliter.
MNA Monitored Natural Attenuation.
oz Ounce.
SPLP Synthetic Precipitation Leaching Procedure.
UCS Unconfined Compressive Strength of Cohesive Soils.
VOCs Volatile Organic Compounds.
< Less than.



Former Plant Site

Note: Approximate Property Boundary

ARCADIS
10352 Plaza Americana Drive
Baton Rouge, Louisiana 70816
Tel: 225.292.1004 Fax: 225.218.9677

SITE LOCATION MAP

VICKSBURG CHEMICAL COMPANY

VICKSBURG, MISSISSIPPI

Site Location

500 0 500 1,000 Feet

Project Manager: JE	Completed By: AB
Task Manager: CD	Date: 07/31/2006
Project No.: LA002656.0001	Figure No.: 1

REFERENCE:

USGS, Vicksburg West Quadrangle, Mississippi
7.5 Minute Series (Topographic)

U:\projects\Vicksburg\LA002656.0001.00002\maps\mxd\Vicksburg_SiteMap_Figure1.mxd

U:\projects\Vicksburg\LA002656.0001.00002\maps\mxd\Vicksburg_SiteMap.pdf

User Name : smen Path\Name : G:\APROJECT\Mississippi Bluffs\LA002656.0001\Figures\2456-01-02c.dwg

LEGEND

- PROPOSED SURFICIAL SOIL SAMPLING LOCATION (AREA 1 AND 4)
- PROPOSED SLUDGE SAMPLING LOCATION (AREA 5)
- ARSENIC AND TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES
- SOIL/SLUDGE CONTAINING VOCs
- ARSENIC CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES
- CONCENTRATION OF CONTAMINATION EXCEEDS VALUES IN MDEQ TIER 1 TRG TABLE
- TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES
- DINOSEB AND TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

AREA 1 – SWMU 1, 5, 7, 8, 9, 11, 12, 14, 15, 16, AND 17
AREA 2 – SWMU 20 (SW CORNER)
AREA 3 – SWMU 2
AREA 4 – SWMU 20 (AREA BOUNDED BY MW-13, MW-14, AND MW-1)
PROPOSED SOIL SAMPLE LOCATION
AREA 5 – SWMU 23

0 200' 400' 800'

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DRAWN BY	CHECKED
D. EKINIA	CAD
PROJECT MANAGER	DEPARTMENT MANAGER
DRE	DRE
DATE	TASK/PHASE NUMBER
11-6-06	0008

ARCADIS
10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
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WWW.ARCADIS-US.COM

PROPOSED SOLIDIFICATION/STABILIZATION SAMPLING LOCATIONS

FORMER VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER
LA002656.0001

DRAWING NUMBER
2

ARCADIS

Appendix A

RCRA Facility Investigation Soil and Groundwater Sample Locations

VICKSBURG CHEMICAL COMPANY
VICKSBURG, MISSISSIPPI

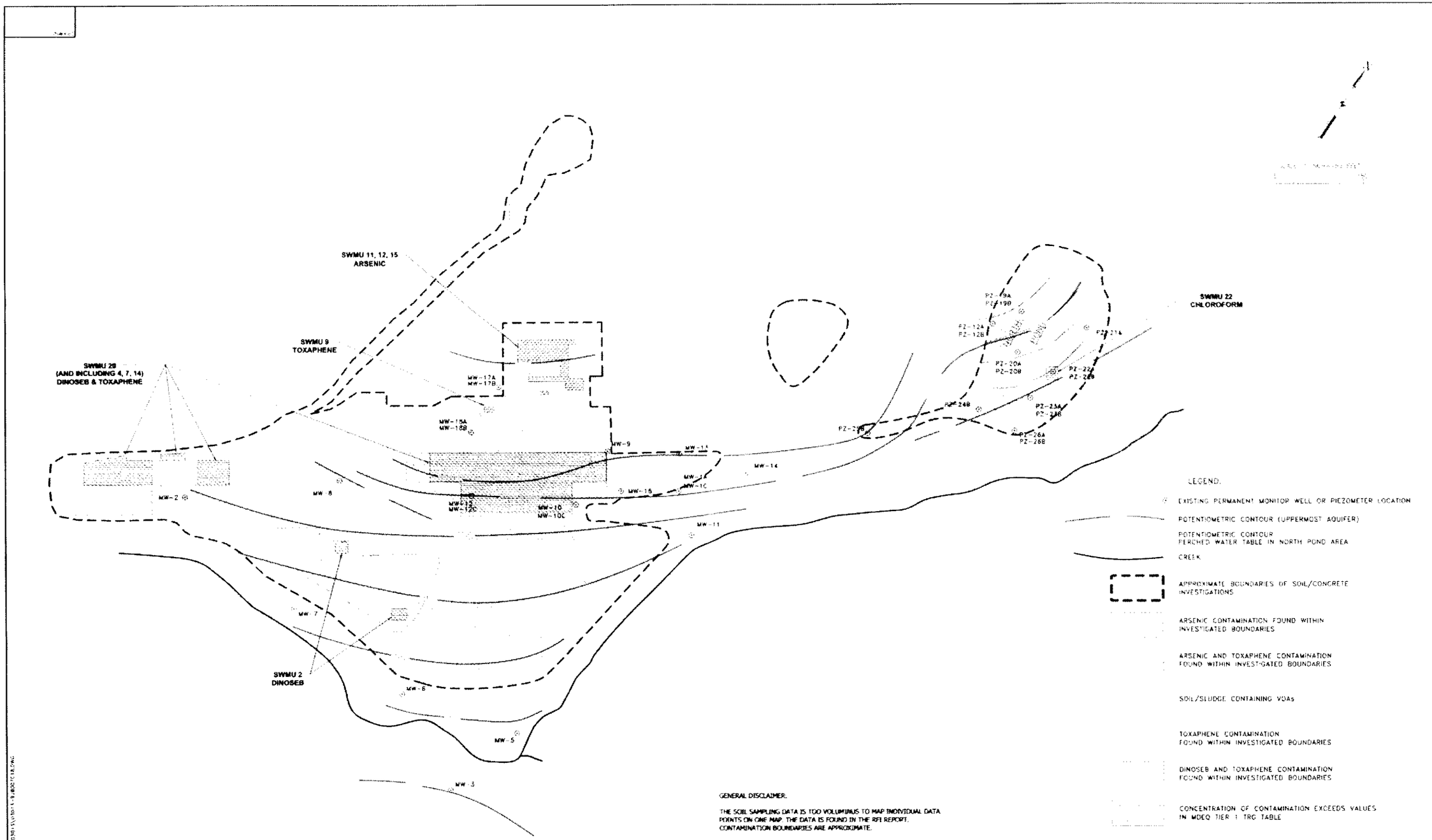
URS
2822 O'Neal Lane
Baton Rouge, Louisiana 70816
225/751-1873

REFERENCE DRAWINGS

RCRA FACILITY INVESTIGATION
CMS EXECUTED

SWMU LOCATIONS, BET SOIL AND CONCRETE
SAMPLE POINTS, GWA MONITOR WELL LOCATIONS

DRAWING NO.
1



GENERAL DISCLAIMER:

THE SOIL SAMPLING DATA IS TOO VOLUMINOUS TO MAP INDIVIDUAL DATA POINTS ON ONE MAP. THE DATA IS FOUND IN THE RFI REPORT. CONTAMINATION BOUNDARIES ARE APPROXIMATE.

VICKSBURG CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

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

REFERENCE DRAWINGS

GROUNDWATER ASSESSMENT

SITE WIDE SOIL CONTAMINATION WITH AREAS OF CONTAMINATION GREATER THAN MDEQ TIER 1 TRG TABLE VALUES FOR RESTRICTED USE SHOWN

35092B007C

4-6

Appendix B

Field Forms

ARCADIS

SOIL / SEDIMENT SAMPLING LOG

PROJECT NAME: _____

PROJECT NUMBER: _____ Date: _____

SITE LOCATION: _____ CODED/

SAMPLE ID NUMBER: _____ REPLICATE NO: _____

TIME SAMPLING BEGAN: _____ ENDED: _____

WEATHER: _____

SITE DESCRIPTION: _____

SAMPLING DATA

COLLECTION METHOD: _____

DEPTH (ft): _____ MOISTURE CONTENT: _____

COLOR: _____ ODOR: _____

DESCRIPTION: _____

ANALYSES REQUIRED	*CONTAINER DESCRIPTION*
	From Lab: X or GM

SAMPLING MONITORING (TIP, OVA, HNU, etc.) _____

REMARKS: _____

SAMPLING PERSONNEL: _____

ARCADIS G & M, Inc.
10352 Plaza Americana Drive
Baton Rouge, LA 70816

SAMPLE / CORE LOG

Boring/Well: _____ Project No.: _____

Site Location: _____ Drilling Started: _____ Drilling Completed: _____

Land-Surface Elev.: _____ Surveyed: ____ Estimated: ____ Datum: _____

Drilling Fluid: _____ Drilling Method Used: _____

Drilling Contractor: _____ Driller: _____ Helper: _____

Prepared By: _____ Hammer Weight: _____ Hammer Drop (inches): _____

Fill | Silty Clay | Silt | Sandy Silt | Silty Sand | Acetate Sleeve | Water First Encountered

Clay | Sandy Clay | Clayey Silt | Sand | Clayey Sand | Split Spoon | Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	OVA (wo/F)(w/F) (ppm) (ppm)	REMARKS
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

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Infrastructure, environment, facilities

Imagine the result

Mississippi Department of Environmental Quality

and

MISSISSIPPI BLUFFS INDUSTRIAL PARK, LLC

Site Baseline Sampling Work Plan

Former Vicksburg Chemical Company
Vicksburg, Mississippi

10 January 2007

ARCADIS

Craig A. Derouen, P.E.
Project Engineer

David R. Escudé, P.E.
Associate Vice President/Principal Engineer

Rudy J. Guichard
Vice President/Area Manager

Site Baseline Sampling Work Plan

Former Vicksburg Chemical Company
Vicksburg, Mississippi

Prepared for:
Mississippi Department of Environmental Quality and Mississippi Bluffs Industrial Park, LLC

Prepared by:
ARCADIS U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677

Our Ref.:
LA002656.0001.00007

Date:
10 January 2007

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FINAL

1. Introduction and Work Plan Rationale

1.1 Objectives/Rationale

This Work Plan presents a scope of work for performing sampling activities at the former Vicksburg Chemical Company (Vicksburg Chemical). The site was formerly a pesticide and herbicide manufacturing facility divided into two areas called the North Plant and South Plant. The primary objective of the activities proposed in this document will be to collect and evaluate soil, groundwater, and storm water data in accordance with the Mississippi Department of Environmental Quality (MDEQ) Brownfields program. Soil, groundwater, and storm water data will be acquired to further define present site conditions and to determine the regulatory and remediation paths forward.

All investigative sampling proposed in this Work Plan will be conducted in accordance with MDEQ's Brownfields program. MDEQ Brownfields Tier 1 Target Remediation Goals (TRGs) will be used as actionable standards. Waste characterization and disposal will be completed in accordance with MDEQ-approved methodology specific to this site. The use of MDEQ Brownfields investigative procedures and corrective action standards is appropriate in this investigation.

1.2 Property Background

1.2.1 Property Location

Vicksburg Chemical was formerly owned by Cedar Chemical Corporation (Cedar Chemical). The facility is located south of Interstate 20 on Rifle Range Road and within the southwest section of the city of Vicksburg, Warren County, Mississippi. The site is composed of approximately 535 acres located in Sections 4, 5, 8, 9, and 10, township 15 north, range 3 east (Latitude: North 32° 18' 01", Longitude: West 90° 53' 57"). The site location is shown on Figure 1.

1.2.2 Property History

The North Plant began operation in 1961 and produced potassium nitrate, liquid chlorine, and liquid nitrogen tetroxide. The raw materials for the North Plant included potassium chloride and nitric acid. The South Plant began operation in 1953 manufacturing chlorinated pesticides, nitrogen-based herbicides, and other agricultural chemicals. The only active operations at the South Plant after 1992 were the nitric acid

FINAL

unit constructed in 1986 and a potassium carbonate unit constructed in 1994. During various periods prior to 1987, the South Plant produced dinitro butyl phenol (dinoseb or DNBP), monosodium methane arsenate (MSMA) diethyl hexyl phosphoric acid (DEHPA), 1-hydroxy-ethylidene-1-1-diphosphonic acid (UNIHIB), toxaphene, methyl parathion, cyanazine (bladex), and atrazine. Toxaphene and methyl parathion are insecticides, while atrazine, dinoseb, and MSMA are herbicides. Raw materials for these operating processes included chlorine, camphene, ortho-secondary butyl phenol (OSBP), sodium arsenate, sodium hydroxide, methyl chloride, sulfuric acid, sodium paranitrophenolate, and phosphorus trichloride.

Originally, the two plants were completely separate, owned and operated by two different companies. The South Plant was originally constructed by Spencer Chemical in 1953. American Metal Climax Corporation (Amax) constructed the North Plant in 1961. After purchasing the South Plant in 1964, Gulf Chemical added a formaldehyde unit in 1966. According to historical environmental documents, Vicksburg Chemical was formed in early 1972 and purchased both the Gulf Oil and Amax facilities (except the formaldehyde plant) in July 1972. In 1978, Vicksburg Chemical was merged into Vertac, Inc., which merged into Vertac Chemical Corporation (VCC) in September 1979. Cedar Chemical acquired the Vicksburg Chemical plant from VCC in February 1986. Fermenta A.B. of Sweden acquired Cedar Chemical in June 1986. Nine West Corporation (Trans Resources, Inc.) acquired Cedar Chemical in January 1988.

In addition to the above-mentioned operations at the plant, the property was the location of two additional operations: 1) an operation by Reagent Chemical to produce aqueous hydrochloric acid from a by-product of the toxaphene operation; and 2) the Gulf formaldehyde plant. The formaldehyde unit owned and formerly operated by Borden Chemical is located inside the former boundary of the South Plant.

1.3 Project History and Detailed Summary of Previous Investigation Activities

Vicksburg Chemical initiated a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) in 1994 and continued through 2001. The *RCRA Facility Investigation Draft Final Report* and *Draft Groundwater Assessment Report* were completed in August 2001 and November 2001, respectively. Both reports were submitted to the U.S. Environmental Protection Agency (USEPA) and subsequently approved in December 2001. A draft Corrective Measures Study was developed in the spring of 2002.

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On March 8, 2002, VCC and Cedar Chemical filed for bankruptcy in the United States Bankruptcy Court for the Southern District of New York. The bankruptcy was contested by MDEQ, the Arkansas Department of Environmental Quality, USEPA Region 4, USEPA Region 6, and the U.S. Department of Justice. The court eventually approved an agreement allowing Vicksburg Chemical to abandon its properties and authorizing MDEQ to direct the transfer of the Vicksburg Chemical property to any entity identified by MDEQ. Since that time, MDEQ has kept the site under its control while structuring an agreement to clean up the plant site in a manner protective of human health and the environment. On December 19, 2005, MDEQ finalized an agreement for Mississippi Silvertip Development, LLC (Silvertip), to remediate the abandoned Vicksburg Chemical site. The developer, Silvertip, intends to create a Mississippi Bluffs Industrial Park to foster the sustainable reuse of the former chemical plant site and adjacent areas. It is anticipated that mixed use (i.e. light industrial, commercial, recreational, and residential) will be possible at the completion of the remedial action. Harcros Chemicals, Inc., is currently leasing portions of the former North Plant to facilitate a chemical blending, mixing, and distribution facility. Concurrently, ARCADIS G&M, Inc. (ARCADIS), is performing the remediation services with MDEQ oversight and control. Silvertip plans to construct high-end commercial and residential sites and a championship golf course on a majority of the remaining acreage.

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1.4 Data Needs and Objectives

Additional site data are needed to sufficiently characterize soil contaminant boundaries for remediation purposes, to ascertain present groundwater contaminant concentrations, and to evaluate baseline storm water quality. Data collected as part of the RFI process have been used to select the additional sample locations and are considered valid and usable. The objective of this sampling effort is to collect soil, groundwater, and storm water samples representative of present site conditions that will define the overall remediation strategy for this site.

1.5 Work Plan Approach

The general Work Plan strategy was developed to obtain data representative of present site conditions. Since Vicksburg Chemical declared bankruptcy in 2002, the site has not been regularly investigated or maintained. The most recent soil and groundwater data on overall site conditions available to ARCADIS are contained in the RFI and supplemental investigations. This Work Plan is based in large part on the analytical data presented in the *RCRA Facility Investigation*

Draft Final Report (URS 2001a), *Draft Groundwater Assessment Report* (URS 2001b), and other reports that pertain to the project area. The analytical data contained in these reports were compared to the February 28, 2002, MDEQ Brownfields Tier 1 TRGs for soil and groundwater. The soil concentrations, with the exception of arsenic concentrations, were compared to Tier 1 TRGs for restricted sites as chemical of concern (CoC) concentrations at this site. Arsenic concentrations were compared to the 95 percent Upper Confidence Limit of the mean of the background concentration as presented in the *Quality Assurance Project Plan* (QAPP; ARCADIS 2006a). The soil and groundwater results obtained from the implementation of this Work Plan will help to determine if the site conditions have significantly changed since the last investigations.

The purpose of the storm water sampling is to evaluate if site CoC are present in storm water. If the storm water does contain CoC at unacceptable concentrations, treatment prior to discharge may be required. Areas likely to receive storm water in the form of sheet flow and sumps that historically collected storm water will be sampled during a rainfall event to provide the necessary baseline data.

While in operation, the Vicksburg Chemical plant operated under a State of Mississippi Water Pollution Control permit (Permit No. MS0027995). Storm water was discharged under this permit to the Mississippi River. The sampling parameters contained in the former Water Pollution Control permit are incorporated into the storm water sampling program.

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2. Field Operations

2.1 Source Areas Characterization

Data presented in the RFI indicated five main impacted areas. These areas were defined in the QAPP as four distinct areas in the South Plant and one in the North Plant. The areas were designated:

- Area 1 – South Plant – Solid Waste Management Units (SWMUs) 1, 5, 7, 8, 9, 11, 12, 14, 15, 16, and 17;
- Area 2 – South Plant – Portion of Southwest Corner SWMU 20;
- Area 3 – South Plant – SWMU 2;

- Area 4 – South Plant – Part of SWMU 20 Bounded by MW-1, MW-13, and MW-14; and
- Area 5 – North Plant Pond – SWMU 23.

Each area contains CoC concentrations that exceed the MDEQ Tier 1 TRGs. Tables 1 and 2 list the sample designations where CoC concentrations exceed MDEQ Tier 1 TRGs in soil and groundwater, respectively.

The areal extent of surficial impacts, potential source areas for storm water contamination, has not been completely defined. One of the goals of this baseline sampling is to identify potential storm water contaminant source areas. Data may be used to redirect storm water from these areas to minimize the need for treatment prior to discharge.

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2.2 Sampling Requirements

Some of the tasks that will be conducted during sampling activities have been outlined in detail in the QAPP. The pertinent sections are listed below and incorporated by reference.

2.2.1 Sampling Equipment and Procedures

Soil samples will be collected using direct push technology (Geoprobe®) and/or hand auger equipment. The proper use of these items in the collection of samples representative of site conditions is detailed in Sections 11.2 (Soil Boring/Sampling Geoprobe® Device) and 11.3 (Soil Sampling – Hand Auger) in the QAPP. Groundwater samples will be collected using low-flow purging techniques or with a bailer as described in Section 11.6 (Groundwater Sampling Procedures) in the QAPP. Storm water samples will be collected in accordance with the procedures described in Section 10.6 (Sample Collection Protocols) in the QAPP.

2.2.2 Sample Handling and Analysis

Sample handling and analysis were discussed in detail in Sections 10 and 11 of the QAPP. These procedures will be followed during the implementation of this Work Plan. Table 6 (Summary of Methods, Containers, Preservatives, and Holding Times) of the QAPP contains information relative to specific analyses. This table was revised to include additional storm water parameters not included in the original table. The

following parameters were added: Total Phosphorus (as P) and Fluoride (as F). The revised table is included as Table 3 of this Work Plan.

2.2.3 Quality Assurance/Quality Control (QA/QC) Samples

Appropriate QA/QC samples will be prepared in accordance with the procedures outlined in Section 10.12 (Field Quality Control Samples) of the QAPP. The QA/QC samples will include:

- Field blanks;
- Equipment rinsate blanks;
- Duplicate samples; and
- Matrix spike/matrix spike duplicate samples.

QA/QC samples will be collected at a frequency of 1 per each 20 samples of each matrix. Trip blanks will be included in ice chests used to transport the samples to the receiving laboratory. The sampling personnel will complete a chain-of-custody form that will accompany the samples to the laboratory.

2.3 Extent of Contamination in Soil

Soil contamination at the site has been extensively investigated through the RFI process. Due to the nature of the proposed remedies for soil contamination (capping, solidification, stabilization, landfilling), the horizontal delineation of CoC boundaries is critical. To adequately provide sufficient protection of human health and the environment, soil samples will be collected from the locations shown on Figure 2 to confirm and more precisely locate contaminant boundaries. The results of the soil sampling will be used in the development of the final remedy for each area.

2.3.1 Soil Sampling and Analysis Plan (SAP)

A Geoprobe® sampling unit will be used to advance probeholes for the collection of subsurface data at each of the sampling locations depicted on Figure 2. The Geoprobe® is a preferred technique for subsurface sampling in shallow unconsolidated materials because it minimizes the generation of soil cuttings and the introduction of foreign fluids into the probehole.

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All drilling equipment will be properly decontaminated prior to advancing each probehole. This will be accomplished by thoroughly cleaning the Geoprobe® drive assembly to remove all soil residues.

The probehole at each location will be advanced and sampled to a depth sufficient to complete delineation of surface and subsurface impacts.

Soil samples will be continuously collected from land surface to total depth (estimated to be less than 12 feet below ground surface (ft bls) based on previous RFI data), as each probehole is being advanced. As each soil sample is retrieved to land surface, the sampling tube will be cut open and the sample removed (sampling personnel will wear clean gloves when handling each sample). The sides of the core will be trimmed away with a decontaminated stainless steel knife to allow for the collection of an undisturbed sample. The sample will be used to fill the appropriate laboratory-provided sample containers. Samples collected for the analysis of volatile organic compounds (VOCs) will be collected by USEPA SW-846 Method 5035. All sample containers will be labeled and placed into an ice bath within an insulated ice chest.

Any remaining soil sample will be inspected and described by an experienced field geologist with all relevant data (i.e., soil type, lithology, color, physical characteristics, moisture content, and any observed evidence of contamination) recorded onto a Sample/Core Log prepared for each probehole. The Sample/Core Log will present a complete description of the soil lithology encountered from land surface to the total depth of the probehole. Appendix A includes an example of the Sample/Core Log.

The samples will be submitted to the laboratory under proper chain-of-custody protocols. Selected parameters will be analyzed in accordance with the data presented in Table 3 specific to each analysis. At a minimum, the soil samples will be analyzed for the analytical parameters proposed in Table 4 and the VOCs contained in Appendix IX of 40 Code of Federal Regulations Part 264, or an analytical parameter set provided by MDEQ.

Soil samples collected from the following intervals in each probehole will be retained for chemical analyses:

- The soil sample collected from land surface to 2 ft bls;
- The soil sample collected from 2 to 4 ft bls; and

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- A sample from any obvious stained intervals below 4 ft bls if the 2- to 4-ft bls sample appears to be stained.

2.3.2 Soil Sampling Objectives

The specific objective of soil sampling is to define the horizontal extent of contamination in the areas shown on Figure 2. These data will be used to identify the extent of areas that will need to be capped as a part of the final remedy. The present interpretation of the data indicates that soil capping activities will be needed in Areas 1, 4, and 5.

2.3.3 Soil Sampling Locations and Frequency

The soil sampling locations were selected to fill data gaps based on the spatial distribution of previous sampling events. The proposed soil sampling activities are anticipated to be a one-time sampling event. In the event that soil CoC concentrations are detected in excess of limiting MDEQ Tier 1 TRGs, additional sampling may be necessary to adequately define contaminant boundaries.

2.4 Extent of Contamination in Groundwater

Groundwater contamination at the site has been extensively investigated through the RFI process. Previous sampling events indicated contaminant plumes extending toward Stouts Bayou to the east and Hennessey Bayou to the south. Due to the extended amount of time that has elapsed since the last sampling of all wells, a baseline groundwater sampling event is necessary to confirm present groundwater conditions. It is necessary to conduct the sampling proposed in this Work Plan prior to implementing the final groundwater remedy. Based on the results of the baseline groundwater sampling, additional monitor wells may be necessary to adequately define current groundwater conditions. A map showing the well locations is included as Figure 3.

2.4.1 Groundwater SAP

Prior to collecting the groundwater samples, static water level measurements will be recorded in all temporary wells, and each well will be checked for the presence of any free-phase material.

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Groundwater samples will be collected from each well using either a small-diameter hand bailer, high volume pump (i.e., Grundfos Redi-flo® pump), flow through cell, or a peristaltic pump. In accordance with the procedures outlined in Section 11.6 of the QAPP, sampling will be conducted using low-flow procedures or each well will be purged of three to five volumes of standing water (or until dry) prior to collecting a groundwater sample. Each groundwater sample will be poured directly into the appropriate laboratory-provided sample container(s), the containers properly labeled, and placed in an ice bath within an insulated ice chest. Separate aliquots of groundwater will be collected during purging from each well with a goal of stabilization prior to sampling. Stabilization will be determined through the field measurement of pH, specific conductance, temperature, and turbidity. As each well is being purged and sampled, Field Parameters and Water Sampling Logs (Appendix B) will be completed by sampling personnel.

The samples will be submitted to the laboratory under proper chain-of-custody protocols. Selected parameters will be analyzed in accordance with the data presented in Table 3 specific to each analysis. At a minimum, the groundwater samples will be analyzed for the analytical parameters proposed in Table 5, or an analytical parameter set provided by MDEQ.

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2.4.2 Groundwater Sampling and Objectives

The specific objective of groundwater sampling is to define the present condition of groundwater in the existing monitor wells and determine if the network sufficiently monitors the existing known groundwater impacts.

2.4.3 Groundwater Sampling Locations and Frequency

The existing groundwater monitor well network consists of 37 wells. No new monitor or recovery wells are proposed to be installed during this sampling event. Well construction data for the monitor wells were obtained from Table 1 of the *Draft Groundwater Assessment Report* (URS 2001b). The locations of the wells are shown on Figure 3. A copy of Table 1 is presented in Appendix C. The exact condition of each well is presently unknown. However, a monitor well inspection will be conducted at each well during the baseline sampling event and a checklist prepared. A copy of the checklist is included in Appendix D. It is assumed that the wells are in good enough condition to provide samples representative of the groundwater zone in which the well was initially completed. The baseline groundwater sampling activities proposed herein are anticipated to be a one-time sampling event. Based on the

results, a routine sampling frequency and parameter list will be proposed to MDEQ in the Site Characterization Report for future sampling activities. In the event that groundwater CoC concentrations are detected in excess of limiting MDEQ Tier 1 TRGs, additional sampling and or well installation activities may need to be conducted to adequately monitor groundwater concentrations prior to the submission of the Site Characterization Report.

2.5 Storm Water Sampling

2.5.1 Storm Water SAP

Storm water samples will be collected from various locations at the site as shown on Figure 4. Samples will be collected during a storm water event of sufficient intensity and duration to collect a sample representative of sheet flow conditions. Each storm water sample will be a grab sample collected in clean containers supplied by the laboratory. Dippers, bailers, or similar sampling equipment may be used, if necessary, to collect a representative sample. If not, sample containers will be lowered to the surface of the storm water for filling. Once filled, the containers will be properly sealed, labeled, and placed in an ice bath within an insulated ice chest. The ice chest and a completed chain-of-custody document will be shipped or transported to the laboratory.

The samples will be submitted to the laboratory under proper chain-of-custody protocols. Selected parameters will be analyzed in accordance with the data presented in Table 3 specific to each analysis. At a minimum, the storm water samples will be analyzed for the analytical parameters contained in Table 6, or an analytical parameter set provided by MDEQ. The storm water parameters identified in Table 6 were contained in Vicksburg Chemical's previous State of Mississippi Water Pollution Control permit (MS0027995).

2.5.2 Storm Water Sampling Objectives

The specific objectives of storm water sampling are:

- To determine potential areas that may adversely impact site storm water; and
- To determine if any best management practices and/or storm water treatment is necessary prior to discharge to the Mississippi River.

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2.5.3 Storm Water Sampling Locations and Frequency

The proposed storm water sampling locations are presented on Figure 3. The majority of the locations shown on this map are sheet flow sample locations. In addition to the sheet flow sample locations, storm water sumps, storm water basins, and the storm water outfall will be sampled. The activities proposed in this document are intended to be a one-time baseline sampling event. The purpose of the baseline sampling is to determine if treatment is necessary and define the sample points and parameter set(s) that should continue to be monitored in future storm water sampling events.

2.6 Investigation Derived Wastes

Waste materials generated during this investigation and corrective action will include soil, used personal protective equipment, decontamination water, and purged groundwater. Waste materials will be appropriately containerized or placed into the storm water basin with approval from MDEQ. All drums will be labeled with the contents of the drum and date of generation of the waste material. The drums will be staged in a secure location and will be incorporated into the remediation to be conducted at the site. Liquid and solid waste will be segregated to facilitate final disposal.

2.7 Regulatory Involvement

All site activities will be conducted after receiving approval of this Work Plan from MDEQ. MDEQ will have oversight on all aspects of remediation activities conducted at this site as per the Agreed Order. Future sampling frequencies, parameter lists, methodology, etc., will be approved by MDEQ prior to field implementation.

All wells advanced by direct push technology methods will be plugged by a State of Mississippi certified water well driller in accordance with MDEQ-approved methods. The plugging and abandonment will be conducted with a cement/bentonite mixture, or a material that provides equivalent subsurface protection.

2.8 Additional Work

A registered land surveyor will survey all soil sample points and monitor well locations. These locations will be plotted on a scaled map of the site.

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3. Remedial Site Conceptual Exposure Model

A draft Remedial Site Conceptual Exposure Model (RSCEM) form for the site is presented in Appendix E. The RSCEM is an important tool for obtaining an understanding of site exposure pathway dynamics. It depicts the site and its environment(s) and delineates potential chemical sources, chemical release and transport mechanisms, affected media, migration routes, and potential human and ecological receptors. The RSCEM provides a framework for problem definition, aids in the identification of data gaps, and, more importantly, identifies key exposure pathways and associated media on which to focus assessment activities.

The RSCEM represents potential exposure pathways under both current and foreseeable future exposure scenarios. An industrial exposure scenario will be considered for the portion of the site that was the former Vicksburg Chemical plant. The apparent release source is the former site operations. The RSCEM identifies soil and groundwater as the media of concern. Potential receptors include current and future industrial workers and site visitors and hypothetical future recreational receptors via groundwater/surface water exchange. The final remediation will address the exposure pathways to protect potential receptors.

4. Reporting

Following the completion of all field activities, a Site Characterization Report will be prepared for submittal to MDEQ. The report will document all field activities and present an interpretation of surface and subsurface conditions. Appropriate historical and new data tables, figures, and appendices will be included in the report to support the text. The report will conclude by presenting recommendations for a path forward to obtain site closure.

5. Schedule

The sampling program will be initiated within 3 weeks of receiving written authorization to proceed from MDEQ. It is anticipated that the planned field activities can be completed within 3 to 4 weeks. Analytical data should be received within 2 weeks of completing the last planned field activities. A Site Characterization Report will be prepared and submitted to MDEQ within 8 weeks of receipt of the analytical results. If field activities are delayed, or if additional field activities are required to completely define the nature and extent of subsurface impacts, MDEQ will be promptly notified.

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6. References

ARCADIS. 2006a. Quality Assurance Project Plan, Vicksburg Chemical Company. September 14.

ARCADIS. 2006b. Health and Safety Plan, Vicksburg Chemical Company. October 27.

MDEQ. Brownfields Site Characterization Work Plan Format. http://www.deq.state.ms.us/MDEQ.nsf/pdf/GARD_bfwplan/$File/BFWPlan.PDF?OpenElement.

MDEQ. 2002. Subpart II Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfield Sites. February 28.

URS. 2001a. RCRA Facility Investigation Draft Final Report, Vicksburg Chemical Company. August.

URS. 2001b. Draft Groundwater Assessment Report, Vicksburg Chemical Company. November.

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Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Soil Samples							
1, 16, 17	D-1-B	0-1	Arsenic	12,500	11,800	µg/kg	Yes
1, 16, 17	I-1-B	0-1	Toxaphene	31,700	5,200	µg/kg	Yes
1, 16, 17	I-1-B	0-1	Arsenic	27,000	11,800	µg/kg	Yes
1, 16, 17	L-1-A	0-1	Arsenic	14,500	11,800	µg/kg	Yes
1, 16, 17	2-C-C	Concrete	Arsenic	36,000	11,800	µg/kg	Yes
1, 16, 17	11-C-C	Concrete	Atrazine	52,800	25,800	µg/kg	Yes
1, 16, 17	12-2-A	1-2	Arsenic	13,300	11,800	µg/kg	Yes
1, 16, 17	15-2-A	1-2	Arsenic	12,900	11,800	µg/kg	Yes
1, 16, 17	16-C-A	Concrete	Arsenic	13,700	11,800	µg/kg	Yes
1, 16, 17	18-C-A	Concrete	Arsenic	27,000	11,800	µg/kg	Yes
1, 16, 17	19-C-A	Concrete	Arsenic	18,800	11,800	µg/kg	Yes
4	4-4	0.5-1	Arsenic	15,700	11,800	µg/kg	Yes
5	5-4	3-10	Arsenic	39,200	11,800	µg/kg	Yes
5	5-11	3-10	Arsenic	30,800	11,800	µg/kg	Yes
5	5-13	3-10	Arsenic	174,000	11,800	µg/kg	Yes
5	5-14	3-10	Arsenic	39,000	11,800	µg/kg	Yes
9	8S	0.5-1	Arsenic	61,000	11,800	µg/kg	Yes
9	8D	1.5-2	Arsenic	60,000	11,800	µg/kg	Yes
9	A-1 Result		Benzo(a)pyrene	1,160	784	µg/kg	Yes
11, 12, 15	B-1-D (Sump/Drainage)	0-1	Arsenic	39,400	11,800	µg/kg	Yes
11, 12, 15	E-1-D (Sump/Drainage)	0-1	Arsenic	345,000	11,800	µg/kg	Yes
11, 12, 15	BB-1-D (Sump/Drainage)	0-1	Arsenic	2,870,000	11,800	µg/kg	Yes
11, 12, 15	Q-1-D (Sump/Drainage)	0-1	Arsenic	2,080,000	11,800	µg/kg	Yes
11, 12, 15	EE-1-D (Sump/Drainage)	0-1	Arsenic	456,000	11,800	µg/kg	Yes
11, 12, 15	EE-1-D (Sump/Drainage)	0-1	PCDD/PCDF (Dioxin)	0.344	0.0763	µg/kg	Yes
11, 12, 15	V-1-D (Sump/Drainage)	0-1	Arsenic	2,770,000	11,800	µg/kg	Yes
11, 12, 15	W-1-D (Sump/Drainage)	0-1	Arsenic	145,000	11,800	µg/kg	Yes
11, 12, 15	Y-1-D (Sump/Drainage)	0-1	Arsenic	60,200	11,800	µg/kg	Yes
11, 12, 15	M-1-D (Sump/Drainage)	0-1	Arsenic	35,600	11,800	µg/kg	Yes
11, 12, 15	1-C-D	Concrete	Arsenic	18,400	11,800	µg/kg	Yes
11, 12, 15	5-C-D	Concrete	Arsenic	70,600	11,800	µg/kg	Yes
11, 12, 15	6-1-D	0-1	Arsenic	24,900	11,800	µg/kg	Yes
11, 12, 15	6-2-D	1-2	Arsenic	14,100	11,800	µg/kg	Yes
11, 12, 15	C-1-G	0-1	Arsenic	216,000	11,800	µg/kg	Yes
11, 12, 15	C-2-G	1-2	Arsenic	501,000	11,800	µg/kg	Yes
11, 12, 15	C-3-G	2-4	Arsenic	76,000	11,800	µg/kg	Yes

Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Soil Samples (continued)							
11, 12, 15	C-4-G	4-6	Arsenic	109,000	11,800	µg/kg	Yes
11, 12, 15	C-5-G	6-8	Arsenic	114,000	11,800	µg/kg	Yes
11, 12, 15	D-1-G	0-1	Arsenic	48,800	11,800	µg/kg	Yes
11, 12, 15	D-2-G	1-2	Arsenic	309,000	11,800	µg/kg	Yes
11, 12, 15	D-4-G	4-6	Arsenic	27,600	11,800	µg/kg	Yes
11, 12, 15	D-5-G	6-8	Arsenic	14,700	11,800	µg/kg	Yes
11, 12, 15	H-1-G	0-1	Arsenic	22,300	11,800	µg/kg	Yes
11, 12, 15	I-1-G	0-1	Arsenic	72,800	11,800	µg/kg	Yes
11, 12, 15	I-2-G	1-2	Arsenic	57,500	11,800	µg/kg	Yes
11, 12, 15	I-3-G	2-4	Arsenic	185,000	11,800	µg/kg	Yes
11, 12, 15	I-4-G	4-6	Arsenic	241,000	11,800	µg/kg	Yes
11, 12, 15	I-5-G	6-8	Arsenic	138,000	11,800	µg/kg	Yes
11, 12, 15	J-1-G	0-1	Arsenic	101,000	11,800	µg/kg	Yes
11, 12, 15	J-2-G	1-2	Arsenic	205,000	11,800	µg/kg	Yes
11, 12, 15	K-1-G	0-1	Arsenic	38,800	11,800	µg/kg	Yes
11, 12, 15	K-2-G	1-2	Arsenic	31,500	11,800	µg/kg	Yes
11, 12, 15	K-3-G	2-4	Arsenic	14,600	11,800	µg/kg	Yes
11, 12, 15	K-4-G	4-6	Arsenic	46,000	11,800	µg/kg	Yes
11, 12, 15	K-6-G	8-10	Arsenic	55,100	11,800	µg/kg	Yes
11, 12, 15	L-1-G	0-1	Arsenic	132,000	11,800	µg/kg	Yes
11, 12, 15	L-2-G	1-2	Arsenic	80,600	11,800	µg/kg	Yes
11, 12, 15	O-1-G	0-1	Arsenic	254,000	11,800	µg/kg	Yes
11, 12, 15	O-2-G	1-2	Arsenic	41,400	11,800	µg/kg	Yes
11, 12, 15	T-2-G	1-2	Arsenic	14,400	11,800	µg/kg	Yes
11, 12, 15	X-1-G	0-1	Arsenic	64,400	11,800	µg/kg	Yes
11, 12, 15	X-2-G	1-2	Arsenic	63,300	11,800	µg/kg	Yes
11, 12, 15	Z-1-G	0-1	Arsenic	323,000	11,800	µg/kg	Yes
11, 12, 15	Z-2-G	1-2	Arsenic	51,200	11,800	µg/kg	Yes
11, 12, 15	Z-3-G	2-4	Arsenic	22,300	11,800	µg/kg	Yes
11, 12, 15	DD-1-G	0-1	Arsenic	24,300	11,800	µg/kg	Yes
11, 12, 15	DD-2-G	1-2	Arsenic	59,600	11,800	µg/kg	Yes
11, 12, 15	ZZ-1-G	0-1	Arsenic	11,900	11,800	µg/kg	Yes
11, 12, 15	ZZ-2-G	1-2	Arsenic	18,100	11,800	µg/kg	Yes
11, 12, 15	7-C-G	Concrete	Arsenic	68,200	11,800	µg/kg	Yes
18	18-1	0.5-1	Arsenic	17,500	11,800	µg/kg	Yes
18	18-3	0.5-1	Arsenic	12,600	11,800	µg/kg	Yes
20	20-21C		Chloroform	2,186	478	µg/kg	Yes
23	22-B		Chloroform	830	478	µg/kg	Yes
30	30-1	0.5-1	TPH (conservative)	4,433,000	300,000	µg/kg	Yes
30	30-2	0.5-1	TPH (conservative)	699,000	300,000	µg/kg	Yes
30	30-3	0.5-1	TPH (conservative)	15,431,000	300,000	µg/kg	Yes

Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Composite Surface Samples (2 to 8 grab samples from each quartile of each section composited)							
20	20-A	0-0.5	Toxaphene	8,240	5,200	µg/kg	Yes
20	20-B	0-0.5	Toxaphene	18,989	5,200	µg/kg	Yes
20	20-C	0-0.5	Dinoseb	355,541	204,000	µg/kg	Yes
20	20-C	0-0.5	Toxaphene	8,401	5,200	µg/kg	Yes
20	20-D	0-0.5	Toxaphene	14,200	5,200	µg/kg	Yes
20	20-F	0-0.5	Dinoseb	1,078,068	204,000	µg/kg	Yes
20	20-F	0-0.5	Toxaphene	10,318	5,200	µg/kg	Yes
20	20-G	0-0.5	Toxaphene	22,981	5,200	µg/kg	Yes
20	20-H	0-0.5	Toxaphene	19,052	5,200	µg/kg	Yes
20	20-I	0-0.5	Toxaphene	110,964	5,200	µg/kg	Yes
20	20-J	0-0.5	Toxaphene	41,652	5,200	µg/kg	Yes
20	20-K	0-0.5	Toxaphene	6,098	5,200	µg/kg	Yes
20	20-N	0-0.5	Toxaphene	9,263	5,200	µg/kg	Yes
20	20-O	0-0.5	Toxaphene	6,727	5,200	µg/kg	Yes
20	20-T	0-0.5	Arsenic	12,100	11,800	µg/kg	Yes
20	20-T	0-0.5	Toxaphene	7,617	5,200	µg/kg	Yes
Composite Soil Pile Samples (8 grab samples composited)							
20	20-BB	0-0.5	Toxaphene	37,036	5,200	µg/kg	Yes
20	20-CC	0-0.5	Toxaphene	6,852	5,200	µg/kg	Yes
20	20-DD	0-0.5	Toxaphene	14,691	5,200	µg/kg	Yes
20	20-EE	0-0.5	Toxaphene	16,815	5,200	µg/kg	Yes
20	20-FF	0-0.5	Toxaphene	76,683	5,200	µg/kg	Yes
20	20-II	0-0.5	Toxaphene	17,413	5,200	µg/kg	Yes
20	20-LL	0-0.5	Toxaphene	14,673	5,200	µg/kg	Yes
20	20-MM	0-0.5	Toxaphene	11,152	5,200	µg/kg	Yes

(1) Analytical data obtained from RFI process.
MDEQ Mississippi Department of Environmental Quality.
SWMU Solid Waste Management Unit.
Tier 1 TRG (Restricted) MDEQ Tier 1 TRG for the restricted use of soil.
TPH Total Petroleum Hydrocarbon.
TRG Target Remediation Goal.
µg/kg *Micrograms per Kilogram.*

Table 2. Exceedances of MDEQ Tier 1 TRG for Groundwater, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG	Units	Concentration Exceeds Tier 1 TRG
1, 16, 17	2-W-TA	Arsenic	538	50	µg/L	Yes
2	MW-5	Dinoseb	12	7	µg/L	Yes
2	MW-5	Trichloroethene	79	5	µg/L	Yes
2	MW-6	Dinoseb	75	7	µg/L	Yes
2	MW-6	Toxaphene	25	3	µg/L	Yes
2	MW-6	Trichloroethene	9.03	5	µg/L	Yes
2	LS1-W	Bis(2-ethyl)hexylphthalate	213.44	6	µg/L	Yes
2	LS2-W	4-Nitrophenol	547.61	292	µg/L	Yes
2	LS2-W	Atrazine	478	3	µg/L	Yes
2	LS2-W	Carbon Tetrachloride	71.4	5	µg/L	Yes
2	LS2-W	Dinoseb	8,714	7	µg/L	Yes
2	LS3-W	Bis(2-ethyl)hexylphthalate	474.04	6	µg/L	Yes
2	LS4-W	Chloroform	17.3	0.155	µg/L	Yes
2	LS4-W	Carbon Tetrachloride	126	5	µg/L	Yes
2	LS4-W	Bis(2-ethyl)hexylphthalate	42.03	6	µg/L	Yes
2	LS4-W	Dinoseb	597	7	µg/L	Yes
2	LS5-W	Chloroform	105	0.155	µg/L	Yes
2	LS5-W	Acetophenone	18.92	0.0416	µg/L	Yes
2	LS5-W	4-Nitrophenol	2,359	292	µg/L	Yes
2	LS5-W	Bis(2-ethyl)hexylphthalate	130.9	6	µg/L	Yes
2	LS5-W	Atrazine	6.33	3	µg/L	Yes
2	LS5-W	Dinoseb	797	7	µg/L	Yes
2	2-15-W	Atrazine	123	3	µg/L	Yes
9	TP-1	Arsenic	378	50	µg/L	Yes
9	TP-1	Trichloroethene	68	5	µg/L	Yes
9	MW-18A	Arsenic	319	50	µg/L	Yes
9	MW-18B	Arsenic	197	50	µg/L	Yes
9	MW-18B	Dinoseb	132	7	µg/L	Yes
11, 12, 15	G-W-G	Arsenic	14,300	50	µg/L	Yes
11, 12, 15	D-W-G	Arsenic	253	50	µg/L	Yes
11, 12, 15	I-W-G	Arsenic	288,000	50	µg/L	Yes
11, 12, 15	K-W-G	Arsenic	297	50	µg/L	Yes
11, 12, 15	R-W-G	Arsenic	5,260	50	µg/L	Yes
11, 12, 15	X-W-G	Arsenic	730	50	µg/L	Yes
11, 12, 15	Z-W-G	Arsenic	1,720	50	µg/L	Yes
11, 12, 15	DD-W-G	Arsenic	1,260	50	µg/L	Yes
11, 12, 15	WW-W-G	Arsenic	56	50	µg/L	Yes
11, 12, 15	ZZ-W-G	Arsenic	216	50	µg/L	Yes
11, 12, 15	7-W-G	Arsenic	51,000	50	µg/L	Yes
11, 12, 15	MW-17A	Carbon Tetrachloride	7.25	5	µg/L	Yes
11, 12, 15	MW-17B	Chloroform	1.43	0.155	µg/L	Yes
11, 12, 15	MW-18A	Arsenic	319	50	µg/L	Yes
11, 12, 15	MW-18B	Arsenic	194	50	µg/L	Yes
11, 12, 15	MW-18B	Dinoseb	132	7	µg/L	Yes
20	MW-1C	Chloroform	1.38	0.155	µg/L	Yes
20	MW-1C	Trichloroethene	10.8	5	µg/L	Yes
20	MW-10C	Dinoseb	717	7	µg/L	Yes

Table 2. Exceedances of MDEQ Tier 1 TRG for Groundwater, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG	Units	Concentration Exceeds Tier 1 TRG
20	MW-10C	Chloroform	1,076	0.155	µg/L	Yes
20	MW-10C	Carbon Tetrachloride	1,486	5	µg/L	Yes
20	MW-12C	*Dinoseb*	277	7	µg/L	Yes
20	MW-12C	Vinyl Chloride	13	2	µg/L	Yes
20	MW-12C	1,1-Dichloroethene	7.39	7	µg/L	Yes
20	MW-12C	1,2-Dichloroethene (total)	88.3	70	µg/L	Yes
20	MW-12C	Chloroform	3,879	0.155	µg/L	Yes
20	MW-12C	1,2-Dichloroethane	113	5	µg/L	Yes
20	MW-12C	Carbon Tetrachloride	23,350	5	µg/L	Yes
20	MW-12C	1,1,2-Trichloroethane	84.2	5	µg/L	Yes
20	MW-12C	Tetrachloroethene	174	5	µg/L	Yes
20	20-18-W	Atrazine	65	3	µg/L	Yes
20	20-18-W	Chloroform	21.5	0.155	µg/L	Yes
20	20-18-W	Carbon Tetrachloride	13.3	5	µg/L	Yes
20	20-18-W	Benzene	9.58	5	µg/L	Yes
20	20-19-W	Benzene	7.21	5	µg/L	Yes
20	20-20-W	*Dinoseb*	18,821	7	µg/L	Yes
20	20-20-W	Chloromethane	3.36	1.43	µg/L	Yes
20	20-20-W	Chloroform	10.2	0.155	µg/L	Yes
20	20-20-W	Carbon Tetrachloride	46.2	5	µg/L	Yes
20	20-21-W	Atrazine	140	3	µg/L	Yes
20	20-21-W	Chloromethane	126	1.43	µg/L	Yes
20	20-21-W	Vinyl Chloride	5.46	2	µg/L	Yes
20	20-21-W	Methylene Chloride	908	5	µg/L	Yes
20	20-21-W	1,1-Dichloroethene	54.6	7	µg/L	Yes
20	20-21-W	1,2-Dichloroethene (total)	1,758	70	µg/L	Yes
20	20-21-W	Chloroform	37,380	0.155	µg/L	Yes
20	20-21-W	1,2-Dichloroethane	321	5	µg/L	Yes
20	20-21-W	Carbon Tetrachloride	357,500	5	µg/L	Yes
20	20-21-W	Bromodichloromethane	296	0.168	µg/L	Yes
20	20-21-W	*cis-1,3-Dichloropropene*	42.3	0.0842	µg/L	Yes
20	20-21-W	Trichloroethene	1,346	5	µg/L	Yes
20	20-21-W	Benzene	23.7	5	µg/L	Yes
20	20-21-W	1,1,2-Trichloroethane	290	5	µg/L	Yes
20	20-21-W	Tetrachloroethene	180	5	µg/L	Yes
20	20-22-W	Atrazine	146	3	µg/L	Yes
20	20-22-W	Dinoseb	396	7	µg/L	Yes
20	20-22-W	Vinyl Chloride	46.5	2	µg/L	Yes
20	20-22-W	Methylene Chloride	45.7	5	µg/L	Yes
20	20-22-W	1,2-Dichloroethene (total)	125	70	µg/L	Yes
20	20-22-W	Chloroform	5,120	0.155	µg/L	Yes
20	20-22-W	1,2-Dichloroethane	68.2	5	µg/L	Yes
20	20-22-W	Carbon Tetrachloride	4,705	5	µg/L	Yes
20	20-22-W	Bromodichloromethane	75.8	0.168	µg/L	Yes
20	20-22-W	1,2-Dichloropropane	11.2	5	µg/L	Yes
20	20-22-W	Trichloroethene	44.6	5	µg/L	Yes
20	20-22-W	Benzene	9.33	5	µg/L	Yes

Table 2. Exceedances of MDEQ Tier 1 TRG for Groundwater, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Chemical of Concern	Site Concentration(1)	MDEQ Tier 1 TRG	Units	Concentration Exceeds Tier 1 TRG
20	20-22-W	1,1,2-Trichloroethane	74.4	5	µg/L	Yes
20	20-22-W	Tetrachloroethene	55.2	5	µg/L	Yes
20	20-23-W	Atrazine	30	3	µg/L	Yes
20	20-23-W	Dinoseb	27	7	µg/L	Yes
23	20-B	Chloroform	1,700	0.155	µg/L	Yes
23	20-B	Bromodichloromethane	36	0.168	µg/L	Yes
23	20-B	Dibromochloromethane	14	0.126	µg/L	Yes
23	22-A	Chloroform	44	0.155	µg/L	Yes
23	22-B	Chloroform	1,600	0.155	µg/L	Yes
23	22-B	Bromodichloromethane	66	0.168	µg/L	Yes
23	22-B	Dibromochloromethane	78	0.126	µg/L	Yes
23	22-B	Bromoform	160	8.48	µg/L	Yes
23	23-B	Chloroform	79	0.155	µg/L	Yes
23	22-1-W	Chloroform	6.78	0.155	µg/L	Yes

(1) Analytical data obtained from RFI process.
MDEQ Mississippi Department of Environmental Quality.
SWMU Solid Waste Management Unit.
Tier 1 TRG MDEQ Tier 1 TRG for Groundwater.
TRG Target Remediation Goal.
µg/L Micrograms per Liter.

ARCADIS

Table 3. Summary of Methods, Containers, Preservatives, and Holding Times, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
General Parameters						
VOCs	Water	5030, 5032	8260/624	3 x 40-mL vial with Teflon lined septum	pH < 2 with HCl, Cool 4°C	14 days
	Water	5030, 5032	8260/624	3 x 40-mL vial with Teflon lined septum	If effervescence is observed, eliminate HCl preservative and Cool 4°C	7 days
	Solid	5035	8260	3 x Encore™ OR 2 x Sodium Bisulfate vial	Cool 4°C	48 hours to preservation for Encore™, then 14 days to
SVOCs	Water	3510, 3520 [d]	8270 (Low Level)/625	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8270 (Low Level)	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Organochlorine Pesticides	Water	3510, 3520 [d]	8081/608	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8081	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Organochlorine Herbicides	Water	3510, 3520 [d]	8151	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8151	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Metals (except Mercury)	Water	3005, 3010	6010/6020/200.7	1 x 1-L HDPE	pH < 2 with HNO_3, Cool 4°C	6 months
	Solid	3050, 3051	6010	1 x 8-oz G	Cool 4°C	6 months
Waste Characterization Parameters						
Corrosivity (pH)	Aqueous Waste	NA	9040	250 mL HDPE	NA	24 hours
	Solid Waste Material	NA	9045	1 x 8-oz wide-mouth G	NA	24 hours
General Chemistry Parameters						
Ammonia	Water	NA	350.3	250 mL HDPE	pH < 2 with H_2SO_4, Cool 4°C	28 days
BOD	Water	NA	405.1	1 x 1-L HDPE	Cool 4°C	48 hours
Chloride	Water	NA	325.3/300.0/9056	250 mL HDPE/2 x 40 mL vial	Cool 4°C	28 days
COD	Water	NA	HACH 8000	125 mL HDPE	pH <2 with H_2SO_4	28 days
Fluoride	Water	NA	340.1/340.2	500 mL HDPE	Cool 4°C	28 days

Table 3. Summary of Methods, Containers, Preservatives, and Holding Times, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
Nitrate	Water	NA	353.2/300.0/9056	250 mL HDPE/ 2 x 40 mL vial	Cool 4°C	2 days
Phosphorus (Total)	Water	NA	365.1/365.2/365.5	1 x 100 mL HDPE or G	pH < 2 with H_2SO_4	28 days
Sulfate	Water	NA	375.4/300.0/9056	250 mL HDPE/	Cool 4°C	28 days
Total Dissolved Solids (TDS)	Water	NA	160.1	500 mL HDPE	Cool 4°C	7 days
Total Suspended Solids TSS)	Water	NA	160.2	500 mL HDPE	Cool 4°C	7 days

(b) Sample volumes may be combined for MNA parameters where preservatives are the same and adequate sample volume is supplied to the laboratory. Volumes
(c) Maximum holding time allowed from date of collection.
(d) Cleanup methods may be applicable if matrix interference is encountered. Cleanup methods may include alumina (Method 3610), florisil (Method 3620), silica gel
(e) *If residual chlorine is present, requires sodium thiosulfate in each sample container.*
(f) Waste Characterization addresses solid (soils, sludge, waste) material analysis for waste disposal purposes. Liquid (aqueous or organic) wastes will be
(g) This holding time is a contractual holding time that has been established by ARCADIS and is established in the USEPA Region 4 Laboratory Operations and

°C	Degrees Centigrade.	mL	Milliliter.
BOD	Biological Oxygen Demand.	MNA	Monitored Natural Attenuation.
COD	Chemical Oxygen Demand.	NA	Not Applicable.
G	Glass.	oz	Ounce.
GPC	Gel Permeation Chromatography.	RCRA	Resource Conservation and Recovery Act.
H_2SO_4	Sulfuric Acid.	SVOCs	Semivolatile Organic Compounds.
HCl	Hydrochloric Acid.	TSS	*Total Suspended Solids.*
HDPE	High Density Polyethylene.	USEPA	U.S. Environmental Protection Agency.
HNO_3	Nitric Acid.	VOCs	Volatile Organic Compounds.
L	Liter.		

Table 4. Proposed Soil Sampling Parameters, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Analytical Method	Chemical of Concern	MDEQ Tier 1 TRG (Restricted Use) (mg/kg)
Volatile Organic Compounds (VOCs)	Method 8260	Benzene	1.36
		Bromodichloromethane	1.89
		Bromoform	90.1
		Carbon Tetrachloride	0.569
		Chloroform	0.478
		Dibromochloromethane	68.1
		1,2-Dichloroethane	0.621
		Methylene Chloride	21.9
		1,1,1,2-Tetrachloroethane	220
		Tetrachloroethene	18.2
		Trichloroethene	7.92
		1,2,4-Trimethylbenzene	102,000
		1,3,5-Trimethylbenzene	436
		Vinyl Chloride	0.939
Semivolatile Organic Compounds (SVOCs)	Method 8270	Acetophenone	2,630
		Atrazine	25.8
		bis-(2-Ethyl)hexyl Phthalate	409
		Cyanazine	6.81
		4-Nitrophenol	16,400
		Pentachlorophenol	23.8
Organochlorine Pesticides	Method 8081	Toxaphene	5.2
Organochlorine Herbicides	Method 8151	Dinoseb	204
Metals	Method 6010 or 6020	Arsenic	11.8

MDEQ Mississippi Department of Environmental Quality.
mg/kg Milligrams per kilogram.
TRG Target Remediation Goal.

Table 5. Proposed Groundwater Sampling Parameters, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Analytical Method	Chemical of Concern	MDEQ Tier 1 TRG (µg/L)
Volatile Organic Compounds (VOCs)	Method 8260	Benzene	5 (MCL)
		Bromodichloromethane	0.168
		Bromoform	8.48
		Carbon Tetrachloride	5 (MCL)
		Chloroform	0.155
		Dibromochloromethane	0.126
		1,2-Dichloroethane	5 (MCL)
		Methylene Chloride	5 (MCL)
		1,1,1,2-Tetrachloroethane	0.406
		Tetrachloroethene	5 (MCL)
		Trichloroethene	5 (MCL)
		1,2,4-Trimethylbenzene	12.3
		1,3,5-Trimethylbenzene	12.3
		Vinyl Chloride	2 (MCL)
Semivolatile Organic Compounds (SVOCs)	Method 8270	Acetophenone	0.0416
		Atrazine	3 (MCL)
		bis-(2-Ethyl)hexyl Phthalate	6 (MCL)
		Cyanazine	0.0797
		4-Nitrophenol	292
		Pentachlorophenol	1 (MCL)
Organochlorine Pesticides	Method 8081	Toxaphene	3 (MCL)
Organochlorine Herbicides	Method 8151	Dinoseb	7 (MCL)
Metals	Method 6010 or 6020	Arsenic	50 (MCL)

MCL Maximum contaminant level.
MDEQ Mississippi Department of Environmental Quality.
µg/L Micrograms per liter.
TRG Target Remediation Goal.

Table 6. Proposed Storm Water Sampling Parameters, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Analytical Method	Chemical of Concern	Water Quality Limit (µg/L)
Analytical Parameters			
Volatile Organic Compounds (VOCs)	624	Benzene	PQL[1]
		Bromodichloromethane	PQL
		Bromoform	PQL
		Carbon Tetrachloride	PQL
		Chloroform	PQL
		Dibromochloromethane	PQL
		1,2-Dichloroethane	PQL
		Methylene Chloride	PQL
		1,1,1,2-Tetrachloroethane	PQL
		Tetrachloroethene	PQL
		Trichloroethene	PQL
		1,2,4-Trimethylbenzene	PQL
		1,3,5-Trimethylbenzene	PQL
		Vinyl Chloride	PQL
Semivolatile Organic Compounds (SVOCs)	625	Acetophenone	PQL
		Atrazine	PQL
		bis-(2-Ethyl)hexyl Phthalate	PQL
		Cyanazine	PQL
		4-Nitrophenol	PQL
		Pentachlorophenol	PQL
Organochlorine	608	Toxaphene	PQL
Organochlorine	8151	Dinoseb	PQL
Metals	200.7	Arsenic	PQL
Storm Water Parameters			
General Chemistry	350.3	Ammonia (as N)	PQL
	405.1	Biochemical Oxygen Demand (5-day)	PQL
	HACH 8000	Chemical Oxygen Demand	PQL
	325.3/300.0/9056	Chloride	75,000
	340.1/340.2	Fluoride (as F)	PQL
	353.2/300.0/9056	Nitrates (as N)	PQL
	9040	pH	PQL
	375.4/300.0/9056	Sulfate	120,000
	160.1	Total Dissolved Solids	400,000
	365.1/365.2/365.5	Total Phosphorus (as P)	PQL
	160.2	Total Suspended Solids	PQL
Organochlorine	608	Toxaphene	PQL
Organochlorine	8151	Dinoseb	PQL

(1) PQL to be used until final water quality regulatory limits for all chemicals of concern are presented in the forthcoming Agreed Order for Storm Water.

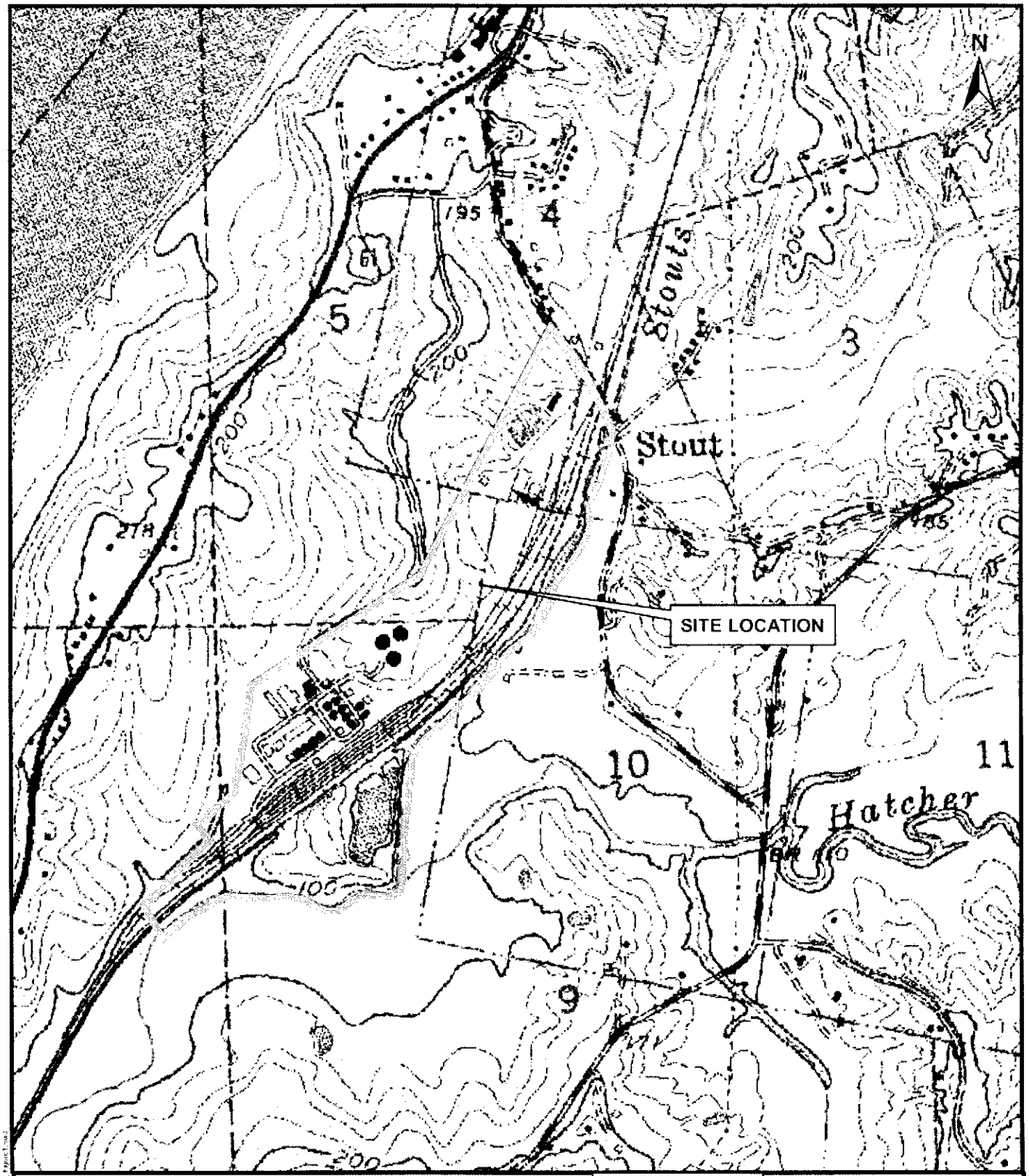
MCL Maximum contaminant level.

MDEQ Mississippi Department of Environmental Quality.

PQL Practical Quantitation Limit.

TRG Target Remediation Goal.

µg/L Micrograms per liter.



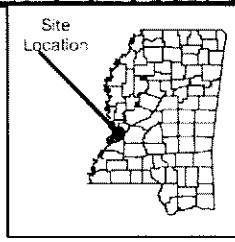
Former Plant Site

Note: Approximate Property Boundary

SITE LOCATION MAP

VICKSBURG CHEMICAL COMPANY

VICKSBURG, MISSISSIPPI



500 0 500 1,000 Feet

ARCADIS
10352 Plaza Americana Drive
Baton Rouge, Louisiana 70816
Tel: 225.292.1004 Fax: 225.218.9677

REFERENCE:

USGS, Vicksburg West Quadrangle, Mississippi
7.5 Minute Series (Topographic)

Project Manager: JE	Completed By: AB
Task Manager: CD	Date: 07/31/2006
Project No.: LA002656.0001	Figure No.: 1

LEGEND

PROPOSED SOIL SAMPLING LOCATIONS

ARSENIC AND TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

SOIL/SLUDGE CONTAINING VOCs

ARSENIC CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

CONCENTRATION OF CONTAMINATION EXCEEDS VALUES IN MDEQ TIER I TRG TABLE

TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

DINOSEB AND TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

AREA 1 – SWMU 1, 5, 7, 8, 9, 11, 12, 14, 15, 16, AND 17
AREA 2 – SWMU 20 (SW CORNER)
AREA 3 – SWMU 2
AREA 4 – SWMU 20 (AREA BOUNDED BY MW-13, MW-14, AND MW-1)
PROPOSED SOIL SAMPLE LOCATION
AREA 5 – SWMU 23

0 200' 400' 800'

DRAWN BY	CHECKED
S. MEN	CAD
PROJECT MANAGER	DEPARTMENT MANAGER
DRE	DRE
DATE	TASK/PHASE NUMBER
11-6-06	0007

10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
FAX: 225-218-9677
WWW.ARCADIS-US.COM

PROPOSED SOIL SAMPLING LOCATIONS

FORMER VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER: LA002656.0001

DRAWING NUMBER: 2

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User Name : dekinin

Path\Name : G:\APROJECT\Mississippi Bluffs\LA002656.0001\Figures\2456-01-02g-PropSoilSampLocation.dwg

User Name : dekinia Path\Name : G:\APROJECT\Mississippi Bluffs\LA002656.0001\Figures\MW LOCATIONS.dwg

LEGEND

MONITORING WELL LOCATION

0 200' 400' 800'

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DRAWN BY: D. EKINIA	CHECKED: CAD
PROJECT MANAGER: DRE	DEPARTMENT MANAGER: DRE
DATE: 12-14-06	TASK/PHASE NUMBER: 0007

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MONITOR WELL LOCATIONS

FORMER VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER: LA002656.0001

DRAWING NUMBER: 3

User Name : dekinia Path\Name : G:\APROJECT\Mississippi Bluffs\LA002656.0001\Figures\StormwaterSamplingLocations.dwg

LEGEND

10-FOOT CONTOUR INTERVAL

2-FOOT CONTOUR INTERVAL

PROPOSED STORM WATER SAMPLING LOCATION

0 200' 400' 800'

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DRAWN BY: S. MEN	CHECKED: CAD
PROJECT MANAGER: DRE	DEPARTMENT MANAGER: DRE
DATE: 10-26-06	TASK/PHASE NUMBER: 0007

ARCADIS
10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
FAX: 225-218-9677
WWW.ARCADIS-US.COM

PROPOSED STORM WATER SAMPLING LOCATIONS

FORMER VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER: LA002656.0001

DRAWING NUMBER: 4

Appendix A

Sample Core Log

ARCADIS G & M, Inc.
10352 Plaza Americana Drive
Baton Rouge, LA 70816

SAMPLE / CORE LOG

Boring/Well: _____ Project No.: _____

Site Location: _____ Drilling Started: _____ Drilling Completed: _____

Land-Surface Elev.: _____ Surveyed: ____ Estimated: ____ Datum: _____

Drilling Fluid: _____ Drilling Method Used: _____

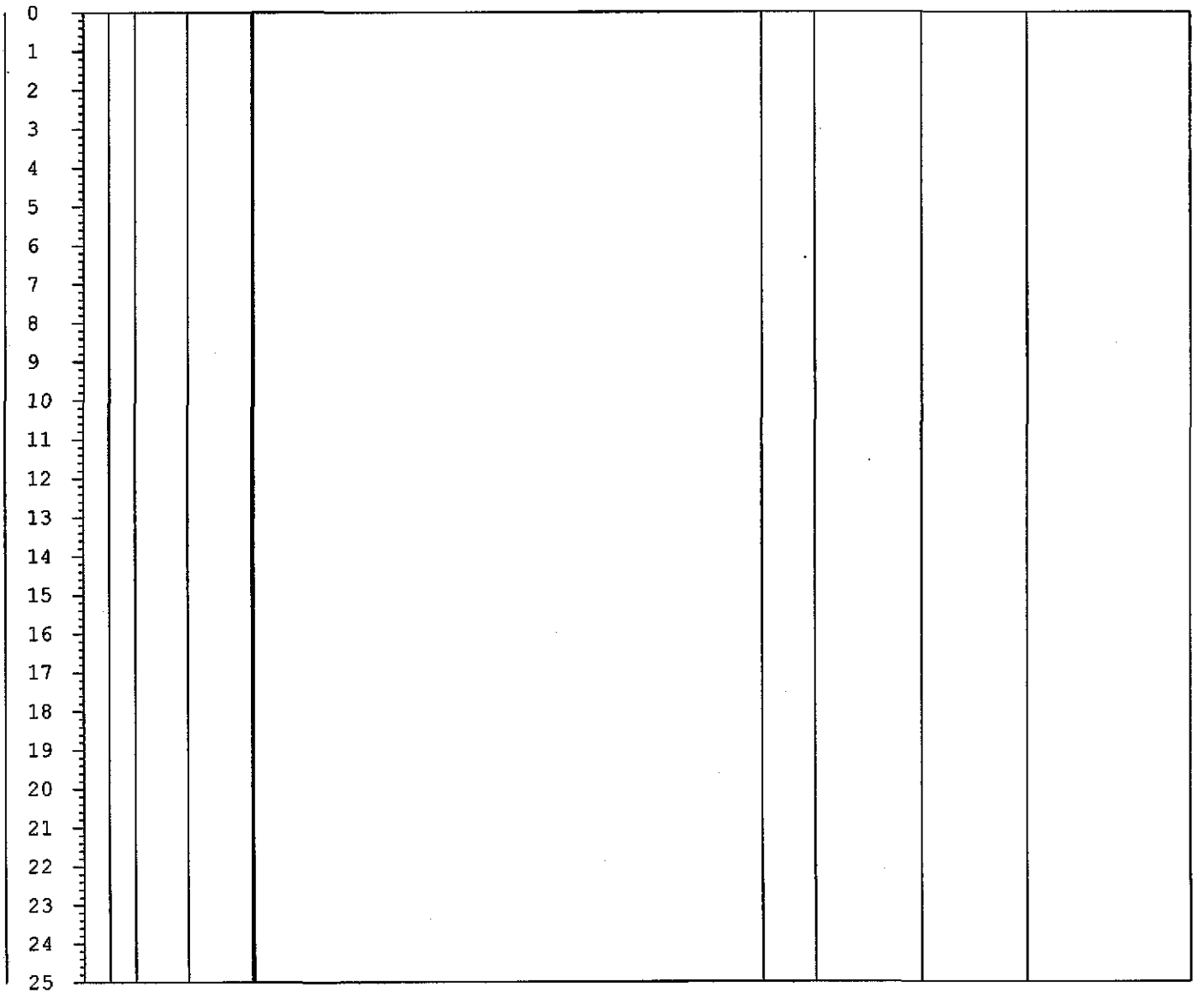
Drilling Contractor: _____ Driller: _____ Helper: _____

Prepared By: _____ Hammer Weight: _____ Hammer Drop (inches): _____

Fill | Silty Clay | Silt | Sandy Silt | Silty Sand | Acetate Sleeve | ≤ Water First Encountered

Clay | Sandy Clay | Clayey Silt | Sand | Clayey Sand | Split Spoon | ≥ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	OVA (wo/F)(w/F) (ppm) (ppm)	REMARKS



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Appendix B

Field Parameters and Water Sampling Logs

FIELD PARAMETERS

ARCADIS U.S., Inc.

Well Identification Number: _____

Project Name/Number: **Mississippi Bluffs/** _____ Date: _____

Water Level (TOC): _____ Total Depth: _____

OVM Reading: _____ Five Well Volumes: _____

Start Time: _____ Total Volumes Removed: _____

Time	Water Level (ft btoc)	Temp (°F/°C)	Spc. Cond. (µmhos/cm)	Turbidity (NTU)	pH (s.u.)

Observations/Comments: _____

_____

_____

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WATER SAMPLING LOG

roject _____ Project No. _____

Site Location _____ Date: _____

Site/Well No. _____ Replicate No. _____ Code No. _____

Weather _____ Sampling Time: Begin _____ End _____

Evacuation Data

Measuring Point _____

MP Elevation (ft) _____

Land Surface Elevation (ft) _____

Sounded Well Depth (ft bmp) _____

Depth To Water (ft bmp) _____

Water Level Elevation (ft) _____

Water Column In Well (ft) _____

Casing Diameter/Type _____

Gallons In Well _____

Gallons Pumped/Bailed Prior To Sampling _____

Sample Pump Intake Setting (ft bmp) _____

Purge Time Begin _____ End _____

Pumping Rate (gpm) _____

Evacuation Method _____

Field Parameters

Color _____

Odor _____

Appearance _____

pH (s.u.) _____

Conductivity (ms/cm) _____

Conductivity (µmhos/cm _____

Turbidity (NTU) _____

Temperature (^{O}C/ ^{O}F) _____

Dissolved Oxygen (mg/L) _____

ORP (mV) _____

Sampling Method _____

Remarks _____

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel

Well Casing Volumes

Gal./Ft. 1" = 0.04 | 1 - 1/2" = 0.09 | 2 - 1/2" = 0.26 | 3 - 1/2" = 0.50 | 6" = 1.47 | 1 - 1/4" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65

bmp	Below measuring point	ml	Milliliter	NTU	Nephelometric Turbidity Units
^{O}C/^{O}F	Degrees Celsius/Fahrenheit	mS/cm	Millisiemens per centimeter	PVC	Polyvinyl chloride
ft	Feet	msl	Mean sea level	s.u.	Standard units
gpm	Gallons per minute	NA	Not Applicable	µmhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds
ppt	Parts per thousand	CS	Carbon steel	SS	Stainless steel

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Appendix C

Historical Monitor Well Network

TABLE 1

GROUNDWATER DATA LEVEL MEASUREMENTS

Piezometer or Well Number	Casing Elevation (ft msl)	Bottom Elevation (ft msl)	Top of Screen (ft msl)	November 1993 Groundwater Elevation (ft msl)
MW 1 A	113.01	83.01	93.51	108.39
MW 2	108.21	68.21	78.71	98.87
MW 3	99.33	69.33	79.83	
MW 4	114.70	94.70	105.20	106.89
MW 5	100.30	80.30	85.80	84.01
MW 6	100.76	73.78	79.28	86.48
MW 7	99.66	69.33	74.83	92.39
MW 8	110.83	80.83	86.33	103.14
MW 9	116.02	58.02	73.02	110.89
MW 10	114.73	61.73	74.73	107.40
MW 11	105.62	57.62	70.62	98.16
MW 12	112.06	64.56	80.06	109.32
MW 13	113.52	63.52	73.52	109.51
MW 14	113.9	57.9	67.9	107.64
MW 15	Plugged and abandoned during surface impoundment retrofit			
MW 16	111.84	58.84	68.84	108.84
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

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Appendix D

Monitor Well Inspection Checklist

MONITOR WELL INSPECTION CHECKLIST

Project Name: _____ Project Number: _____

Inspectors Name: _____ Inspection Date: _____

Monitor Well ID: _____ Site Location: _____

Type of Well: ☐ Flush Mounted ☐ Above Grade

A. Condition of protective casing: _____

B. Condition of concrete pads (note cracks, breaks, slope direction): _____

_____

C. Condition of guard posts: _____

D. Is the well locked? _____

E. Is well identification number clearly marked? _____

F. Is the TOC elevation mark clearly visible on the well ? _____

G. Condition of well casing: _____

H. Condition of well cap: _____

I. Condition of surrounding grounds (i.e., overgrowth, is the well accessible, etc.): _____

J. Does water adequately drain from the well site?: _____

K. Total depth of well (properly decon tape between wells). _____

_____

L. Depth to top of grout from protective casing - length of protective casing above concrete pad: _____

M. Comments/Recommendations: _____

_____

Appendix E

Remedial Site Conceptual Exposure Model

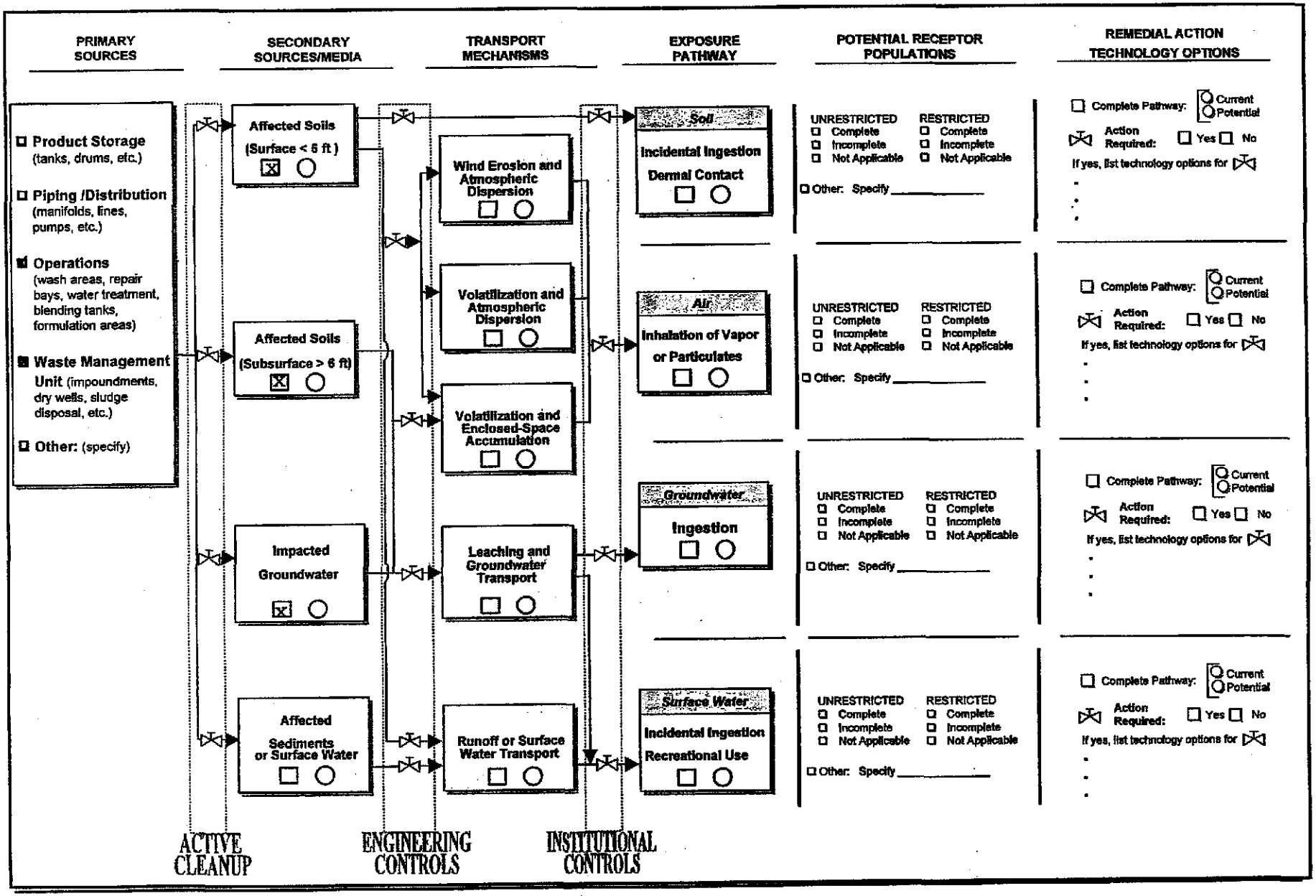
Worksheet

Remedial Site Conceptual Exposure Model (SCEM)

Site Name: Former Vicksburg Chemical Company
Site Location: Vicksburg Mississippi

Completed By: Craig Derouen
Revision Date: 11/20/06

☐ Complete ○ Potentially Complete ☒ Draft ☐ Final



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INDUSTRIAL PARK, LLC

SWMU 2 Slope Stability Work Plan

Former Vicksburg Chemical Company
Vicksburg, Mississippi

17 January 2007

ARCADIS

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SWMU 2 Slope Stability Work Plan

Former Vicksburg Chemical Company
Vicksburg, Mississippi

Prepared for:
Mississippi Department of Environmental Quality and Mississippi Bluffs Industrial Park, LLC

Prepared by:
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Our Ref.:
LA002656.0001.00009

Date:
17 January 2007

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2 Summary of Required Analyses

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1 Site Location Map

2 Proposed Stability Sampling Locations

Appendix

A Historical Data

B Field Forms

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1. Introduction and Work Plan Rationale

1.1 Objectives/Rationale

This Work Plan presents a scope of work for performing a slope stability study on the landfill area at the former Vicksburg Chemical Company (Vicksburg Chemical). The site was formerly a pesticide and herbicide manufacturing facility divided into two areas called the North Plant and South Plant. The landfill area, located in the South Plant, was designated Solid Waste Management Unit (SWMU) 2 during a Resource Conservation and Recovery Act (RCRA) mandated investigation. The primary objective of the activities proposed in this document will be to collect and evaluate soil samples to determine the stability of the existing slopes in the area of the on-site landfill. Secondary objectives will be to characterize the present depth of the landfill and to collect sufficient data to evaluate the landfill's capacity to receive additional material resulting from potential future remedial activities.

All investigative sampling proposed in this Work Plan will be conducted in accordance with the Mississippi Department of Environmental Quality's (MDEQ's) Brownfields Program. Waste characterization and disposal will be completed in accordance with MDEQ-approved methodology specific to this site.

1.2 Property Background

1.2.1 Property Location

Vicksburg Chemical was formerly owned by Cedar Chemical Corporation (Cedar Chemical). The facility is located south of Interstate 20 on Rifle Range Road within the southwestern section of the city of Vicksburg in Warren County, Mississippi. The site is composed of approximately 535 acres located in Sections 4, 5, 8, 9, and 10, township 15 north, range 3 east (Latitude: North 32° 18' 01", Longitude: West 90° 53' 57"). The site location is shown on Figure 1.

1.2.2 Property History

The North Plant began operation in 1961 and produced potassium nitrate, liquid chlorine, and liquid nitrogen tetroxide. The raw materials for the North Plant included potassium chloride and nitric acid. The South Plant began operation in 1953 manufacturing chlorinated pesticides, nitrogen-based herbicides, and other agricultural chemicals. The only active operations at the South Plant after 1992 were the nitric acid

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unit constructed in 1986 and a potassium carbonate unit constructed in 1994. During various periods prior to 1987, the South Plant produced dinitro butyl phenol (dinoseb or DNBP), monosodium methane arsenate (MSMA), diethyl hexyl phosphoric acid (DEHPA), 1-hydroxy-ethylidene-1-1-diphosphonic acid (UNIHIB), toxaphene, methyl parathion, cyanazine (bladex), and atrazine. Toxaphene and methyl parathion are insecticides, while atrazine, dinoseb, and MSMA are herbicides. Raw materials for these operating processes included chlorine, camphene, ortho-secondary butyl phenol (OSBP), sodium arsenate, sodium hydroxide, methyl chloride, sulfuric acid, sodium paranitrophenolate, and phosphorus trichloride.

Originally, the two plants were completely separate, owned and operated by two different companies. The South Plant was originally constructed by Spencer Chemical in 1953. American Metal Climax Corporation (Amax) constructed the North Plant in 1961. After purchasing the South Plant in 1964, Gulf Chemical added a formaldehyde unit in 1966. According to historical environmental documents, Vicksburg Chemical was formed in early 1972 and purchased both the Gulf Oil and Amax facilities (except the formaldehyde plant) in July 1972. In 1978, Vicksburg Chemical was merged into Vertac, Inc., which merged into Vertac Chemical Corporation (VCC) in September 1979. Cedar Chemical acquired the Vicksburg Chemical plant from VCC in February 1986. Fermenta A.B. of Sweden acquired Cedar Chemical in June 1986. Nine West Corporation (Trans Resources, Inc.) acquired Cedar Chemical in January 1988.

In addition to the above-mentioned operations at the plant, the property was the location of two additional operations: 1) an operation by Reagent Chemical to produce aqueous hydrochloric acid from a by-product of the toxaphene operation; and 2) a Gulf formaldehyde plant. The formaldehyde unit owned and formerly operated by Borden Chemical is located inside the former boundary of the South Plant.

1.3 Project History

1.3.1 Site-Wide

Vicksburg Chemical initiated a RCRA Facility Investigation (RFI) in 1994 and continued through 2001. The *RCRA Facility Investigation Draft Final Report* (URS 2001a) and *Draft Groundwater Assessment Report* (URS 2001b) were completed in August 2001 and November 2001, respectively. Both reports were submitted to the U.S. Environmental Protection Agency (USEPA) and subsequently

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approved in December 2001. A draft Corrective Measures Study was developed in the spring of 2002.

On March 8, 2002, VCC and Cedar Chemical filed for bankruptcy in the United States Bankruptcy Court for the Southern District of New York. The bankruptcy was contested by MDEQ, the Arkansas Department of Environmental Quality, USEPA Region 4, USEPA Region 6, and the U.S. Department of Justice. The court eventually approved an agreement allowing Vicksburg Chemical to abandon its properties and authorizing MDEQ to direct the transfer of the Vicksburg Chemical property to any entity identified by MDEQ. Since that time, MDEQ has kept the site under its control while structuring an agreement to clean up the plant site in a manner protective of human health and the environment. On December 19, 2005, MDEQ finalized an agreement for Mississippi Silvertip Development, LLC (Silvertip), to remediate the abandoned Vicksburg Chemical site. The developer, Silvertip, intends to create a Mississippi Bluffs Industrial Park to foster the sustainable reuse of the former chemical plant site and adjacent areas. It is anticipated that mixed use (i.e., light industrial, commercial, recreational, and residential) will be possible at the completion of the remedial action. Harcros Chemicals, Inc., is currently leasing portions of the former North Plant to facilitate a chemical blending, mixing, and distribution facility. Concurrently, ARCADIS U.S., Inc. (ARCADIS), is performing the remediation services with MDEQ oversight and control. Silvertip plans to construct high-end commercial and residential sites and a championship golf course on a good portion of the remaining acreage.

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1.3.2 SWMU 2

The following text was obtained from the MDEQ's *Preliminary Assessment Report* dated May 12, 2003:

> "The Inactive Landfill (SWMU 2) is located on a natural hill approximately 30 feet in elevation above the levees of the adjacent Surface Impoundment and between the railroad tracks and Hennessey's Bayou. The inactive disposal facility is approximately 500 feet by 500 feet and was used to receive residues associated with the manufacture of herbicides and insecticides. One pit was excavated atop the hill to store Dinoseb process wastewater. When the neutralization facilities for the Dinoseb process were completed, 200,000 gallons of wastewater was removed from the pond in 1980. Three other disposal pits were also excavated in this area. These pits were used as disposal locations for pallets, fiber and steel drums, and other solid waste material. Dredge materials

from the Surface Impoundment, contaminated with pesticides and chemical residues, were also placed into the disposal pits. Over 4,000 empty drums once containing cyanuric chloride, Dinoseb, tributylanline, methyl parathion and epichlorohydrin were stored in the three unlined pits. Vicksburg Chemical attempted to dissolve the drums with hydrochloric acid. The volume of acid is unknown. In 1977, the drums which could meet DOT requirements, were removed from the pits and disposed of off site.

The bags from the bag collectors in the Atrazine process area, contaminated with Atrazine, were placed in fiber drums and buried in the landfill. Numerous cyanuric chloride drums were also buried. Erosion of the landfill cover allowed for liberation of hydrochloric acid fumes as runoff reacted with remaining cyanuric chloride. Sixty-four (64) drums containing sulfur, PCl3, PSCl3 from the methyl parathion process were buried just north of the northernmost holding pond. Drums containing Dinoseb and other products were also buried in the landfill. Most burials occurred between 1972 and 1975. Since September 1975 all waste materials have been taken to permitted industrial waste landfills.

The landfill was initially closed in 1979 by regrading, covering with soil and planting with grass. Additional improvements occurred in 1983 with grading and construction of an engineered cap in accordance with plans by the MDEQ.

In 1988, the existing cover system of the landfill did not appear to be fully performing the purpose for which it was placed Interim corrective measures have been taken around the landfill unit to correct erosion problems."

1.4 Data Needs and Objectives

Additional site data are needed to evaluate the geotechnical properties of the existing landfill. Historical data and observations made during site visits have been used to identify locations of concern. Copies of the historical data identified in Appendix A are considered valid and usable. The objective of this sampling effort is to collect and evaluate soil samples to determine the stability of the existing slopes in the area of the on-site landfill. Secondary objectives are to collect sufficient data to evaluate the landfill's capacity to receive additional material and to determine the depth of the landfill.

1.5 Work Plan Approach

The general Work Plan strategy was developed to obtain samples representative of present site conditions. Personnel and equipment will be deployed to the Vicksburg Chemical site to collect soil samples from locations representative of the landfill area. Samples will be containerized and submitted to a geotechnical laboratory for analysis by the methods presented on Table 1.

2. Methodology

2.1 Sample Locations

The sample locations for this stability study are shown on Figure 2. These sample locations were selected because they represent areas that will provide information on the present construction of the landfill. The RFI indicated five main impacted areas requiring site remediation. These areas were defined in the *Quality Assurance Project Plan* (QAPP; ARCADIS 2006a) developed for this Site. Four distinct areas were defined in the South Plant and one in the North Plant. The stability study activities proposed in this Work Plan pertain to Area 3 – South Plant – SWMU 2 as presented in the QAPP. Soil samples will be collected from locations within and adjacent to this area to evaluate present site conditions.

2.2 Sample Collection Procedures

Some of the tasks that will be conducted during sampling activities have been outlined in detail in the QAPP. The pertinent sections are listed below and incorporated by reference.

2.2.1 Sampling Equipment and Procedures

Prior to sampling, a site visit will be conducted by an ARCADIS engineer to finalize the sample locations. Final sample locations will be surveyed and located on a base map for further use. The proposed stability sampling locations are shown on Figure 2.

Samples from eleven borings (B-1 through B-11) will be collected for geotechnical analyses. Samples from three borings (B-12 through B-14) will be used to characterize and determine the strata of the landfill. Samples from four borings (B-15 through B-18) will be advanced to the Byram Marl for visual characterization of the subsurface. Sample collection equipment will consist of a Geoprobe® or drill rig. The proper use of

a Geoprobe® in the collection of samples representative of site conditions is detailed in Section 11.2 in the QAPP. Samples will be collected from the drill rig in a manner consistent with Section 11.2 of the QAPP. The drill rig will be operated in accordance with the manufacturer's operations manual. Additionally, for safety reasons there will be more than one person on site during field sample collection. Safety precautions to protect workers are included in the Vicksburg Chemical *Health and Safety Plan* (ARCADIS 2006b). Decontamination of field equipment shall be conducted in accordance with the procedures described in Section 10.5 of the QAPP. The proposed stability sampling locations are shown on Figure 2.

Geotechnical samples will be collected from Borings B-1 through B-11. Cohesive or semi-cohesive material will be obtained at each 5-foot interval or change in strata, whichever is less. The samples will be collected using Shelby tubes or split-spoon samplers. Cohesive samples will be collected using a 3-inch Shelby tube barrel. Undisturbed samples collected using a Shelby tube barrel will be sealed on each end. The entire Shelby tube will be submitted to the laboratory for analysis. For cohesionless soils, a split-spoon sampler will be used. The extruded sample will be placed into laboratory-provided containers prior to shipment to the laboratory.

The samples will be containerized immediately upon collection. Undisturbed samples collected for geotechnical analysis will be kept with the containerized samples. The geotechnical samples will remain at ambient temperature until relinquished to the laboratory.

Borings B-12 through B-14 will be advanced at the locations shown on Figure 2. These borings will be used to characterize the subsurface strata. Samples will not be collected from these locations.

2.2.2 Sample Handling and Analysis

Sample handling and analysis were discussed in detail in Chapters 10 and 11 of the QAPP. These procedures will be followed as applicable to the handling of geotechnical samples during the implementation of this Work Plan. Table 1 contains a summary of the analyses that will be performed on each sample.

2.3 Documentation

Each sample will be described in the field upon collection. The observed characteristics will be documented on field forms (Appendix B) completed by sampling

personnel. In addition to the visual soil characteristics, the interval where groundwater was first encountered will be noted on the log. After field activities are completed, the boring log will be updated to include the results of the laboratory analyses and surveying activities.

2.4 Geotechnical Analyses

The samples collected during the implementation of this Work Plan will be containerized and submitted to a geotechnical laboratory for analyses. Table 2 contains a summary of the required analyses for each sample. The results of the testing procedures discussed below will be utilized in the determination the stability of the slopes at SWMU 2.

2.4.1 Laboratory Tests

Soil samples will be submitted to a laboratory for geotechnical testing. The following analyses, or equivalent, will be performed at the each boring location as shown on Table 2:

- Unconfined Compressive Strength Test: 1) ASTM International (ASTM) D2166, or 2) American Association of State Highway and Transportation Officials (AASHTO) T208;
- Unconsolidated Undrained Triaxial Test: ASTM D2850;
- Consolidation Test: ASTM D2435;
- Moisture Content: ASTM D2216;
- Atterberg Limits: ASTM D4318;
- Soil Density/Unit Weight: ASTM D854;
- Triaxial Permeability Test: ASTM D5084; and
- Visual identification of samples as well as soil classification to be performed on samples.

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The samples will be collected in containers that meet laboratory requirements for each analysis. Proper chain-of-custody procedures will be followed during the transport and relinquishment of sample volumes.

2.4.2 Field Tests

In addition to visual characterization, for cohesionless soils, a standard penetration test (ASTM D1586 – Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils) will be performed in the field on each 3-foot interval.

2.5 Survey

The depth and boring location of the samples collected during this evaluation will be recorded. A topographic survey of the entire landfill area, including the boring locations and elevations, will be conducted. All surveying activities will be conducted by a surveyor licensed by the State of Mississippi.

2.6 Investigation Derived Wastes

Waste materials generated during this investigation and corrective action will include soil, sludge, used sampling equipment, decontamination water, and used personal protective equipment. Waste materials will be containerized in 55-gallon drums or similar appropriate containers or will be placed back onto the landfill for incorporation in the final remedy. The drums will be staged in a secure location and will be incorporated into the remediation to be conducted at the site. Waste characterization and on-site disposal will be completed in accordance with MDEQ-approved methodology specific to this site.

2.7 Regulatory Involvement

All site activities will be conducted after receiving approval from MDEQ of this SWMU 2 Slope Stability Work Plan. MDEQ will have oversight on all aspects of remediation activities conducted at this Site as per the Agreed Order. Future sampling frequencies, parameter lists, methodology, etc., will be approved by MDEQ prior to field implementation.

3. Reporting

Following the completion of all field activities, the results of the Slope Stability Study activities will be included in the SWMU 2 Slope Stability report that will be prepared for submittal to MDEQ. The report will document all field activities and present an interpretation of surface and subsurface conditions. Appropriate historical and new data tables, figures, and appendices will be included in the report to support the text. The report will conclude by presenting recommendations for a path forward to obtain site closure.

4. Schedule

The sampling program will be initiated within 3 weeks of receiving written authorization to proceed from MDEQ. It is anticipated that the planned field activities can be completed within 2 to 3 weeks. Analytical data should be received within 3 weeks of completing the Slope Stability Study. A report will be prepared and submitted to MDEQ within 4 weeks of receipt of the analytical results. If field activities are delayed or if additional field activities are required to completely define the nature and extent of subsurface impacts, MDEQ will be promptly notified.

5. References

ARCADIS. 2006a. Quality Assurance Project Plan, Vicksburg Chemical Company. September 14.

ARCADIS. 2006b. Health and Safety Plan, Vicksburg Chemical Company. October 27.

MDEQ. 2003. Preliminary Assessment Report, Vicksburg Chemical Company. May 12.

URS. 2001a. RCRA Facility Investigation Draft Final Report, Vicksburg Chemical Company. August.

URS. 2001b. Draft Groundwater Assessment Report, Vicksburg Chemical Company. November.

D R A F T

Table 1. Summary of Geotechnical Methods, SWMU 2 Stability Study Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Matrix	Method
Geotechnical Laboratory Parameters		
Unconfined Compressive Strength of Cohesive Soil	Solid	ASTM D2166
Unconsolidated-Undrained Triaxial Compression	Solid	ASTM D2850
Consolidation Test	Solid	ASTM D2435
Moisture Content	Solid	ASTM D2216
Atterberg Limits	Solid	ASTM D4318
Unit Weight	Solid	ASTM D854
Triaxial Permeability Test	Solid	ASTM D855
Percent Passing the No. 200 Sieve (ASTM D1140)[1]	Solid	ASTMD
Geotechnical Field Parameters		
Standard Penetration Test	Solid	ASTM D1586

[1] Test may be conducted on samples collected from the borings presented in Table 2 at the discretion of the geotechnical engineer.

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Table 2. Summary of Proposed Analyses[1], SWMU 2 Stability Study Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

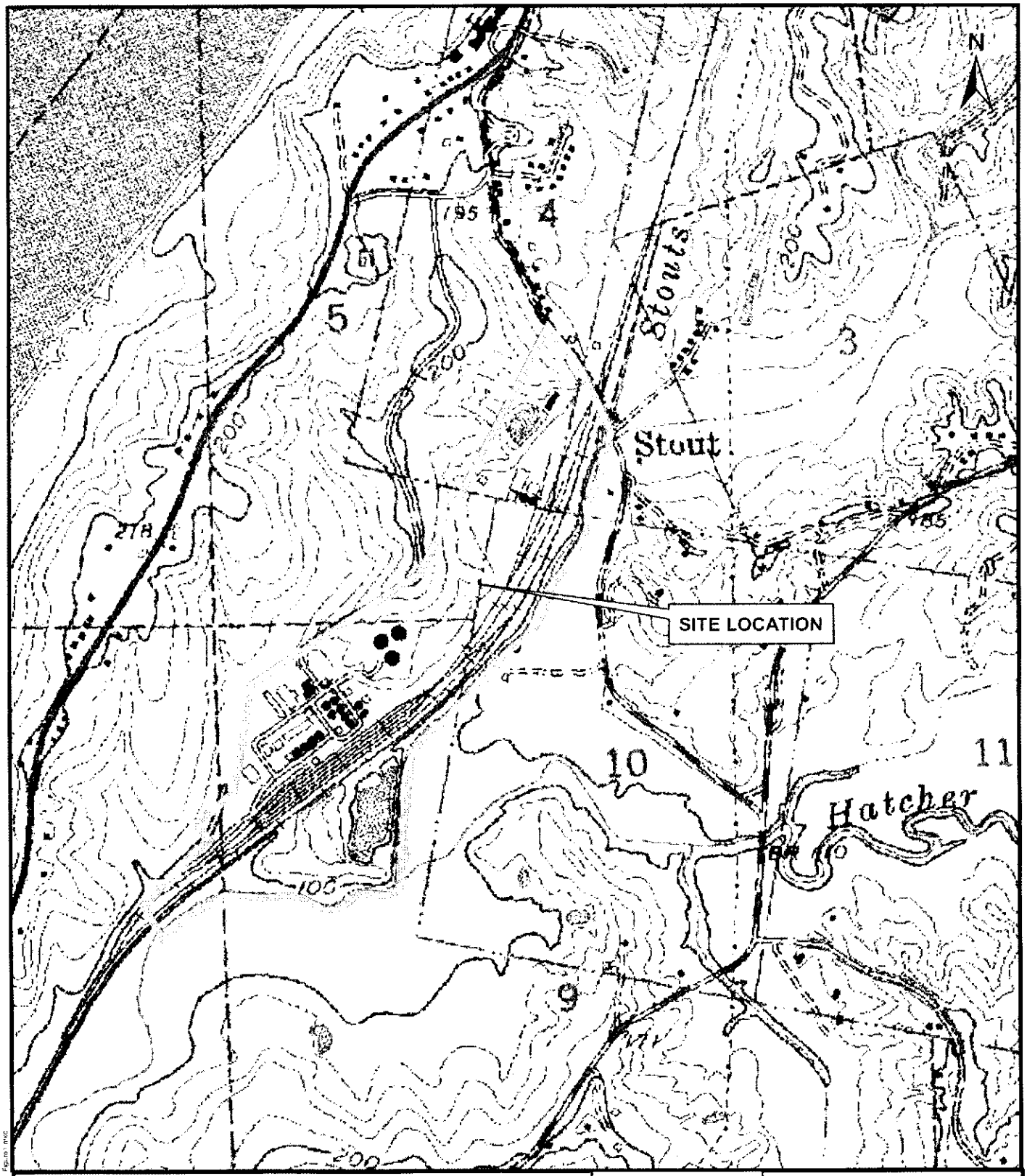
Sample[2]	Depth of Boring (feet)	Unconfined Compressive Strength (ASTM D2166)	Unconsolidated-Undrained Triaxial Compression (ASTM D2850)	Consolidation Test (ASTM D2435)	Moisture Content (ASTM D2216)	Atterberg Limits (ASTM D4318)	Unit Weight (ASTM D854)	Standard Penetration Test (ASTM D1586)	Triaxial Permeability Test (ASTM D5084)	Visual Log
B-1	80	4 samples on cohesive soils, except fissured clays	5 samples on fissured clays and/or silts		7 samples	7 samples	9 samples	Cohesionless Soils	2 samples	Yes
B-2	80	4 samples on cohesive soils, except fissured clays	5 samples on fissured clays and/or silts		7 samples	7 samples	9 samples	Cohesionless Soils	2 samples	Yes
B-3	80	4 samples on cohesive soils, except fissured clays	5 samples on fissured clays and/or silts		7 samples	7 samples	9 samples	Cohesionless Soils	2 samples	Yes
B-4	80	3 samples on cohesive soils, except fissured clays	2 samples on fissured clays and/or silts	6 Samples	5 samples	5 samples	5 samples	Cohesionless Soils		Yes
B-5	40	2 samples on cohesive soils, except fissured clays	2 samples on fissured clays and/or silts		4 samples	3 samples	3 samples	Cohesionless Soils		Yes
B-6	40	2 samples on cohesive soils, except fissured clays	2 samples on fissured clays and/or silts		3 samples	3 samples	3 samples	Cohesionless Soils		Yes
B-7	40	2 samples on cohesive soils, except fissured clays	1 sample on fissured clays and/or silts		3 samples	3 samples	3 samples	Cohesionless Soils		Yes
B-8	40	2 samples on cohesive soils, except fissured clays	1 sample on fissured clays and/or silts		3 samples	3 samples	3 samples	Cohesionless Soils		Yes
B-9	40	3 samples on cohesive soils, except fissured clays	2 samples on fissured clays and/or silts		3 samples	3 samples	3 samples	Cohesionless Soils		Yes
B-10	40	2 samples on cohesive soils, except fissured clays	2 samples on fissured clays and/or silts		3 samples	3 samples	3 samples	Cohesionless Soils		Yes
B-11	40	4 samples on cohesive soils, except fissured clays	1 sample on fissured clays and/or silts	4 Samples	3 samples	3 samples	3 samples	Cohesionless Soils		Yes

ARCADIS

Table 2. Summary of Proposed Analyses[1], SWMU 2 Stability Study Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Sample[2]	Depth of Boring (feet)	Unconfined Compressive Strength (ASTM D2166)	Unconsolidated-Undrained Triaxial Compression (ASTM D2850)	Consolidation Test (ASTM D2435)	Moisture Content (ASTM D2216)	Atterberg Limits (ASTM D4318)	Unit Weight (ASTM D854)	Standard Penetration Test (ASTM D1586)	Triaxial Permeability Test (ASTM D5084)	Visual Log
B-12[3]	80									Yes
B-13[3]	80									Yes
B-14[3]	80									Yes
B-15[4]	60									Yes
B-16[4]	60									Yes
B-17[4]	60									Yes
B-18[4]	60									Yes

(1) Proposed field activities. *Actual analyses conducted by the laboratory will be based on observed soil characteristics in the field.*
(2) Sample locations shown on Figure 2. Borings B-1 through B-4 will be sampled continuously for the first 40 feet, then every 5-feet interval thereafter. Borings B-5 through B-11 will be sampled continuously for the first 15 feet, then every 5 feet interval thereafter.
(3) Borings B-12, B-13, and B-14 will not be sampled for geotechnical parameters. They will be advanced continuously to the depth of the landfill contents and logged in the field only.
(4) Borings B-15 through B-18 will not be sampled for geotechnical parameters. They will be advanced continuously to the depth of theByram Marl and logged in the field only.



Former Plant Site

Note: Approximate Property Boundary

SITE LOCATION MAP

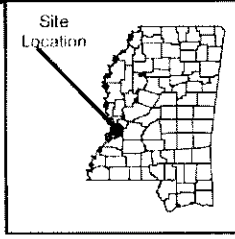
VICKSBURG CHEMICAL COMPANY

VICKSBURG, MISSISSIPPI

ARCADIS
10352 Plaza Americana Drive
Baton Rouge, Louisiana 70816
Tel: 225.292.1004 Fax: 225.218.9677

REFERENCE:

USGS, Vicksburg West Quadrangle, Mississippi
7.5 Minute Series (Topographic)



500 0 500 1,000
Feet

Project Manager: JE	Completed By: AB
Task Manager: CD	Date: 07/31/2006
Project No.: LA002656.0001	Figure No.: 1

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DRAWN BY: T. NICKEL	CHECKED: CAD
PROJECT MANAGER: DRE	DEPARTMENT MANAGER: DRE
DATE: 01-02-06	TASK/PHASE NUMBER: 0008

ARCADIS
10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
FAX: 225-218-9677
WWW.ARCADIS-US.COM

PROPOSED STABILITY SAMPLING LOCATIONS

FORMER VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER: LA002656.0001

DRAWING NUMBER: 2

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Appendix A

Historical Data

PE00-0717 | SHEET 1 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/2/00 FINISH 8/2/00 LOGGER H. Dean Lowe

Depth Below Surface (FT)	SAMPLE Interval	SAMPLE Type and Number	SAMPLE Recovery (IN)	Standard Penetration Test PID Results ~~6" 6" 6" (N)~~	SOIL DESCRIPTION: Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group	Symbolic Log	COMMENTS: Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation
	1.	LFS-1 A(0-4)	48	0.0	Tan fine silt (wea. Loess), friable, dry	ML	
5	2.		48	0.0	Same as above but moist at 4ft – V. moist at 5.3 ft.		
				9.0			
10	3		48	0.0	Gray fine silt (wea. Loess) grades to tan at 9.5 ft. Wet at 9 ft. V. wet at 11.2 ft.	ML	chemical odor at 9 ft. -- becomes less intense with depth
	4		46	0.0	Reddish stained w/ sweet chemical odor		
15				15			
	5	~~NDL~~ LSF LFS-1 B(14-16)	47	0.0 18	Lt. tan - gray fine silt (ML), soft saturated	ML	chemical odor
20	6	LFS-1 C(23-24)	39	0.0	Brown-tan fine silt (wea. Loess), firm, v. moist - grades to Tan at 20 ft and slightly moist to dry	ML	More intense odor at 18 ft.
				25.7			
25	7		46	0.0	Yellowish tan fine silt (Loess) soft, saturated		v. slight chemical odor at 25.7
	8		38	0.0	Grades to tan at 28 ft.	ML	
30							

PE00-0717 | SHEET 2 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/2/00 FINISH 8/2/00 LOGGER H. Dean Lowe

Depth Below Surface (FT)	SAMPLE Interval	SAMPLE Type and Number	SAMPLE Recovery (IN)	Standard Penetration Test/PID Results (N)	SOIL DESCRIPTION: Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group	Symbolic Log	COMMENTS: Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation
	8		38	0.0	Tan fine Silt (Wea. Loëss), soft, saturated - no odor		
	9		40	0.0			
35						ML	
	10		30	0.0			
40							
	11		32	0.0	Gray fine Silt (unwea. Loëss), soft, saturated, no odor	ML	
45					TD at 44 ft.		
					Well Construction Date Installed: 8/4/00 Constr. Materials: 3/4" ID PVC Backfill: Granular Bentonite Filter Sand: #3 Sand Screen: 3/4" ID PVC 0.010 slot Bottom:	Pipe & Screen	0 - 26 ft. bgs 26 - 48 ft. bgs 43 - 48 ft bgs 48 ft. bgs
					Water Levels Date: 8/4/00 Time: 1500 Depth: 42.45 ft. bgs Time: 1510 Depth: 40.75 ft. bgs		

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-1

Date Sampled: 8/2/00 Time Sampled:

Sampling Method: Geoprobe macro Sampler Sample Depth: 0 to 4 feet bgs

Type of Soil: fine silt (ML)

Sample Analysis: VOC Cyanide SVOC Pesticide/PCB Atrazine/Cyanazine/Dinoseb Sample Container: VOC = 2 oz. Clear Glass; SVOC = 4 oz. Amber Glass; Pesticide = 4 oz. Amber Glass; Atrazine = 4 oz. Amber Glass; Cyanide = 4 oz. Clear Glass

Sample Quantity Collected: 18 oz. Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/2/00

Remarks:

Sample No. LFS-1 A (0-4 ft. depth)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-1

Date Sampled: 8/2/00 Time Sampled:

Sampling Method: Geoprobe macro Sampler Sample Depth: 14 to 16 feet bgs

Type of Soil: fine silt (ML)

Sample Analysis: VOC, SVOC, Cyanide, Pesticide/PCB, Atrazine/Cyanazine/Dimeth Sample Container: VOC = 2 oz. clear Glass; SVOC = 4 oz. Amber Glass; Pesticide = 4 oz. Amber Glass; Atrazine = 4 oz. Amber Glass; Cyanide = 4 oz. Clear Glass

Sample Quantity Collected: 18 oz. Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/2/00

Remarks:

Sample No. LFS-1 B (14-16 ft. depth)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-1

Date Sampled: 8/2/00 Time Sampled:

Sampling Method: Geoprobe macro sampler Sample Depth: 24 to 26 feet bgs

Type of Soil: fine Silt (ML)

Sample Analysis: VOC, SVOC, Cyanide; Pesticide/PCB, Atrazine/Cyanazine/Dinoseb

Sample Container: VOC = 2 oz. Clear Glass; SVOC = 4 oz. Amber Glass; Pesticide = 4 oz. Amber Glass; Atrazine = 4 oz. Amber Glass; Cyanide = 4 oz Clear Glass

Sample Quantity Collected: 18 oz Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/2/00

Remarks:

Sample No. LFS-1C (24-26 ft. depth)

GROUNDWATER SAMPLING LOG
PETRA ENVIRONMENTAL, INC.
Houston, Texas *Baton Rouge, Louisiana*

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS

Boring Number: LFS-1

Date Sampled: 8/6/00

Time Sampled: VOC = 0645
Metals/Cyanide = 0830
SVOC = 0835
Pest/PCB & Atrazine = 1000

Sampling Method: VOC = SS Bailer
Others = Geoprobe vacuum

Sample Depth: 43-48 feet bgs

:Sample Type: Grab

Sample Number(s): LS1-W

:Sample Quantity Collected: 3.8 liters

Sample Container: VOC = 40 ml glass vial
Cyanide = 500 milliter plastic
Metals = 250 milliter plastic
Others = 1 liter amber glass

Sample Analysis: VOC Pesticide/PCB Atrazine/Cyanazine/Dinoseb
Cyanide T. Metals

Preservative: VOC = HCL
Cyanide = NaOH
Metals = HNO_3

Purging: N/A Well installed with Geoprobe

Time: 0610 SWL(ft): 40.7 Well Depth(ft bgs): 48 Well Vol.(gal): N/A

	pH	Cond.	Temp.(degrees)	Vol. Removed (gal)
1st WV				
2ndWV				
3rdWV				
Ave.				Total

Remarks:

Sampling: Slow well yield = approx. 1 liter per hour

Time: WL(ft):

pH: Cond(mhos): Temp.(degrees C F)

Remarks:

Field Technician: H. Dean Lowe

Signature / Date:
H. Dean Lowe 8/6/00

PE00-0717 | SHEET 1 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/3/00 FINISH 8/3/00 LOGGER H. Dean Lowe

Depth Below Surface (FT)	SAMPLE Interval	SAMPLE Type and Number	SAMPLE Recovery (IN)	Standard Penetration Test/PID Results	SOIL DESCRIPTION (Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group)	Symbolic Log	COMMENTS (Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation)
	1	LFS-2 A (0-4)	47	0.0	Tan fine silt, dry	ML	Fill
				2.2	Tan fine silt (wea. Loess), firm, dry	ML	
				4.0			
5	2		46	0.0	Lt. gray fine silt, firm, moist	ML	Sweet chemical odor @ 4 ft. Pond muck
		LFS-2 B (8-10)		0.0 8.2	Becomes yellowish tan wet, soft @ 8.6 ft		Stronger odor @ 8.2 ft (no register on PID)
10	3		36	0.0 9.8	Rust red stained fine silt, firm, dry	ML	Sweet chemical odor
				10.2	Lt. Gray fine silt, firm to soft, moist & wet		
				0.0		ML	Sweet chemical odor
	4		43	0.0			
				M.2			
15				0.0	Reddish tan fine silt, moist, firm-soft, iron stained top 3"	ML	Sweet chemical odor
				0.0 16.4	Lt. gray fine silt, moist, medium	ML	Sweet chemical odor
				17.0	(Pond muck)		
	5		47	0.0	Reddish tan fine silt (wea. Loess) firm, moist	ML	Pond bottom @ 17 ft. Sweet chemical odor
20							
	6		42	0.0	Same as above	ML	Sweet chemical odor
25							
	7	LFS-2 C (27-29)	47	25.5 0.0	Wet Same as above	ML	Sweet chemical odor
	8		38	0.0 29	Saturated @ 29 ft. Same as above except Lt. tan	ML	Slight chemical odor
30							

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-2

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe Macro Sampler Sample Depth: 0 to 4 feet bgs

Type of Soil: Silt

Sample Analysis: VOC SVOC Cyanide Pesticide/PCB Atrazine, Cyanazine, dimeb

Sample Container: VOC = 2oz Glass; SVOC = 4oz AmberGlass; Pesticide = 4oz AmberGlass; Atrazine = 4oz AmberGlass; Cyanide = 4oz Clear Glass

Sample Quantity Collected: 18 oz Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-2A (0-4)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-2

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe Macro Sampler Sample Depth: 8 to 10 feet bgs

Type of Soil: Silt

Sample Analysis: VOC Pesticide/PCB SVOC Atrazine/Cyanazine/Dimseb Cyanide Sample Container: VOC = 2oz Glass Cyanide = 4oz Glass Other = 4oz Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-2B (8-10)

SOIL SAMPLING LOG

PETRA ENVIRO: IMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-2

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro Sampler Sample Depth: 27 to 29 feet bgs

Type of Soil: Silt

Sample Analysis: VOC Pesticide/PCB SVOC Atrazine/Cyanazine/Dimsel Cyanide Sample Container: VOC = 2 oz. Glass Cyanide = 4 oz. Glass Others = 4 oz. Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe

---

Remarks:

Sample # LFS-2C (27-29)

GROUNDWATER SAMPLING LOG
PETRA ENVIRONMENTAL, INC.
Houston, Texas *Baton Rouge, Louisiana*

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS

Boring Number: LFS-2

Date Sampled: 8/4/00

Time Sampled: 1700

Sampling Method: VOC = ~~SS~~ HDC Bailer
Cyanide = Peristaltic Pump
Metals = Peristaltic Pump

Sample Depth: 43-48 feet bgs

:Sample Type: Grab

Sample Number(s): LS2-W

:Sample Quantity Collected: 790 ml

Sample Container: VOC = 40 ml glass vial
Cyanide = 500ml plastic
Metals = 250ml plastic

Sample Analysis: VOC
Cyanide
Ti Metals

Preservative: VOC = HCl
Cyanide = NaOH
Metals = HNO_3

Purging: N/A Wells set with Geopumbe

Time: ~~SPC~~ 7/20/1633 SWL(ft): 37.95 Well Depth(ft bgs): 48 Well Vol.(gal): N/A

	pH	Cond.	Temp.(degrees)	Vol. Removed.(gal)
1st WV				
2ndWV				
3rdWV				
Ave.			Total	

Remarks:

Sampling: Low well yield = approximately 1.2 liters per hour

Time: WL(ft):

pH: Cond(mhos): Temp.(degrees C F)

Remarks:

Field Technician: H. Dean Lowe

Signature / Date:
H. Dean Lowe 8/4/00

GROUNDWATER SAMPLING LOG
PETRA ENVIRONMENTAL, INC.
Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS - 2

Date Sampled: 8/5/00 Time Sampled: 1300

Sampling Method: Geoprobe vacuum Sample Depth: 43 - 48 feet bgs

:Sample Type: Grab Sample Number(s): LS 2 - W

:Sample Quantity Collected: 3 liters Sample Container: 1 liter - Amber Glass

Sample Analysis: Pesticide / PCB SVOC Atrazine/Cyanazine/Dinoseb Preservative: None

Purging: N/A well installed with Geoprobe

Time: 1200 SWL(ft): 37.90 Well Depth(ft bgs): 48 Well Vol.(gal): N/A

	pH	Cond.	Temp.(degrees)	Vol. Removed.(gal)
1st WV				
2ndWV				
3rdWV				
Ave.				Total

Remarks:

Sampling: Low well yield = approx. 1.2 liters per hour

Time: WL(ft):

pH: Cond(mhos): Temp.(degrees C F)

Remarks:

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/5/00

PROJECT NUMBER PE00-0717 | SHEET 1 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/2/00 FINISH 8/2/00 LOGGER H. Dean Lowe

Depth Below Surface (FT)	SAMPLE Interval	SAMPLE Type and Number	SAMPLE Recovery (IN)	~~Standard Penetration Test Results 6"-6"-6" (N)~~ PID	SOIL DESCRIPTION Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group	Symbolic Log	COMMENTS Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation
	1	LFS-3 A(0-4)	45	0.0	Tan fine silt (Loëss fill), med. dry	ML (Fill)	
5	2		41	0.0 6.3	Becomes reddish tan at 6.3 ft. and slightly moist		Fill
					Reddish tan fine silt (weg. Loëss), medium, dry to slightly moist		Native Soil
10	3		44	0.0	Same as above		
15	4	LFS-3 B(14-16)	38	0.0	Same as above	ML	
	5		40	0.0	Same as above		
20	6		34	0.0	Same as above but less red color		
25	7	LFS-3 C(24-26)	36	0.0	Same as above - v. moist wet at 25.5 Saturated at 28.1 ft.		
30	8		42	0.0			

PE00-0717 | SHEET 2 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/2/00 FINISH 8/2/00 LOGGER H. Dean Lowe

Depth Below Surface (FT)	SAMPLE Interval	SAMPLE Type and Number	SAMPLE Recovery (IN)	Standard Penetration ~~Test~~ PID ~~Results~~ ~~6" 6" 6"~~ ~~(N)~~	SOIL DESCRIPTION Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group	Symbolic Log	COMMENTS Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation
	8		42	0.0	Tan fine silt (wea. Loëss), soft, saturated		
	9		40	0.0	Same as above	ML	No odor
35	10		37	0.0	Same as above.		
40					TD = 40 ft.		
					Well Construction Date Installed: 8/4/00 Constr. Materials: 3/4" ID PVC Pipe & Screen Backfill: Granular Bentonite Filter: #3 sand Screen: 3/4" ID PVC 0.010 slot Bottom:		0-25 ft. bgs 25-~~48~~ 45 ft. bgs 43-~~48~~ 45 ft. bgs ~~45~~ 45 ft. bgs
					Water Levels Date: 8/4/00 Time: 1130 Depth: 40.0 Time: 1340 Depth: 40.10 Time: 1547 Depth: 38.91		

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-3

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro sampler Sample Depth: 0 to 4 feet bgs

Type of Soil: Silt

Sample Analysis: VOC SVOC Cyanide Pesticide/PCB Atrazine/Cyanazine/Diesel Sample Container: VOC = 2oz Glass; Cyanide = 4oz Glass; Others = 4oz Amber Glass

Sample Quantity Collected: 18oz Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-3A (0-4)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-3

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro Sampler Sample Depth: 14 to 16 feet bgs

Type of Soil: Silt

Sample Analysis: VOC, SVOC, Cyanide, Pesticide/PCB, Atrazine/Cyanazine/Dinoseb Sample Container: VOC = 2 oz Glass; Cyanide = 4 oz Glass; Others = 4 oz Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-3 B(14-16)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS - 3

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro Sampler Sample Depth: 24 to 26 feet bgs

Type of Soil: Silt

Sample Analysis: VOC SVOC Cyanide Pesticide/PCB Atrazine/Cyanazine/Dinoseb Sample Container: VOC = 2 oz Glass; Cyanide = 4 oz Glass; Others = 4 oz Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe

---

Remarks:

Sample # LFS-3C (24-26)

GROUNDWATER SAMPLING LOG
PETRA ENVIRONMENTAL, INC.
Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS - 3

Date Sampled: 8/6/00 Time Sampled: 1300/1520

Sampling Method: VOC = SS Bailer Other = Geoprobe vacuum Sample Depth: 40-45 feet bgs

:Sample Type: Grab Sample Number(s): LS3 - W

:Sample Quantity Collected: Metals = 250ml Cyanide = 500ml Pesticide/PCB = 1 liter Sample Container: Metals = 250 ml plastic Cyanide = 500ml plastic Pesticide/PCB = 1 litre amber glass

Sample Analysis: T. Metals Cyanide Pesticide/PCB Preservative: metals = HNO_3 Cyanide = NaOH Pesticide = None

Purging: N/A Well installed with Geoprobe

Time: 0710 SWL(ft): 38.9 Well Depth(ft bgs): 45 Well Vol.(gal): N/A

	pH	Cond.	Temp.(degrees)	Vol. Removed.(gal)
1st WV				
2ndWV				
3rdWV				
Ave.			Total	

Remarks:

Sampling: V. low yield & turbid = approx. 1/4 liter per hour

Time: WL(ft):

pH: Cond(mhos): Temp.(degrees C F)

Remarks:

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/6/00

PE00-0717 | SHEET 1 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/3/00 FINISH 8/3/00 LOGGER H. Dean Loar

Depth Below Surface (FT)	SAMPLE Interval	SAMPLE Type and Number	SAMPLE Recovery (IN)	Standard Penetration Test / PID Results / PID	SOIL DESCRIPTION: Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group	Symbolic Log	COMMENTS: Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation
	1	LFS-4 A (0-4)	40	~~50.5~~ 0.0	Lt. Tan to reddish tan fine silt Fill	ML	
					Reddish tan fine silt (loess) Firm, moist		- Mod. Sweet Chemical odor @ 2.7 ft.
				50.5	Yellowish tan @ 4 ft. Tan @ 4.2		- Strong sweet chemical odor @ 4-4.2 ft. Moderate odor below 4.2 ft.
5	2	LFS-4 B (4-6)	42	4.6	- V. wet 6.7 to 8 ft.		
				1.0	Dry to slightly moist below 8 ft.		
						ML	
10	3		38	1.0	Same as above		Detectable odor
	4		36	1.3	Same as above		
15							
	5		40	0.0	- Becomes v. moist @ 18.2 ft.		slight odor
20							
	6		36	0.0	Same as above but moist - dry		
25							
	7	LFS-4 C (24-26)	34	0.0	Same as above		
	8		38	~~NA~~ 0.0	Saturated @ 28.5 ft. Tan fine silt (wea. loess) Soft		slight odor
30							

PE00-0717 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/3/00 FINISH 8/3/00 LOGGER H. Deem Lowe

Depth Below Surface (FT)	SAMPLE: Interval	Type and Number	Recovery (IN)	~~Standard Penetration Test~~ PID Reading (ppm)	SOIL DESCRIPTION: Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group	Symbolic Log	COMMENTS: Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation
	8		38	0.0	Tan fine silt (wea. Loess) s.ft, saturated		V. slight sweet chem. odor
	9		37	0.0	same as above	ML	
35							
	10		34	0.0	Same as above		V. slight odor
40							
					TD @ 40 ft Well Construction Date Installed: 8/4/00 Constr. Material: 3/4" ID PVC Pipe & Screen Backfill: Bentonite Granules: 0 - 43 ft. bgs Filter: #3 sand (2" ID borehole) 28 - 48 ft. bgs Screen: 3/4" ID, 0.010 slot PVC 43 - 48 ft. bgs Casing: 3/4" ID PVC pipe 0 - 43 ft. bgs Bottom: 48 ft. bgs Water Level Date: 8/4/00 Time: 1007 Depth: 42.9 ft. bgs Time: 1027 Depth: 42.5 ft. bgs Time: 1325 Depth: 38.7 ft. bgs Time: 1533 Depth: 37.45 ft. bgs		

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-4

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe Macro Sampler Sample Depth: 0 to 4 feet bgs

Type of Soil: Silt

Sample Analysis: VOC Pest/PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide T. Metals Sample Container: VOC = 2 oz Glass Cyanide = 4oz Glass Others = 4oz amber Glass

Sample Quantity Collected: 18 oz Preservative Used: NONE

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-4A (0-4)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-4

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro sampler Sample Depth: 4 to 6 feet bgs

Type of Soil: Silt

Sample Analysis: VOC Pest/PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide T. Metals

Sample Container: VOC = 2oz. Glass Cyanide = 4oz. Glass Others = 4oz amber Glass

Sample Quantity Collected: 18 oz Preservative Used: NONE

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-4B(4-6)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS - 4

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe Macro Sampler Sample Depth: 24 to 26 feet bgs

Type of Soil: Silt

Sample Analysis: VOC Pest/PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide Sample Container: VOC = 2 oz. Glass; Cyanide = 4 oz. Glass; Others = 4 oz. Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: NONE

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-4C (24-26)

GROUNDWATER SAMPLING LOG
PETRA ENVIRONMENTAL, INC.
Houston, Texas *Baton Rouge, Louisiana*

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS

Boring Number: LFS-4

Date Sampled: ~~8/4~~ 8/5/00

Time Sampled: VOC, Cyanide, Metals = 1630; Pest/PCB, SVOC, Atrazine = 1800

Sampling Method: VOC = SS Bailer; others = Geoprobe vacuum

Sample Depth: 43-48 feet bgs

:Sample Type: Grab

Sample Number(s): LS4-W

:Sample Quantity Collected: 3.8 liters

Sample Container: VOC = 40ml glass vial; Cyanide = 500ml liter plastic; Metals = 250ml liter plastic; others = 1 Liter Amber Glass

Sample Analysis: VOC Pesticide/PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide T. Metals

Preservative: VOC = HCL; Cyanide = NaOH; Metals = HNO_3; others = None

Purging: N/A well installed w/ Geoprobe

Time: 1802 SWL(ft): 38.5 Well Depth(ft bgs): 48 Well Vol.(gal): N/A

	pH	Cond.	Temp.(degrees)	Vol. Removed.(gal)
1st WV				
2ndWV				
3rdWV				
Ave.			Total	

Remarks:

Sampling: Low well yield = approximately 1 liter per hour

Time: WL(ft):

pH: Cond(mhos): Temp.(degrees C F)

Remarks:

Field Technician: H. Dean Lowe

Signature / Date:

H. Dean Lowe 8/5/00

PE00-0717 | SHEET 1 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/3/00 FINISH 8/3/00 LOGGER H. Dean Lowe

Depth Below Surface (FT)	SAMPLE Interval	SAMPLE Type and Number	SAMPLE Recovery (IN)	~~Standard Penetration Test~~ PID ~~Results~~ ~~(N)~~	SOIL DESCRIPTION: Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group	Symbolic Log	COMMENTS: Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation
	1	LFS-5 A (0-4) MS(0-4) MSD (0-4)	39	0.0 2.3	Lt. tan fine silt w/ thin clay @ base, dry	ML	Fill No Odor
					Tan fine silt, firm, dry	ML	Fill No odor
5	2		43	5.5 0.0	Gray-tan silty verigated clay of low plasticity, med., Moist Becomes reddish tan @ 7ft.	CL	Fill slight chemical odor
10	3		40	0.0 10 0.0	Reddish brown silty clay, firm, with occas. manganese nodules, moist	CL	Chemical odor
15	4		32	0.0	Same as above but verigated	CL	Chemical odor
	5	LFS-5 B (16-18)	43	6.1 0.0	Yellowish colored lense Same as above	CL	strong chemical odor
20	6		32	3.7 21.7 0.0	Same as above	CL	chemical odor
					Gray fine silt with hummus in top 6", moist, med. dense	ML	No chemical odor
25	7		31	0.0 24.9 0.0 25.2 0.0 25.8	Red silty clay, high plasticity	CH	No chemical odor
					Tan-gray laminated silt & silty clay	ML/CL	No chemical odor
					Dk gray silty clay, with black humus specks, moist, stiff medium to low plasticity	CL	No chemical odor
30	8		31	28.5	Gray v. silty clay, low plasticity v. moist, soft	CL	No chemical odor

PE00-0717 | SHEET 2 OF 2

SOIL BORING LOG

PROJECT Vicksburg Chemical Co Landfill LOCATION Vicksburg, MS

ELEVATION _____ DRILLING CONTRACTOR Petra Environmental, Inc.

DRILLING METHOD AND EQUIPMENT Geoprobe 5400 Truck Mounted

WATER LEVEL AND DATE _____ START 8/3/00 FINISH 8/3/00 LOGGER H. Dean Love

Depth Below Surface (FT)	SAMPLE Interval	Type and Number	Recovery (IN)	Standard Penetration Test/PID Results (M)	SOIL DESCRIPTION: Soil Name, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USGS Group	Symbolic Log	COMMENTS: Monitoring Well Installation, Geotechnical Properties, Analytical Tests, Instrumentation
	8		31	0.0	Gray v.silty clay, low plasticity, with humus specks, v. moist firm to stiff	CL	No chemical odor
	9	JFS-5 C (34-36)	32	0.0 33.5 0.0 35 0.0	Reddish brown silty clay of moderate to high plasticity, stiff to hard grades to gray Gray v. silty clay, low plasticity	CH CL	No chemical odor No chemical odor
	10		30	36.5 0.0	Reddish tan fine slightly clayey silt, soft, saturated	ML	No chemical odor
					TD @ 40 ft.		

Well Construction
Date Installed : 8/4/00
Constr. Material : 3/4" pipe (PVC) & screen
Backfill : Bentonite Granules 0 - 25
Filter : #3 sand (2" ID Borehole) 25 - 48
Screen : 3/4" ID 0.010 slot PVC 43 - 48
Casing : 3/4" ID PVC pipe 0 - 48
Bottom: 48

Water Level
Date : 8/4/00
Time : 0900 Depth : 43.2
Time : 0915 Depth : 43.0
Time : 0930 Depth : 43.0
Time : 1320 Depth : 43.3
Time : 1540 Depth : 40.65

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-5

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro Sampler Sample Depth: 0 to 4 feet bgs

Type of Soil: Clay

Sample Analysis: VOC Pest / PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide

Sample Container: VOC = 2 oz. Glass; Cyanide = 4oz. Glass; Others = 4 oz. Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: NONE

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-5A (0-4)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-5

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro sampler Sample Depth: 0 to 4 feet bgs

Type of Soil: Clay

Sample Analysis: VOC Pest / PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide Sample Container: VOC = 2 oz. Glass; Cyanide = 4oz. Glass; Others = 4 oz. Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: NONE

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-5MS (0-4)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-5

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro sampler Sample Depth: 0 to 4 feet bgs

Type of Soil: Clay

Sample Analysis: VOC Pest / PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide Sample Container: VOC = 2 oz. Glass; Cyanide = 4oz. Glass; Others = 4 oz. Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: None

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-5 MSD (0-4)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-5

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro sampler Sample Depth: 16 to 18 feet bgs

Type of Soil: Clay

Sample Analysis: VOC Pest / PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide Sample Container: VOC = 2 oz. Glass; Cyanide = 4oz. Glass; Others = 4 oz. Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: NONE

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-5B (16-18)

SOIL SAMPLING LOG

PETRA ENVIRONMENTAL, INC.

Houston, Texas Baton Rouge, Louisiana

Project Name: Vicksburg Chemical Co.Landfil Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS Boring Number: LFS-5

Date Sampled: 8/3/00 Time Sampled:

Sampling Method: Geoprobe macro sampler Sample Depth: 34 to 36 feet bgs

Type of Soil: Clay

Sample Analysis: VOC Pest / PCB SVOC Atrazine/Cyanazine/Dinoseb Cyanide

Sample Container: VOC = 2 oz. Glass; Cyanide = 4oz. Glass; Others = 4 oz. Amber Glass

Sample Quantity Collected: 18 oz Preservative Used: NONE

Field Technician: H. Dean Lowe Signature / Date: H. Dean Lowe 8/3/00

Remarks:

Sample # LFS-5 C (34-36)

GROUNDWATER SAMPLING LOG
PETRA ENVIRONMENTAL, INC.
Houston, Texas *Baton Rouge, Louisiana*

Project Name: Vicksburg Chemical Co. Landfill Site Name: Vicksburg Chemical Co. Plant

Location: Vicksburg, MS

Boring Number: LFS-5

Date Sampled: 8/6/00

Time Sampled: VOC = 0705 Other = 1200

Sampling Method: VOC = SS Bailer Geoprobe Vacuum

Sample Depth: ~~43~~ 48 feet bgs

:Sample Type: Grab

Sample Number(s): LSS-W

:Sample Quantity Collected: 1.8 liters

Sample Container: VOC = 40ml glass Other = 1 liter amber glass

Sample Analysis: VOC Pesticide/PCB Atrazine/Cyanazine/Dinoseb SVOC

Preservative: VOC = HCL Other = None

Purging: N/A Well installed with Geoprobe

Time: 0700 SWL(ft): 40.5 Well Depth(ft bgs): 48 Well Vol.(gal): N/A

	pH	Cond.	Temp.(degrees)	Vol. Removed.(gal)
1st WV				
2ndWV				
3rdWV				
Ave.				Total

Remarks:

Sampling: Well yield = 1.75 liters in 2½ hour. Slower after 2 hours

Time: WL(ft):

pH: Cond(mhos): Temp.(degrees C F)

Remarks:

Field Technician: H. Dean Lowe

Signature / Date: H. Dean Lowe 8/6/00

Appendix B

Field Forms

ARCADIS U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge, LA 70816

SAMPLE / CORE LOG

Boring/Well: _____ Project No.: _____

Site Location: _____ Drilling Started: _____ Drilling Completed: _____

Land-Surface Elev.: _____ Surveyed: ____ Estimated: ____ Datum: _____

Drilling Fluid: _____ Drilling Method Used: _____

Drilling Contractor: _____ Driller: _____ Helper: _____

Prepared By: _____ Hammer Weight: _____ Hammer Drop (inches): _____

Fill | Silty Clay | Silt | Sandy Silt | Silty Sand | Shelby Tube | Water First Encountered

Clay | Sandy Clay | Clayey Silt | Sand | Clayey Sand | Split Spoon | Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	OVA (wo/F)(w/F) (ppm) (ppm)	REMARKS
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SOIL / SEDIMENT SAMPLING LOG

PROJECT NAME: _____

PROJECT NUMBER: _____ Date: _____

SITE LOCATION: _____

SAMPLE ID NUMBER: _____ CODED/ REPLICATE NO: _____

TIME SAMPLING BEGAN: _____ ENDED: _____

WEATHER: _____

SITE DESCRIPTION: _____

SAMPLING DATA

COLLECTION METHOD: _____

DEPTH (ft): _____ MOISTURE CONTENT: _____

COLOR: _____ ODOR: _____

DESCRIPTION: _____

ANALYSES REQUIRED	*CONTAINER DESCRIPTION*
	From Lab: X or GM

SAMPLING MONITORING (TIP, OVA, HNU, etc.) _____

REMARKS: _____

SAMPLING PERSONNEL: _____

ARCADIS

DAILY LOG

Well(s) _____ Project /No. _____ Page _____ of _____

Site Location _____

Prepared By _____

Date/Time	Description of Activities

ARCADIS

Imagine the result

DEC 19 2006

Working COPY

DRAFT

Mississippi Department of Environmental Quality

and

MISSISSIPPI BLUFFS INDUSTRIAL PARK, LLC

Site Baseline Sampling Work Plan

Former Vicksburg Chemical Company
Vicksburg, Mississippi

15 December 2006

ARCADIS

Site Baseline Sampling Work Plan

Former Vicksburg Chemical Company
Vicksburg, Mississippi

Craig A. Derouen, P.E.
Project Engineer

David R. Escudé, P.E.
Associate Vice President/Principal Engineer

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Prepared for:
Mississippi Department of Environmental Quality and Mississippi Bluffs Industrial Park, LLC

Prepared by:
ARCADIS G&M, Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677

Our Ref.:
LA002656.0001.00007

Date:
15 December 2006

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DRAFT

1. Introduction and Work Plan Rationale

1.1 Objectives/Rationale

This Work Plan presents a scope of work for performing sampling activities at the former Vicksburg Chemical Company (Vicksburg Chemical). The site was formerly a pesticide and herbicide manufacturing facility divided into two areas called the North Plant and South Plant. The primary objective of the activities proposed in this document will be to collect and evaluate soil, groundwater, and storm water data in accordance with the Mississippi Department of Environmental Quality (MDEQ) Brownfields program. Soil, groundwater, and storm water data will be acquired to further define present site conditions and to determine the regulatory and remediation paths forward.

All investigative sampling proposed in this Work Plan will be conducted in accordance with MDEQ's Brownfields program. MDEQ Brownfields Tier 1 Target Remediation Goals (TRGs) will be used as actionable standards. Waste characterization and disposal will be completed in accordance with MDEQ-approved methodology specific to this site. The use of MDEQ Brownfields investigative procedures and corrective action standards is appropriate in this investigation.

D R A F T

1.2 Property Background

1.2.1 Property Location

Vicksburg Chemical was formerly owned by Cedar Chemical Corporation (Cedar Chemical). The facility is located south of Interstate 20 on Rifle Range Road and within the southwest section of the city of Vicksburg, Warren County, Mississippi. The site is composed of approximately 535 acres located in Sections 4, 5, 8, 9, and 10, township 15 north, range 3 east (Latitude: North 32° 18' 01", Longitude: West 90° 53' 57"). The site location is shown on Figure 1.

1.2.2 Property History

The North Plant began operation in 1961 and produced potassium nitrate, liquid chlorine, and liquid nitrogen tetroxide. The raw materials for the North Plant included potassium chloride and nitric acid. The South Plant began operation in 1953 manufacturing chlorinated pesticides, nitrogen-based herbicides, and other agricultural chemicals. The only active operations at the South Plant after 1992 were the nitric acid

unit constructed in 1986 and a potassium carbonate unit constructed in 1994. During various periods prior to 1987, the South Plant produced dinitro butyl phenol (dinoseb or DNBP), monosodium methane arsenate (MSMA) diethyl hexyl phosphoric acid (DEHPA), 1-hydroxy-ethylidene-1-1-diphosphonic acid (UNIHIB), toxaphene, methyl parathion, cyanazine (bladex), and atrazine. Toxaphene and methyl parathion are insecticides, while atrazine, dinoseb, and MSMA are herbicides. Raw materials for these operating processes included chlorine, camphene, ortho-secondary butyl phenol (OSBP), sodium arsenate, sodium hydroxide, methyl chloride, sulfuric acid, sodium paranitrophenolate, and phosphorus trichloride.

Originally, the two plants were completely separate, owned and operated by two different companies. The South Plant was originally constructed by Spencer Chemical in 1953. American Metal Climax Corporation (Amax) constructed the North Plant in 1961. After purchasing the South Plant in 1964, Gulf Chemical added a formaldehyde unit in 1966. According to historical environmental documents, Vicksburg Chemical was formed in early 1972 and purchased both the Gulf Oil and Amax facilities (except the formaldehyde plant) in July 1972. In 1978, Vicksburg Chemical was merged into Vertac, Inc., which merged into Vertac Chemical Corporation (VCC) in September 1979. Cedar Chemical acquired the Vicksburg Chemical plant from VCC in February 1986. Fermenta A.B. of Sweden acquired Cedar Chemical in June 1986. Nine West Corporation (Trans Resources, Inc.) acquired Cedar Chemical in January 1988.

In addition to the above-mentioned operations at the plant, the property was the location of two additional operations: 1) an operation by Reagent Chemical to produce aqueous hydrochloric acid from a by-product of the toxaphene operation; and 2) the Gulf formaldehyde plant. The formaldehyde unit owned and formerly operated by Borden Chemical is located inside the former boundary of the South Plant.

1.3 Project History and Detailed Summary of Previous Investigation Activities

Vicksburg Chemical initiated a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) in 1994 and continued through 2001. The *RCRA Facility Investigation Draft Final Report* and *Draft Groundwater Assessment Report* were completed in August 2001 and November 2001, respectively. Both reports were submitted to the U.S. Environmental Protection Agency (USEPA) and subsequently approved in December 2001. A draft Corrective Measures Study was developed in the spring of 2002.

D R A F T

On March 8, 2002, VCC and Cedar Chemical filed for bankruptcy in the United States Bankruptcy Court for the Southern District of New York. The bankruptcy was contested by MDEQ, the Arkansas Department of Environmental Quality, USEPA Region 4, USEPA Region 6, and the U.S. Department of Justice. The court eventually approved an agreement allowing Vicksburg Chemical to abandon its properties and authorizing MDEQ to direct the transfer of the Vicksburg Chemical property to any entity identified by MDEQ. Since that time, MDEQ has kept the site under its control while structuring an agreement to clean up the plant site in a manner protective of human health and the environment. On December 19, 2005, MDEQ finalized an agreement for Mississippi Silvertip Development, LLC (Silvertip), to remediate the abandoned Vicksburg Chemical site. The developer, Silvertip, intends to create a Mississippi Bluffs Industrial Park to foster the sustainable reuse of the former chemical plant site and adjacent areas. It is anticipated that mixed use (i.e. light industrial, commercial, recreational, and residential) will be possible at the completion of the remedial action. Harcros Chemicals, Inc., is currently leasing portions of the former North Plant to facilitate a chemical blending, mixing, and distribution facility. Concurrently, ARCADIS G&M, Inc. (ARCADIS), is performing the remediation services with MDEQ oversight and control. Silvertip plans to construct high-end commercial and residential sites and a championship golf course on a majority of the remaining acreage.

D R A F T

1.4 Data Needs and Objectives

Additional site data are needed to sufficiently characterize soil contaminant boundaries for remediation purposes, to ascertain present groundwater contaminant concentrations, and to evaluate baseline storm water quality. Data collected as part of the RFI process have been used to select the additional sample locations and are considered valid and usable. The objective of this sampling effort is to collect soil, groundwater, and storm water samples representative of present site conditions that will define the overall remediation strategy for this site.

1.5 Work Plan Approach

The general Work Plan strategy was developed to obtain data representative of present site conditions. Since Vicksburg Chemical declared bankruptcy in 2002, the site has not been regularly investigated or maintained. The most recent soil and groundwater data on overall site conditions available to ARCADIS are contained in the RFI and supplemental investigations. This Work Plan is based in large part on the analytical data presented in the *RCRA Facility Investigation*

Draft Final Report (URS 2001a), *Draft Groundwater Assessment Report* (URS 2001b), and other reports that pertain to the project area. The analytical data contained in these reports were compared to the February 28, 2002, MDEQ Brownfields Tier 1 TRGs for soil and groundwater. The soil concentrations, with the exception of arsenic concentrations, were compared to Tier 1 TRGs for restricted sites as chemical of concern (CoC) concentrations at this site. Arsenic concentrations were compared to the 95 percent Upper Confidence Limit of the mean of the background concentration as presented in the *Quality Assurance Project Plan* (QAPP; ARCADIS 2006a). The soil and groundwater results obtained from the implementation of this Work Plan will help to determine if the site conditions have significantly changed since the last investigations.

The purpose of the storm water sampling is to evaluate if site CoC are present in storm water. If the storm water does contain CoC at unacceptable concentrations, treatment prior to discharge may be required. Areas likely to receive storm water in the form of sheet flow and sumps that historically collected storm water will be sampled during a rainfall event to provide the necessary baseline data.

While in operation, the Vicksburg Chemical plant operated under a State of Mississippi Water Pollution Control permit (Permit No. MS0027995). Storm water was discharged under this permit to the Mississippi River. The sampling parameters contained in the former Water Pollution Control permit are incorporated into the storm water sampling program.

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2. Field Operations

2.1 Source Areas Characterization

Data presented in the RFI indicated five main impacted areas. These areas were defined in the QAPP as four distinct areas in the South Plant and one in the North Plant. The areas were designated:

- Area 1 – South Plant – Solid Waste Management Units (SWMUs) 1, 5, 7, 8, 9, 11, 12, 14, 15, 16, and 17;
- Area 2 – South Plant – Portion of Southwest Corner SWMU 20;
- Area 3 – South Plant – SWMU 2;

- Area 4 – South Plant – Part of SWMU 20 Bounded by MW-1, MW-13, and MW-14; and

- Area 5 – North Plant Pond – SWMU 23.

Each area contains CoC concentrations that exceed the MDEQ Tier 1 TRGs. Tables 1 and 2 list the sample designations where CoC concentrations exceed MDEQ Tier 1 TRGs in soil and groundwater, respectively.

The areal extent of surficial impacts, potential source areas for storm water contamination, has not been completely defined. One of the goals of this baseline sampling is to identify potential storm water contaminant source areas. Data may be used to redirect storm water from these areas to minimize the need for treatment prior to discharge.

OR ELIMINATE N/A

2.2 Sampling Requirements

Some of the tasks that will be conducted during sampling activities have been outlined in detail in the QAPP. The pertinent sections are listed below and incorporated by reference.

2.2.1 Sampling Equipment and Procedures

Soil samples will be collected using direct push technology (Geoprobe®) and/or hand auger equipment. The proper use of these items in the collection of samples representative of site conditions is detailed in Sections 11.2 (Soil Boring/Sampling Geoprobe® Device) and 11.3 (Soil Sampling – Hand Auger) in the QAPP. Groundwater samples will be collected using low-flow purging techniques or with a bailer as described in Section 11.6 (Groundwater Sampling Procedures) in the QAPP. Storm water samples will be collected in accordance with the procedures described in Section 10.6 (Sample Collection Protocols) in the QAPP.

— NO BAILER- PREFERENCE MDEQ EQUIPMENT MAY BE USED N/A

2.2.2 Sample Handling and Analysis

Sample handling and analysis were discussed in detail in Sections 10 and 11 of the QAPP. These procedures will be followed during the implementation of this Work Plan. Table 6 (Summary of Methods, Containers, Preservatives, and Holding Times) of the QAPP contains information relative to specific analyses. This table was revised to include additional storm water parameters not included in the original table. The

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following parameters were added: Total Phosphorus (as P) and Fluoride (as F). The revised table is included as Table 3 of this Work Plan.

2.2.3 Quality Assurance/Quality Control (QA/QC) Samples

Appropriate QA/QC samples will be prepared in accordance with the procedures outlined in Section 10.12 (Field Quality Control Samples) of the QAPP. The QA/QC samples will include:

- Field blanks;
- Equipment rinsate blanks;
- Duplicate samples; and
- Matrix spike/matrix spike duplicate samples.

QA/QC samples will be collected at a frequency of 1 per each 20 samples of each matrix. Trip blanks will be included in ice chests used to transport the samples to the receiving laboratory. The sampling personnel will complete a chain-of-custody form that will accompany the samples to the laboratory.

2.3 Extent of Contamination in Soil

Soil contamination at the site has been extensively investigated through the RFI process. Due to the nature of the proposed remedies for soil contamination (capping, solidification, stabilization, landfilling), the horizontal delineation of CoC boundaries is critical. To adequately provide sufficient protection of human health and the environment, soil samples will be collected from the locations shown on Figure 2 to confirm and more precisely locate contaminant boundaries. The results of the soil sampling will be used in the development of the final remedy for each area.

2.3.1 Soil Sampling and Analysis Plan (SAP)

A Geoprobe® sampling unit will be used to advance probeholes for the collection of subsurface data at each of the sampling locations depicted on Figure 2. The Geoprobe® is a preferred technique for subsurface sampling in shallow unconsolidated materials because it minimizes the generation of soil cuttings and the introduction of foreign fluids into the probehole.

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All drilling equipment will be properly decontaminated prior to advancing each probehole. This will be accomplished by thoroughly cleaning the Geoprobe® drive assembly to remove all soil residues.

The probehole at each location will be advanced and sampled to a depth sufficient to complete delineation of surface and subsurface impacts.

Soil samples will be continuously collected from land surface to total depth (estimated to be less than 12 feet below ground surface (ft bls) based on previous RFI data), as each probehole is being advanced. As each soil sample is retrieved to land surface, the sampling tube will be cut open and the sample removed (sampling personnel will wear clean gloves when handling each sample). The sides of the core will be trimmed away with a decontaminated stainless steel knife to allow for the collection of an undisturbed sample. The sample will be used to fill the appropriate laboratory-provided sample containers. Samples collected for the analysis of volatile organic compounds will be collected by USEPA SW-846 Method 5035. All sample containers will be labeled and placed into an ice bath within an insulated ice chest.

Any remaining soil sample will be inspected and described by an experienced field geologist with all relevant data (i.e., soil type, lithology, color, physical characteristics, moisture content, and any observed evidence of contamination) recorded onto a Sample/Core Log prepared for each probehole. The Sample/Core Log will present a complete description of the soil lithology encountered from land surface to the total depth of the probehole. Appendix A includes an example of the Sample/Core Log.

The samples will be submitted to the laboratory under proper chain-of-custody protocols. Selected parameters will be analyzed in accordance with the data presented in Table 3 specific to each analysis. At a minimum, the soil samples will be analyzed for the analytical parameters proposed in Table 4, or an analytical parameter set provided by MDEQ.

Soil samples collected from the following intervals in each probehole will be retained for chemical analyses:

- The soil sample collected from land surface to 2 ft bls;
- The soil sample collected from 2 to 4 ft bls; and

- A sample from any obvious stained intervals below 4 ft bls if the 2- to 4-ft bls sample appears to be stained.

2.3.2 Soil Sampling Objectives

The specific objective of soil sampling is to define the horizontal extent of contamination in the areas shown on Figure 2. These data will be used to identify the extent of areas that will need to be capped as a part of the final remedy. The present interpretation of the data indicates that soil capping activities will be needed in Areas 1, 4, and 5.

2.3.3 Soil Sampling Locations and Frequency

The soil sampling locations were selected to fill data gaps based on the spatial distribution of previous sampling events. The proposed soil sampling activities are anticipated to be a one-time sampling event. In the event that soil CoC concentrations are detected in excess of limiting MDEQ Tier 1 TRGs, additional sampling may be necessary to adequately define contaminant boundaries.

2.4 Extent of Contamination in Groundwater

Groundwater contamination at the site has been extensively investigated through the RFI process. Previous sampling events indicated contaminant plumes extending toward Stouts Bayou to the east and Hennessey Bayou to the south. Due to the extended amount of time that has elapsed since the last sampling of all wells, a baseline groundwater sampling event is necessary to confirm present groundwater conditions. It is necessary to conduct the sampling proposed in this Work Plan prior to implementing the final groundwater remedy. Based on the results of the baseline groundwater sampling, additional monitor wells may be necessary to adequately define current groundwater conditions. A map showing the well locations is included as Figure 3.

2.4.1 Groundwater SAP

Prior to collecting the groundwater samples, static water level measurements will be recorded in all temporary wells, and each well will be checked for the presence of any free-phase material.

Soil Sampling

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QAPP! See 11.2 p

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How is 0-2, 2-4, 4+
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Groundwater samples will be collected from each well using either a small-diameter hand bailer, high volume pump (i.e. Redi-flo® pump), flow through cell, or a peristaltic pump. In accordance with the procedures outlined in Section 11.6 of the QAPP, sampling will be conducted using "low-flow procedures" or each well will be purged of three to five volumes of standing water (or until dry) prior to collecting a groundwater sample. Each groundwater sample will be poured directly into the appropriate laboratory-provided sample container(s), the containers properly labeled, and placed in an ice bath within an insulated ice chest. Separate aliquots of groundwater will then be collected from each well for field measurements of pH, specific conductance, and temperature. As each well is being sampled, a Water Sampling Log (Appendix B) will be completed by sampling personnel.

The samples will be submitted to the laboratory under proper chain-of-custody protocols. Selected parameters will be analyzed in accordance with the data presented in Table 3 specific to each analysis. At a minimum, the groundwater samples will be analyzed for the analytical parameters proposed in Table 5, or an analytical parameter set provided by MDEQ.

2.4.2 Groundwater Sampling and Objectives

The specific objective of groundwater sampling is to define the present condition of groundwater in the existing monitor wells and determine if the network sufficiently monitors the existing known groundwater impacts.

2.4.3 Groundwater Sampling Locations and Frequency

The existing groundwater monitor well network consists of 37 wells. No new monitor or recovery wells are proposed to be installed during this sampling event. Well construction data for the monitor wells were obtained from Table 1 of the *Draft Groundwater Assessment Report* (URS 2001b). The locations of the wells are shown on Figure 3. A copy of Table 1 is presented in Appendix C. The exact condition of each well is presently unknown. However, a monitor well inspection will be conducted at each well during the baseline sampling event and a checklist prepared. A copy of the checklist is included in Appendix D. It is assumed that the wells are in good enough condition to provide samples representative of the groundwater zone in which the well was initially completed. The baseline groundwater sampling activities proposed herein are anticipated to be a one-time sampling event. Based on the results, a routine sampling frequency and parameter list will be proposed to MDEQ in the Site Characterization Report for future sampling activities. In the event that

groundwater CoC concentrations are detected in excess of limiting MDEQ Tier 1 TRGs, additional sampling and or well installation activities may need to be conducted to adequately monitor groundwater concentrations prior to the submission of the Site Characterization Report.

2.5 Storm Water Sampling

2.5.1 Storm Water SAP

Storm water samples will be collected from various locations at the site as shown on Figure 4. Samples will be collected during a storm water event of sufficient intensity and duration to collect a sample representative of sheet flow conditions. Each storm water sample will be a grab sample collected in clean containers supplied by the laboratory. Dippers, bailers, or similar sampling equipment may be used, if necessary, to collect a representative sample. If not, sample containers will be lowered to the surface of the storm water for filling. Once filled, the containers will be properly sealed, labeled, and placed in an ice bath within an insulated ice chest. The ice chest and a completed chain-of-custody document will be shipped or transported to the laboratory.

The samples will be submitted to the laboratory under proper chain-of-custody protocols. Selected parameters will be analyzed in accordance with the data presented in Table 3 specific to each analysis. At a minimum, the storm water samples will be analyzed for the analytical parameters contained in Table 6, or an analytical parameter set provided by MDEQ. The storm water parameters identified in Table 6 were contained in Vicksburg Chemical's previous State of Mississippi Water Pollution Control permit (MS0027995).

2.5.2 Storm Water Sampling Objectives

The specific objectives of storm water sampling are:

- To determine potential areas that may adversely impact site storm water; and
- To determine if any best management practices and/or storm water treatment is necessary prior to discharge to the Mississippi River.

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2.5.3 Storm Water Sampling Locations and Frequency

The proposed storm water sampling locations are presented on Figure 3. The majority of the locations shown on this map are sheet flow sample locations. In addition to the sheet flow sample locations, storm water sumps, storm water basins, and the storm water outfall will be sampled. The activities proposed in this document are intended to be a one-time baseline sampling event. The purpose of the baseline sampling is to determine if treatment is necessary and define the sample points and parameter set(s) that should continue to be monitored in future storm water sampling events.

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2.6 Investigation Derived Wastes

Waste materials generated during this investigation and corrective action will include soil, used personal protective equipment, decontamination water, and purged groundwater. Waste materials will be appropriately containerized or placed into the storm water basin with approval from MDEQ. All drums will be labeled with the contents of the drum and date of generation of the waste material. The drums will be staged in a secure location and will be incorporated into the remediation to be conducted at the site. Liquid and solid waste will be segregated to facilitate final disposal.

2.7 Regulatory Involvement

All site activities will be conducted after receiving approval of this Work Plan from MDEQ. MDEQ will have oversight on all aspects of remediation activities conducted at this site as per the Agreed Order. Future sampling frequencies, parameter lists, methodology, etc., will be approved by MDEQ prior to field implementation.

All wells advanced by direct push technology methods will be plugged by a State of Mississippi certified water well driller in accordance with MDEQ-approved methods. The plugging and abandonment will be conducted with a cement/bentonite mixture, or a material that provides equivalent subsurface protection.

2.8 Additional Work

A registered land surveyor will survey all soil sample points and monitor well locations. These locations will be plotted on a scaled map of the site.

3. Remedial Site Conceptual Exposure Model

A draft Remedial Site Conceptual Exposure Model (RSCEM) form for the site is presented in Appendix E. The RSCEM is an important tool for obtaining an understanding of site exposure pathway dynamics. It depicts the site and its environment(s) and delineates potential chemical sources, chemical release and transport mechanisms, affected media, migration routes, and potential human and ecological receptors. The RSCEM provides a framework for problem definition, aids in the identification of data gaps, and, more importantly, identifies key exposure pathways and associated media on which to focus assessment activities.

The RSCEM represents potential exposure pathways under both current and foreseeable future exposure scenarios. An industrial exposure scenario will be considered for the portion of the site that was the former Vicksburg Chemical plant. The apparent release source is the former site operations. The RSCEM identifies soil and groundwater as the media of concern. Potential receptors include current and future industrial workers and site visitors and hypothetical future recreational receptors via groundwater/surface water exchange. The final remediation will address the exposure pathways to protect potential receptors.

4. Reporting

Following the completion of all field activities, a Site Characterization Report will be prepared for submittal to MDEQ. The report will document all field activities and present an interpretation of surface and subsurface conditions. Appropriate historical and new data tables, figures, and appendices will be included in the report to support the text. The report will conclude by presenting recommendations for a path forward to obtain site closure.

5. Schedule

The sampling program will be initiated within 3 weeks of receiving written authorization to proceed from MDEQ. It is anticipated that the planned field activities can be completed within 3 to 4 weeks. Analytical data should be received within 2 weeks of completing the last planned field activities. A Site Characterization Report will be prepared and submitted to MDEQ within 8 weeks of receipt of the analytical results. If field activities are delayed, or if additional field activities are required to completely define the nature and extent of subsurface impacts, MDEQ will be promptly notified.

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6. References

ARCADIS. 2006a. Quality Assurance Project Plan, Vicksburg Chemical Company. September 14.

ARCADIS. 2006b. Health and Safety Plan, Vicksburg Chemical Company. October 27.

MDEQ. Brownfields Site Characterization Work Plan Format. http://www.deq.state.ms.us/MDEQ.nsf/pdf/GARD_bfwplan/$File/BFWPlan.PDF?OpenElement.

MDEQ. 2002. Subpart II Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfield Sites. February 28.

URS. 2001a. RCRA Facility Investigation Draft Final Report, Vicksburg Chemical Company. August.

URS. 2001b. Draft Groundwater Assessment Report, Vicksburg Chemical Company. November.

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Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Soil Samples							
1, 16, 17	D-1-B	0-1	Arsenic	12,500	11,800	µg/kg	Yes
1, 16, 17	I-1-B	0-1	Toxaphene	31,700	5,200	µg/kg	Yes
1, 16, 17	I-1-B	0-1	Arsenic	27,000	11,800	µg/kg	Yes
1, 16, 17	L-1-A	0-1	Arsenic	14,500	11,800	µg/kg	Yes
1, 16, 17	2-C-C	Concrete	Arsenic	36,000	11,800	µg/kg	Yes
1, 16, 17	11-C-C	Concrete	Atrazine	52,800	25,800	µg/kg	Yes
1, 16, 17	12-2-A	1-2	Arsenic	13,300	11,800	µg/kg	Yes
1, 16, 17	15-2-A	1-2	Arsenic	12,900	11,800	µg/kg	Yes
1, 16, 17	16-C-A	Concrete	Arsenic	13,700	11,800	µg/kg	Yes
1, 16, 17	18-C-A	Concrete	Arsenic	27,000	11,800	µg/kg	Yes
1, 16, 17	19-C-A	Concrete	Arsenic	18,800	11,800	µg/kg	Yes
4	4-4	0.5-1	Arsenic	15,700	11,800	µg/kg	Yes
5	5-4	3-10	Arsenic	39,200	11,800	µg/kg	Yes
5	5-11	3-10	Arsenic	30,800	11,800	µg/kg	Yes
5	5-13	3-10	Arsenic	174,000	11,800	µg/kg	Yes
5	5-14	3-10	Arsenic	39,000	11,800	µg/kg	Yes
9	8S	0.5-1	Arsenic	61,000	11,800	µg/kg	Yes
9	8D	1.5-2	Arsenic	60,000	11,800	µg/kg	Yes
9	A-1 Result		Benzo(a)pyrene	1,160	784	µg/kg	Yes
11, 12, 15	B-1-D (Sump/Drainage)	0-1	Arsenic	39,400	11,800	µg/kg	Yes
11, 12, 15	E-1-D (Sump/Drainage)	0-1	Arsenic	345,000	11,800	µg/kg	Yes
11, 12, 15	BB-1-D (Sump/Drainage)	0-1	Arsenic	2,870,000	11,800	µg/kg	Yes
11, 12, 15	Q-1-D (Sump/Drainage)	0-1	Arsenic	2,080,000	11,800	µg/kg	Yes
11, 12, 15	EE-1-D (Sump/Drainage)	0-1	Arsenic	456,000	11,800	µg/kg	Yes
11, 12, 15	EE-1-D (Sump/Drainage)	0-1	PCDD/PCDF (Dioxin)	0.344	0.0763	µg/kg	Yes
11, 12, 15	V-1-D (Sump/Drainage)	0-1	Arsenic	2,770,000	11,800	µg/kg	Yes
11, 12, 15	W-1-D (Sump/Drainage)	0-1	Arsenic	145,000	11,800	µg/kg	Yes
11, 12, 15	Y-1-D (Sump/Drainage)	0-1	Arsenic	60,200	11,800	µg/kg	Yes
11, 12, 15	M-1-D (Sump/Drainage)	0-1	Arsenic	35,600	11,800	µg/kg	Yes
11, 12, 15	1-C-D	Concrete	Arsenic	18,400	11,800	µg/kg	Yes
11, 12, 15	5-C-D	Concrete	Arsenic	70,600	11,800	µg/kg	Yes
11, 12, 15	6-1-D	0-1	Arsenic	24,900	11,800	µg/kg	Yes
11, 12, 15	6-2-D	1-2	Arsenic	14,100	11,800	µg/kg	Yes
11, 12, 15	C-1-G	0-1	Arsenic	216,000	11,800	µg/kg	Yes
11, 12, 15	C-2-G	1-2	Arsenic	501,000	11,800	µg/kg	Yes
11, 12, 15	C-3-G	2-4	Arsenic	76,000	11,800	µg/kg	Yes

Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Soil Samples (continued)							
11, 12, 15	C-4-G	4-6	Arsenic	109,000	11,800	µg/kg	Yes
11, 12, 15	C-5-G	6-8	Arsenic	114,000	11,800	µg/kg	Yes
11, 12, 15	D-1-G	0-1	Arsenic	48,800	11,800	µg/kg	Yes
11, 12, 15	D-2-G	1-2	Arsenic	309,000	11,800	µg/kg	Yes
11, 12, 15	D-4-G	4-6	Arsenic	27,600	11,800	µg/kg	Yes
11, 12, 15	D-5-G	6-8	Arsenic	14,700	11,800	µg/kg	Yes
11, 12, 15	H-1-G	0-1	Arsenic	22,300	11,800	µg/kg	Yes
11, 12, 15	I-1-G	0-1	Arsenic	72,800	11,800	µg/kg	Yes
11, 12, 15	I-2-G	1-2	Arsenic	57,500	11,800	µg/kg	Yes
11, 12, 15	I-3-G	2-4	Arsenic	185,000	11,800	µg/kg	Yes
11, 12, 15	I-4-G	4-6	Arsenic	241,000	11,800	µg/kg	Yes
11, 12, 15	I-5-G	6-8	Arsenic	138,000	11,800	µg/kg	Yes
11, 12, 15	J-1-G	0-1	Arsenic	101,000	11,800	µg/kg	Yes
11, 12, 15	J-2-G	1-2	Arsenic	205,000	11,800	µg/kg	Yes
11, 12, 15	K-1-G	0-1	Arsenic	38,800	11,800	µg/kg	Yes
11, 12, 15	K-2-G	1-2	Arsenic	31,500	11,800	µg/kg	Yes
11, 12, 15	K-3-G	2-4	Arsenic	14,600	11,800	µg/kg	Yes
11, 12, 15	K-4-G	4-6	Arsenic	46,000	11,800	µg/kg	Yes
11, 12, 15	K-6-G	8-10	Arsenic	55,100	11,800	µg/kg	Yes
11, 12, 15	L-1-G	0-1	Arsenic	132,000	11,800	µg/kg	Yes
11, 12, 15	L-2-G	1-2	Arsenic	80,600	11,800	µg/kg	Yes
11, 12, 15	O-1-G	0-1	Arsenic	254,000	11,800	µg/kg	Yes
11, 12, 15	O-2-G	1-2	Arsenic	41,400	11,800	µg/kg	Yes
11, 12, 15	T-2-G	1-2	Arsenic	14,400	11,800	µg/kg	Yes
11, 12, 15	X-1-G	0-1	Arsenic	64,400	11,800	µg/kg	Yes
11, 12, 15	X-2-G	1-2	Arsenic	63,300	11,800	µg/kg	Yes
11, 12, 15	Z-1-G	0-1	Arsenic	323,000	11,800	µg/kg	Yes
11, 12, 15	Z-2-G	1-2	Arsenic	51,200	11,800	µg/kg	Yes
11, 12, 15	Z-3-G	2-4	Arsenic	22,300	11,800	µg/kg	Yes
11, 12, 15	DD-1-G	0-1	Arsenic	24,300	11,800	µg/kg	Yes
11, 12, 15	DD-2-G	1-2	Arsenic	59,600	11,800	µg/kg	Yes
11, 12, 15	ZZ-1-G	0-1	Arsenic	11,900	11,800	µg/kg	Yes
11, 12, 15	ZZ-2-G	1-2	Arsenic	18,100	11,800	µg/kg	Yes
11, 12, 15	7-C-G	Concrete	Arsenic	68,200	11,800	µg/kg	Yes
18	18-1	0.5-1	Arsenic	17,500	11,800	µg/kg	Yes
18	18-3	0.5-1	Arsenic	12,800	11,800	µg/kg	Yes
20	20-21C		Chloroform	2,186	478	µg/kg	Yes
23	22-B		Chloroform	830	478	µg/kg	Yes
30	30-1	0.5-1	TPH (conservative)	4,433,000	300,000	µg/kg	Yes
30	30-2	0.5-1	TPH (conservative)	699,000	300,000	µg/kg	Yes
30	30-3	0.5-1	TPH (conservative)	15,431,000	300,000	µg/kg	Yes

Table 1. Exceedances of MDEQ Tier 1 TRG for Restricted Soil Use, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Sample Depth (ft)	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG (Restricted)	Units	Concentration Exceeds Tier 1 TRG (Restricted)
Composite Surface Samples (2 to 8 grab samples from each quartile of each section composited)							
20	20-A	0-0.5	Toxaphene	8,240	5,200	µg/kg	Yes
20	20-B	0-0.5	Toxaphene	18,989	5,200	µg/kg	Yes
20	20-C	0-0.5	Dinoseb	355,541	204,000	µg/kg	Yes
20	20-C	0-0.5	Toxaphene	8,401	5,200	µg/kg	Yes
20	20-D	0-0.5	Toxaphene	14,200	5,200	µg/kg	Yes
20	20-F	0-0.5	Dinoseb	1,078,068	204,000	µg/kg	Yes
20	20-F	0-0.5	Toxaphene	10,318	5,200	µg/kg	Yes
20	20-G	0-0.5	Toxaphene	22,981	5,200	µg/kg	Yes
20	20-H	0-0.5	Toxaphene	19,052	5,200	µg/kg	Yes
20	20-I	0-0.5	Toxaphene	110,964	5,200	µg/kg	Yes
20	20-J	0-0.5	Toxaphene	41,652	5,200	µg/kg	Yes
20	20-K	0-0.5	Toxaphene	6,098	5,200	µg/kg	Yes
20	20-N	0-0.5	Toxaphene	9,263	5,200	µg/kg	Yes
20	20-O	0-0.5	Toxaphene	6,727	5,200	µg/kg	Yes
20	20-T	0-0.5	Arsenic	12,100	11,800	µg/kg	Yes
20	20-T	0-0.5	Toxaphene	7,617	5,200	µg/kg	Yes
Composite Soil Pile Samples (8 grab samples composited)							
20	20-BB	0-0.5	Toxaphene	37,036	5,200	µg/kg	Yes
20	20-CC	0-0.5	Toxaphene	6,852	5,200	µg/kg	Yes
20	20-DD	0-0.5	Toxaphene	14,691	5,200	µg/kg	Yes
20	20-EE	0-0.5	Toxaphene	16,815	5,200	µg/kg	Yes
20	20-FF	0-0.5	Toxaphene	76,683	5,200	µg/kg	Yes
20	20-II	0-0.5	Toxaphene	17,413	5,200	µg/kg	Yes
20	20-LL	0-0.5	Toxaphene	14,673	5,200	µg/kg	Yes
20	20-MM	0-0.5	Toxaphene	11,152	5,200	µg/kg	Yes

(1)	Analytical data obtained from RFI process.
MDEQ	Mississippi Department of Environmental Quality.
SWMU	Solid Waste Management Unit.
Tier 1 TRG (Restricted)	MDEQ Tier 1 TRG for the restricted use of soil.
TPH	Total Petroleum Hydrocarbon.
TRG	Target Remediation Goal.
µg/kg	Micrograms per Kilogram.

Table 2. Exceedances of MDEQ Tier 1 TRG for Groundwater, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG	Units	Concentration Exceeds Tier 1 TRG
1, 16, 17	2-W-TA	Arsenic	538	50	µg/L	Yes
2	MW-5	Dinoseb	12	7	µg/L	Yes
2	MW-5	Trichloroethene	79	5	µg/L	Yes
2	MW-6	Dinoseb	75	7	µg/L	Yes
2	MW-6	Toxaphene	25	3	µg/L	Yes
2	MW-6	Trichloroethene	9.03	5	µg/L	Yes
2	LS1-W	Bis(2-ethyl)hexylphthalate	213.44	6	µg/L	Yes
2	LS2-W	4-Nitrophenol	547.61	292	µg/L	Yes
2	LS2-W	Atrazine	478	3	µg/L	Yes
2	LS2-W	Carbon Tetrachloride	71.4	5	µg/L	Yes
2	LS2-W	Dinoseb	8,714	7	µg/L	Yes
2	LS3-W	Bis(2-ethyl)hexylphthalate	474.04	6	µg/L	Yes
2	LS4-W	Chloroform	17.3	0.155	µg/L	Yes
2	LS4-W	Carbon Tetrachloride	126	5	µg/L	Yes
2	LS4-W	Bis(2-ethyl)hexylphthalate	42.03	6	µg/L	Yes
2	LS4-W	Dinoseb	597	7	µg/L	Yes
2	LS5-W	Chloroform	105	0.155	µg/L	Yes
2	LS5-W	Acetophenone	18.92	0.0416	µg/L	Yes
2	LS5-W	4-Nitrophenol	2,359	292	µg/L	Yes
2	LS5-W	Bis(2-ethyl)hexylphthalate	130.9	6	µg/L	Yes
2	LS5-W	Atrazine	6.33	3	µg/L	Yes
2	LS5-W	Dinoseb	797	7	µg/L	Yes
2	2-15-W	Atrazine	123	3	µg/L	Yes
9	TP-1	Arsenic	378	50	µg/L	Yes
9	TP-1	Trichloroethene	68	5	µg/L	Yes
9	MW-18A	Arsenic	319	50	µg/L	Yes
9	MW-18B	Arsenic	197	50	µg/L	Yes
9	MW-18B	Dinoseb	132	7	µg/L	Yes
11, 12, 15	G-W-G	Arsenic	14,300	50	µg/L	Yes
11, 12, 15	D-W-G	Arsenic	253	50	µg/L	Yes
11, 12, 15	I-W-G	Arsenic	288,000	50	µg/L	Yes
11, 12, 15	K-W-G	Arsenic	297	50	µg/L	Yes
11, 12, 15	R-W-G	Arsenic	5,260	50	µg/L	Yes
11, 12, 15	X-W-G	Arsenic	730	50	µg/L	Yes
11, 12, 15	Z-W-G	Arsenic	1,720	50	µg/L	Yes
11, 12, 15	DD-W-G	Arsenic	1,260	50	µg/L	Yes
11, 12, 15	WW-W-G	Arsenic	56	50	µg/L	Yes
11, 12, 15	ZZ-W-G	Arsenic	216	50	µg/L	Yes
11, 12, 15	7-W-G	Arsenic	51,000	50	µg/L	Yes
11, 12, 15	MW-17A	Carbon Tetrachloride	7.25	5	µg/L	Yes
11, 12, 15	MW-17B	Chloroform	1.43	0.155	µg/L	Yes
11, 12, 15	MW-18A	Arsenic	319	50	µg/L	Yes
11, 12, 15	MW-18B	Arsenic	194	50	µg/L	Yes
11, 12, 15	MW-18B	Dinoseb	132	7	µg/L	Yes
20	MW-1C	Chloroform	1.38	0.155	µg/L	Yes
20	MW-1C	Trichloroethene	10.8	5	µg/L	Yes
20	MW-10C	Dinoseb	717	7	µg/L	Yes

Table 2. Exceedances of MDEQ Tier 1 TRG for Groundwater, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Chemical of Concern	Site Concentration[1)]	MDEQ Tier 1 TRG	Units	Concentration Exceeds Tier 1 TRG
20	MW-10C	Chloroform	1,076	0.155	µg/L	Yes
20	MW-10C	Carbon Tetrachloride	1,486	5	µg/L	Yes
20	MW-12C	Dinoseb	277	7	µg/L	Yes
20	MW-12C	Vinyl Chloride	13	2	µg/L	Yes
20	MW-12C	1,1-Dichloroethene	7.39	7	µg/L	Yes
20	MW-12C	1,2-Dichloroethene (total)	88.3	70	µg/L	Yes
20	MW-12C	Chloroform	3,879	0.155	µg/L	Yes
20	MW-12C	1,2-Dichloroethane	113	5	µg/L	Yes
20	MW-12C	Carbon Tetrachloride	23,350	5	µg/L	Yes
20	MW-12C	1,1,2-Trichloroethane	84.2	5	µg/L	Yes
20	MW-12C	Tetrachloroethene	174	5	µg/L	Yes
20	20-18-W	Atrazine	65	3	µg/L	Yes
20	20-18-W	Chloroform	21.5	0.155	µg/L	Yes
20	20-18-W	Carbon Tetrachloride	13.3	5	µg/L	Yes
20	20-18-W	Benzene	9.58	5	µg/L	Yes
20	20-19-W	Benzene	7.21	5	µg/L	Yes
20	20-20-W	Dinoseb	18,821	7	µg/L	Yes
20	20-20-W	Chloromethane	3.36	1.43	µg/L	Yes
20	20-20-W	Chloroform	10.2	0.155	µg/L	Yes
20	20-20-W	Carbon Tetrachloride	46.2	5	µg/L	Yes
20	20-21-W	Atrazine	140	3	µg/L	Yes
20	20-21-W	Chloromethane	126	1.43	µg/L	Yes
20	20-21-W	Vinyl Chloride	5.46	2	µg/L	Yes
20	20-21-W	Methylene Chloride	908	5	µg/L	Yes
20	20-21-W	1,1-Dichloroethene	54.6	7	µg/L	Yes
20	20-21-W	1,2-Dichloroethene (total)	1,758	70	µg/L	Yes
20	20-21-W	Chloroform	37,380	0.155	µg/L	Yes
20	20-21-W	1,2-Dichloroethane	321	5	µg/L	Yes
20	20-21-W	Carbon Tetrachloride	357,500	5	µg/L	Yes
20	20-21-W	Bromodichloromethane	296	0.168	µg/L	Yes
20	20-21-W	cis-1,3-Dichloropropene	42.3	0.0842	µg/L	Yes
20	20-21-W	Trichloroethene	1,346	5	µg/L	Yes
20	20-21-W	Benzene	23.7	5	µg/L	Yes
20	20-21-W	1,1,2-Trichloroethane	290	5	µg/L	Yes
20	20-21-W	Tetrachloroethene	180	5	µg/L	Yes
20	20-22-W	Atrazine	146	3	µg/L	Yes
20	20-22-W	Dinoseb	396	7	µg/L	Yes
20	20-22-W	Vinyl Chloride	46.5	2	µg/L	Yes
20	20-22-W	Methylene Chloride	45.7	5	µg/L	Yes
20	20-22-W	1,2-Dichloroethene (total)	125	70	µg/L	Yes
20	20-22-W	Chloroform	5,120	0.155	µg/L	Yes
20	20-22-W	1,2-Dichloroethane	68.2	5	µg/L	Yes
20	20-22-W	Carbon Tetrachloride	4,705	5	µg/L	Yes
20	20-22-W	Bromodichloromethane	75.8	0.168	µg/L	Yes
20	20-22-W	1,2-Dichloropropane	11.2	5	µg/L	Yes
20	20-22-W	Trichloroethene	44.6	5	µg/L	Yes
20	20-22-W	Benzene	9.33	5	µg/L	Yes

Table 2. Exceedances of MDEQ Tier 1 TRG for Groundwater, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

SWMU	Sample ID	Chemical of Concern	Site Concentration[1]	MDEQ Tier 1 TRG	Units	Concentration Exceeds Tier 1 TRG
20	20-22-W	1,1,2-Trichloroethane	74.4	5	µg/L	Yes
20	20-22-W	Tetrachloroethene	55.2	5	µg/L	Yes
20	20-23-W	Atrazine	30	3	µg/L	Yes
20	20-23-W	Dinoseb	27	7	µg/L	Yes
23	20-B	Chloroform	1,700	0.155	µg/L	Yes
23	20-B	Bromodichloromethane	36	0.168	µg/L	Yes
23	20-B	Dibromochloromethane	14	0.126	µg/L	Yes
23	22-A	Chloroform	44	0.155	µg/L	Yes
23	22-B	Chloroform	1,600	0.155	µg/L	Yes
23	22-B	Bromodichloromethane	66	0.168	µg/L	Yes
23	22-B	Dibromochloromethane	78	0.126	µg/L	Yes
23	22-B	Bromoform	160	8.48	µg/L	Yes
23	23-B	Chloroform	79	0.155	µg/L	Yes
23	22-1-W	Chloroform	6.78	0.155	µg/L	Yes

(1) Analytical data obtained from RFI process.
MDEQ Mississippi Department of Environmental Quality.
SWMU Solid Waste Management Unit.
Tier 1 TRG MDEQ Tier 1 TRG for Groundwater.
TRG Target Remediation Goal.
µg/L Micrograms per Liter.

Table 3. Summary of Methods, Containers, Preservatives, and Holding Times, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
General Parameters						
VOCs	Water	5030, 5032	8260/624	3 x 40-mL vial with Teflon lined septum	pH < 2 with HCl, Cool 4°C	14 days
	Water	5030, 5032	8260/624	3 x 40-mL vial with Teflon lined septum	If effervescence is observed, eliminate HCl preservative and Cool 4°C	7 days
	Solid	5035	8260	3 x Encore™ OR 2 x Sodium Bisulfate vial	Cool 4°C	48 hours to preservation for Encore™, then 14 days to
SVOCs	Water	3510, 3520 [d]	8270 (Low Level)/625	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8270 (Low Level)	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Organochlorine Pesticides	Water	3510, 3520 [d]	8081/608	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8081	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Organochlorine Herbicides	Water	3510, 3520 [d]	8151	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8151	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Metals (except Mercury)	Water	3005, 3010	6010/6020/200.7	1 x 1-L HDPE	pH < 2 with HNO_3, Cool 4°C	6 months
	Solid	3050, 3051	6010	1 x 8-oz G	Cool 4°C	6 months
Waste Characterization Parameters						
Corrosivity (pH)	Aqueous Waste	NA	9040	250 mL HDPE	NA	24 hours
	Solid Waste Material	NA	9045	1 x 8-oz wide-mouth G	NA	24 hours
General Chemistry Parameters						
Ammonia	Water	NA	350.3	250 mL HDPE	pH < 2 with H_2SO_4, Cool 4°C	28 days
BOD	Water	NA	405.1	1 x 1-L HDPE	Cool 4°C	48 hours
Chloride	Water	NA	325.3/300.0/9056	250 mL HDPE/2 x 40 mL vial	Cool 4°C	28 days
COD	Water	NA	HACH 8000	125 mL HDPE	pH <2 with H_2SO_4	28 days
Fluoride	Water	NA	340.1/340.2	500 mL HDPE	Cool 4°C	28 days

Table 3. Summary of Methods, Containers, Preservatives, and Holding Times, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
Nitrate	Water	NA	353.2/300.0/9056	250 mL HDPE/ 2 x 40 mL vial	Cool 4°C	2 days
Phosphorus (Total)	Water	NA	365.1/365.2/365.5	1 x 100 mL HDPE or G	pH < 2 with H_2SO_4	28 days
Sulfate	Water	NA	375.4/300.0/9056	250 mL HDPE/	Cool 4°C	28 days
Total Dissolved Solids (TDS)	Water	NA	160.1	500 mL HDPE	Cool 4°C	7 days
Total Suspended Solids TSS)	Water	NA	160.2	500 mL HDPE	Cool 4°C	7 days

(b) Sample volumes may be combined for MNA parameters where preservatives are the same and adequate sample volume is supplied to the laboratory. Volumes
(c) Maximum holding time allowed from date of collection.
(d) Cleanup methods may be applicable if matrix interference is encountered. Cleanup methods may include alumina (Method 3610), florisil (Method 3620), silica gel
(e) If residual chlorine is present, requires sodium thiosulfate in each sample container.
(f) Waste Characterization addresses solid (soils, sludge, waste) material analysis for waste disposal purposes. Liquid (aqueous or organic) wastes will be
(g) This holding time is a contractual holding time that has been established by ARCADIS and is established in the USEPA Region 4 Laboratory Operations and

°C	Degrees Centigrade.	mL	Milliliter.
BOD	Biological Oxygen Demand.	MNA	Monitored Natural Attenuation.
COD	Chemical Oxygen Demand.	NA	Not Applicable.
G	Glass.	oz	Ounce.
GPC	Gel Permeation Chromatography.	RCRA	Resource Conservation and Recovery Act.
H_2SO_4	Sulfuric Acid.	SVOCs	Semivolatile Organic Compounds.
HCl	Hydrochloric Acid.	TSS	Total Suspended Solids.
HDPE	High Density Polyethylene.	USEPA	U.S. Environmental Protection Agency.
HNO_3	Nitric Acid.	VOCs	Volatile Organic Compounds.
L	Liter.		

Table 4. Proposed Soil Sampling Parameters, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Analytical Method	Chemical of Concern	MDEQ Tier 1 TRG (Restricted Use) (mg/kg)
Volatile Organic Compounds (VOCs)	Method 8260	Benzene	1.36
		Bromodichloromethane	1.89
		Bromoform	90.1
		Carbon Tetrachloride	0.569
		Chloroform	0.478
		Dibromochloromethane	68.1
		1,2-Dichloroethane	0.621
		Methylene Chloride	21.9
		1,1,1,2-Tetrachloroethane	220
		Tetrachloroethene	18.2
		Trichloroethene	7.92
		1,2,4-Trimethylbenzene	102,000
		1,3,5-Trimethylbenzene	436
		Vinyl Chloride	0.939
Semivolatile Organic Compounds (SVOCs)	Method 8270	Acetophenone	2,630
		Atrazine	25.8
		bis-(2-Ethyl)hexyl Phthalate	409
		Cyanazine	6.81
		4-Nitrophenol	16,400
		Pentachlorophenol	23.8
Organochlorine Pesticides	Method 8081	Toxaphene	5.2
Organochlorine Herbicides	Method 8151	Dinoseb	204
Metals	Method 6010 or 6020	Arsenic	11.8

MDEQ Mississippi Department of Environmental Quality.
mg/kg Milligrams per kilogram.
TRG Target Remediation Goal.

Table 5. Proposed Groundwater Sampling Parameters, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Analytical Method	Chemical of Concern	MDEQ Tier 1 TRG (µg/L)
Volatile Organic Compounds (VOCs)	Method 8260	Benzene	5 (MCL)
		Bromodichloromethane	0.168
		Bromoform	8.48
		Carbon Tetrachloride	5 (MCL)
		Chloroform	0.155
		Dibromochloromethane	0.126
		1,2-Dichloroethane	5 (MCL)
		Methylene Chloride	5 (MCL)
		1,1,1,2-Tetrachloroethane	0.406
		Tetrachloroethene	5 (MCL)
		Trichloroethene	5 (MCL)
		1,2,4-Trimethylbenzene	12.3
		1,3,5-Trimethylbenzene	12.3
		Vinyl Chloride	2 (MCL)
Semivolatile Organic Compounds (SVOCs)	Method 8270	Acetophenone	0.0416
		Atrazine	3 (MCL)
		bis-(2-Ethyl)hexyl Phthalate	6 (MCL)
		Cyanazine	0.0797
		4-Nitrophenol	292
		Pentachlorophenol	1 (MCL)
Organochlorine Pesticides	Method 8081	Toxaphene	3 (MCL)
Organochlorine Herbicides	Method 8151	Dinoseb	7 (MCL)
Metals	Method 6010 or 6020	Arsenic	50 (MCL)

MCL Maximum contaminant level.
MDEQ Mississippi Department of Environmental Quality.
µg/L Micrograms per liter.
TRG Target Remediation Goal.

Table 6. Proposed Storm Water Sampling Parameters, Site Baseline Sampling Work Plan, Former Vicksburg Chemical Company, Vicksburg, Mississippi.

Parameter	Analytical Method	Chemical of Concern	Water Quality Limit (µg/L)
Analytical Parameters			
Volatile Organic Compounds (VOCs)	624	Benzene	PQL[1]
		Bromodichloromethane	PQL
		Bromoform	PQL
		Carbon Tetrachloride	PQL
		Chloroform	PQL
		Dibromochloromethane	PQL
		1,2-Dichloroethane	PQL
		Methylene Chloride	PQL
		1,1,1,2-Tetrachloroethane	PQL
		Tetrachloroethene	PQL
		Trichloroethene	PQL
		1,2,4-Trimethylbenzene	PQL
		1,3,5-Trimethylbenzene	PQL
		Vinyl Chloride	PQL
Semivolatile Organic Compounds (SVOCs)	625	Acetophenone	PQL
		Atrazine	PQL
		bis-(2-Ethyl)hexyl Phthalate	PQL
		Cyanazine	PQL
		4-Nitrophenol	PQL
		Pentachlorophenol	PQL
Organochlorine	608	Toxaphene	PQL
Organochlorine	8151	Dinoseb	PQL
Metals	200.7	Arsenic	PQL
Storm Water Parameters			
General Chemistry	350.3	Ammonia (as N)	PQL
	405.1	Biochemical Oxygen Demand (5-day)	PQL
	HACH 8000	Chemical Oxygen Demand	PQL
	325.3/300.0/9056	Chloride	75,000
	340.1/340.2	Fluoride (as F)	PQL
	353.2/300.0/9056	Nitrates (as N)	PQL
	9040	pH	PQL
	375.4/300.0/9056	Sulfate	120,000
	160.1	Total Dissolved Solids	400,000
	365.1/365.2/365.5	Total Phosphorus (as P)	PQL
	160.2	Total Suspended Solids	PQL
Organochlorine	608	Toxaphene	PQL
Organochlorine	8151	Dinoseb	PQL

(1) PQL to be used until final water quality regulatory limits for all chemicals of concern are presented in the forthcoming Agreed Order for Storm Water.

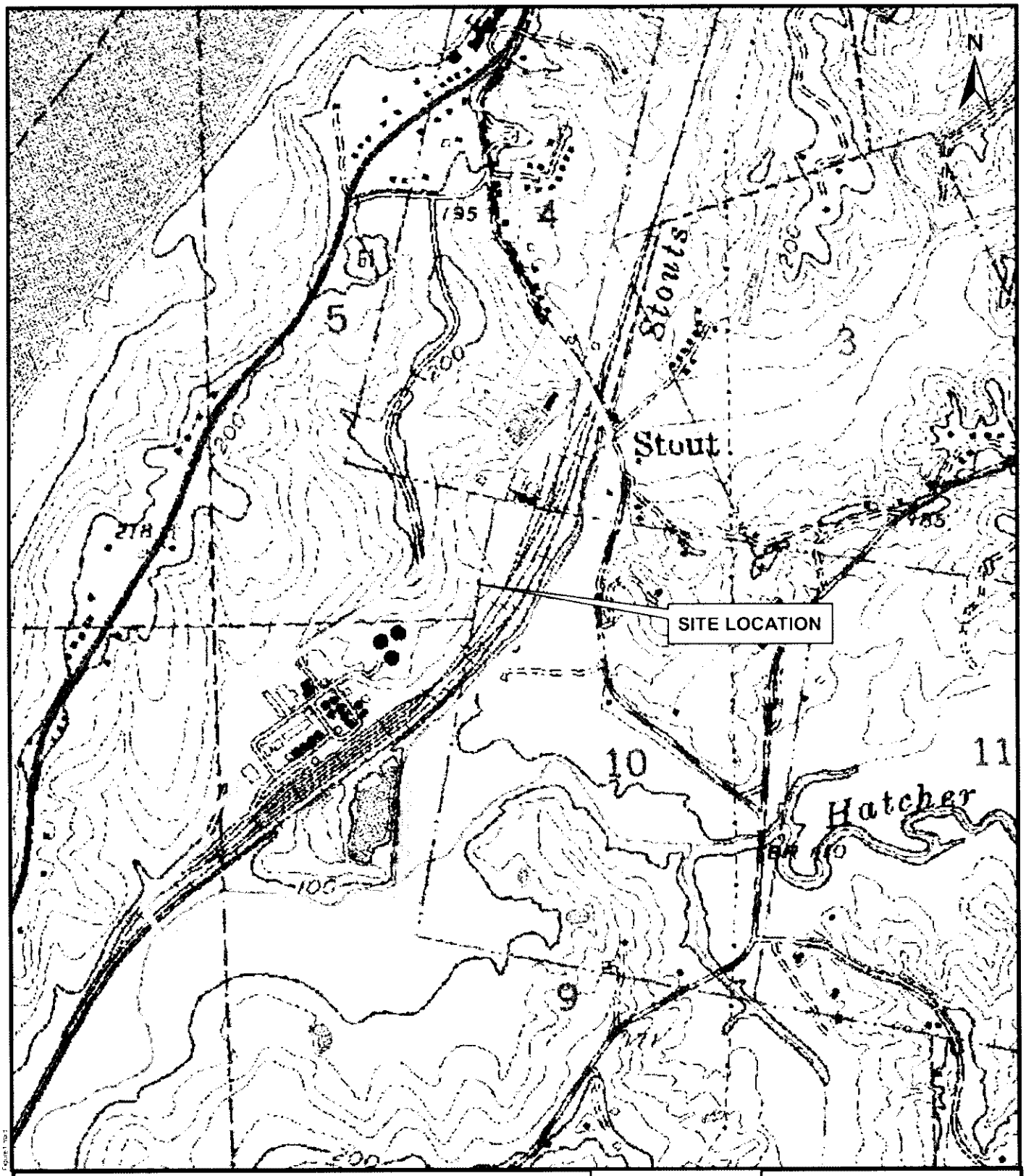
MCL Maximum contaminant level.

MDEQ Mississippi Department of Environmental Quality.

PQL Practical Quantitation Limit.

TRG Target Remediation Goal.

µg/L Micrograms per liter.



Former Plant Site

Note: Approximate Property Boundary

ARCADIS
10352 Plaza Americana Drive
Baton Rouge, Louisiana 70816
Tel: 225.292.1004 Fax: 225.218.9677

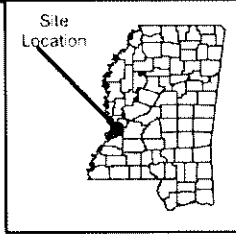
REFERENCE:

USGS Vicksburg West Quadrangle, Mississippi
7.5 Minute Series (Topographic)

SITE LOCATION MAP

VICKSBURG CHEMICAL COMPANY

VICKSBURG, MISSISSIPPI



500 0 500 1,000
Feet

Project Manager: JE	Completed By: AB
Task Manager: CD	Date: 07/31/2006
Project No.: LA002656.0001	Figure No.: 1

LEGEND

PROPOSED SOIL SAMPLING LOCATIONS

ARSENIC AND TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

SOIL/SLUDGE CONTAINING VOCs

ARSENIC CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

CONCENTRATION OF CONTAMINATION EXCEEDS VALUES IN MDEQ TIER I TRG TABLE

TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

DINOSEB AND TOXAPHENE CONTAMINATION FOUND WITHIN INVESTIGATED BOUNDARIES

AREA 1 – SWMU 1, 5, 7, 8, 9, 11, 12, 14, 15, 16, AND 17
AREA 2 – SWMU 20 (SW CORNER)
AREA 3 – SWMU 2
AREA 4 – SWMU 20 (AREA BOUNDED BY MW-13, MW-14, AND MW-1)
PROPOSED SOIL SAMPLE LOCATION
AREA 5 – SWMU 23

0 200' 400' 800'

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DRAWN BY: S. MEN	CHECKED: CAD
PROJECT MANAGER: DRE	DEPARTMENT MANAGER: DRE
DATE: 11-6-06	TASK/PHASE NUMBER: 0007

10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
FAX: 225-218-9677
WWW.ARCADIS-US.COM

PROPOSED SOIL SAMPLING LOCATIONS

FORMER VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER: LA002656.0001

DRAWING NUMBER: 2

LEGEND

MONITORING WELL LOCATION

0 200' 400' 800'

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DRAWN BY	CHECKED
D. EKINIA	CAD
PROJECT MANAGER	DEPARTMENT MANAGER
DRE	DRE
DATE	TASK/PHASE NUMBER
12-14-06	0007

10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
FAX: 225-218-9677
WWW.ARCADIS-US.COM

MONITOR WELL LOCATIONS

FORMER VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER
LA002656.0001

DRAWING NUMBER
3

LEGEND

10-FOOT CONTOUR INTERVAL

2-FOOT CONTOUR INTERVAL

PROPOSED STORM WATER SAMPLING LOCATION

0 200' 400' 800'

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DRAWN BY: S. MEN	CHECKED: CAD
PROJECT MANAGER: DRE	DEPARTMENT MANAGER: DRE
DATE: 10-26-06	TASK/PHASE NUMBER: 0007

10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
FAX: 225-218-9677
WWW.ARCADIS-US.COM

PROPOSED STORM WATER SAMPLING LOCATIONS

FORMER VICKSBURG CHEMICAL COMPANY SITE

PROJECT NUMBER: LA002656.0001

DRAWING NUMBER: 4

Appendix A

Sample Core Log

ARCADIS G & M, Inc.
10352 Plaza Americana Drive
Baton Rouge, LA 70816

SAMPLE / CORE LOG

Boring/Well: _____ Project No.: _____

Site Location: _____ Drilling Started: _____ Drilling Completed: _____

Land-Surface Elev.: _____ Surveyed: ____ Estimated: ____ Datum: _____

Drilling Fluid: _____ Drilling Method Used: _____

Drilling Contractor: _____ Driller: _____ Helper: _____

Prepared By: _____ Hammer Weight: _____ Hammer Drop (inches): _____

Fill | Silty Clay | Silt | Sandy Silt | Silty Sand | Acetate Sleeve | Water First Encountered

Clay | Sandy Clay | Clayey Silt | Sand | Clayey Sand | Split Spoon | Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	OVA (wo/F)(w/F) (ppm) (ppm)	REMARKS
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
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Appendix B

Water Sampling Log

ARCADIS

WATER SAMPLING LOG

roject _____ Project No. _____

Site Location _____ Date: _____

Site/Well No. _____ Replicate No. _____ Code No. _____

Weather _____ Sampling Time: Begin _____ End _____

Evacuation Data

Measuring Point _____

MP Elevation (ft) _____

Land Surface Elevation (ft) _____

Sounded Well Depth (ft bmp) _____

Depth To Water (ft bmp) _____

Water Level Elevation (ft) _____

Water Column In Well (ft) _____

Casing Diameter/Type _____

Gallons In Well _____

Gallons Pumped/Bailed Prior To Sampling _____

Sample Pump Intake Setting (ft bmp) _____

Purge Time Begin _____ End _____

Pumping Rate (gpm) _____

Evacuation Method _____

Field Parameters

Color _____

Odor _____

Appearance _____

pH (s.u.) _____

Conductivity (ms/cm) _____

Conductivity (µmhos/cm _____

Turbidity (NTU) _____

Temperature (°C/ °F) _____

Dissolved Oxygen (mg/L) _____

ORP (mV) _____

Sampling Method _____

Remarks _____

ARCADIS ignored 9/12/06 email to edit to allow for purge water parameter collection data.

Constituents Sampled	Container Description	Number

Sampling Personnel

Well Casing Volumes

Gal./Ft.				
1" = 0.04	1 - 1/2" = 0.09	2 - 1/2" = 0.26	3 - 1/2" = 0.50	6" =
1 - 1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65	

bmp	Below measuring point	ml	Milliliter	NTU
°C/°F	Degrees Celsius/Fahrenheit	mS/cm	Millisiemens per centimeter	PVC
ft	Feet	msl	Mean sea level	s.u.
gpm	Gallons per minute	NA	Not Applicable	µmho
mg/L	Milligrams per liter	NR	Not Recorded	VOC
ppt	Parts per thousand	CS	Carbon steel	SS

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Appendix C

Historical Monitor Well Network

TABLE 1

GROUNDWATER DATA LEVEL MEASUREMENTS

Piezometer or Well Number	Casing Elevation (ft msl)	Bottom Elevation (ft msl)	Top of Screen (ft msl)	November 1993 Groundwater Elevation (ft msl)
MW 1 A	113.01	83.01	93.51	108.39
MW 2	108.21	68.21	78.71	98.87
MW 3	99.33	69.33	79.83	
MW 4	114.70	94.70	105.20	106.89
MW 5	100.30	80.30	85.80	84.01
MW 6	100.76	73.78	79.28	86.48
MW 7	99.66	69.33	74.83	92.39
MW 8	110.83	80.83	86.33	103.14
MW 9	116.02	58.02	73.02	110.89
MW 10	114.73	61.73	74.73	107.40
MW 11	105.62	57.62	70.62	98.16
MW 12	112.06	64.56	80.06	109.32
MW 13	113.52	63.52	73.52	109.51
MW 14	113.9	57.9	67.9	107.64
MW 15	Plugged and abandoned during surface impoundment retrofit			
MW 16	111.84	58.84	68.84	108.84
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

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Appendix D

Monitor Well Inspection Checklist

MONITOR WELL INSPECTION CHECKLIST

Project Name: _____ Project Number: _____

Inspectors Name: _____ Inspection Date: _____

Monitor Well ID: _____ Site Location: _____

Type of Well: ☐ Flush Mounted ☐ Above Grade

A. Condition of protective casing: _____

B. Condition of concrete pads (note cracks, breaks, slope direction): _____

_____

C. Condition of guard posts: _____

D. Is the well locked? _____

E. Is well identification number clearly marked? _____

F. Is the TOC elevation mark clearly visible on the well ? _____

G. Condition of well casing: _____

H. Condition of well cap: _____

I. Condition of surrounding grounds (i.e., overgrowth, is the well accessible, etc.): _____

J. Does water adequately drain from the well site?: _____

K. Total depth of well (properly decon tape between wells). _____

_____

L. Depth to top of grout from protective casing - length of protective casing above concrete pad: _____

M. Comments/Recommendations: _____

_____

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Appendix E

Remedial Site Conceptual Exposure Model

Worksheet

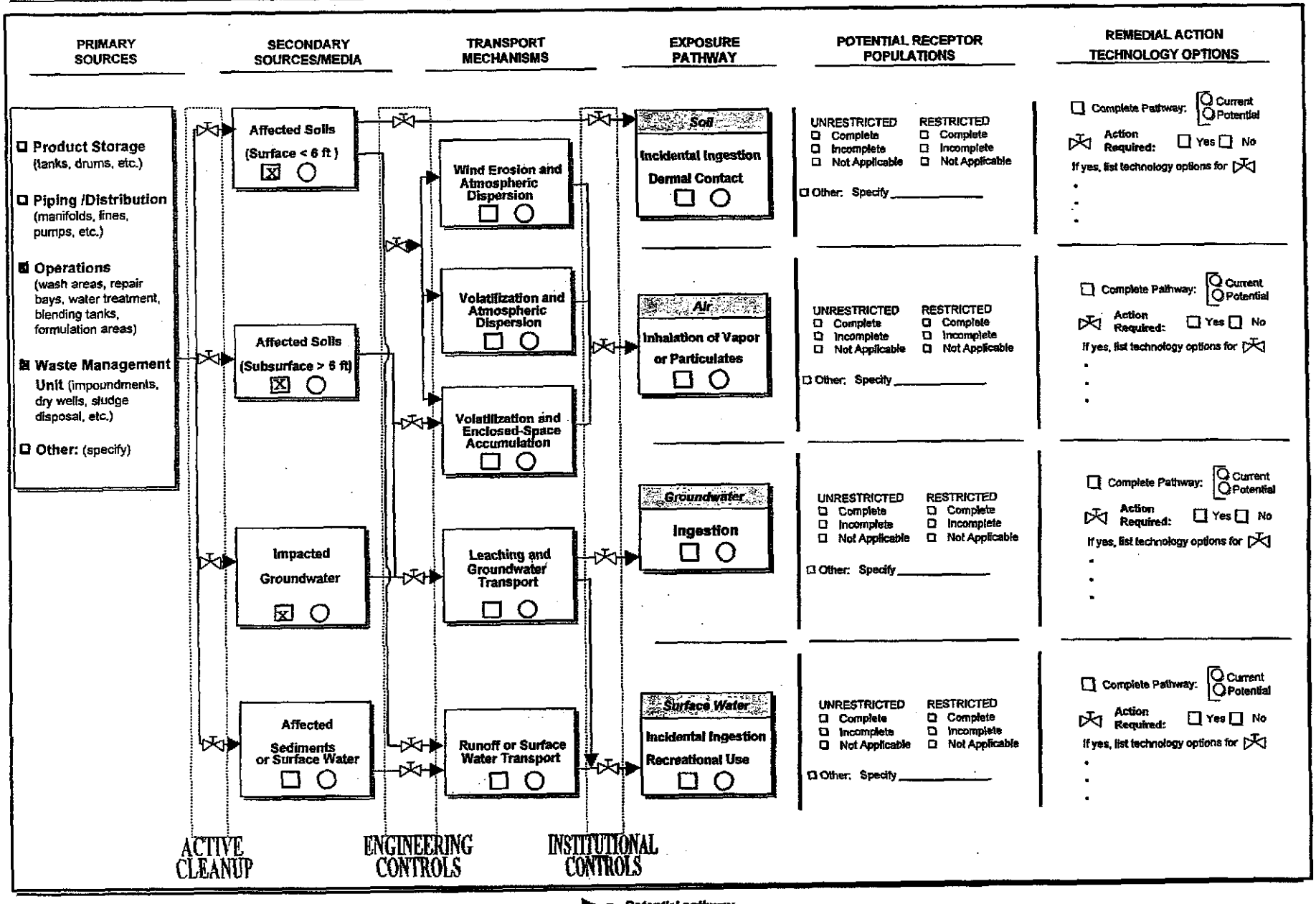
Remedial Site Conceptual Exposure Model (SCEM)

Site Name: Former Vicksburg Chemical Company
Site Location: Vicksburg Mississippi

Completed By: Craig Derouen
Revision Date: 11/20/06

☐ Complete ○ Potentially Complete

☒ Draft ☐ Final



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Imagine the result

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MISSISSIPPI BLUFFS INDUSTRIAL PARK, LLC

Quality Assurance Project Plan

Facility Remediation Program
Vicksburg Chemical Company
Vicksburg, Mississippi

14 September 2006

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Quality Assurance Project Plan

Facility Remediation Program
Vicksburg Chemical Company
Vicksburg, Mississippi

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Date:
14 September 2006

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Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
C	Celsius
CFR	Code of Federal Regulations
CoC	Chemical of Concern
cy	Cubic Yards
DOT	Department of Transportation
DQO	Data Quality Objective
°	Degrees
EDD	Electronic Data Deliverable
EISOPQAM	Environmental Investigations Standard Operating Procedures and Quality Assurance Manual
EQuIS	Environmental Quality Information Systems
GC	Gas Chromatography
GIS	Geographic Information System
HASP	Health and Safety Plan
ICP	Inductively Coupled Plasma
ID	Identification
IDW	Investigation-Derived Waste
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
LTO	Laboratory Task Order
MCL	Maximum Contaminant Level
MDEQ	Mississippi Department of Environmental Quality
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
/MS	/Mass Spectrometry
NELAP	National Environmental Laboratory Accreditation Program
NFG	National Functional Guidelines
NIST	National Institute of Standards and Technology

Acronyms and Abbreviations (continued)

NTU	Nephelometric Turbidity Unit
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
OVM	Organic Vapor Meter
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PPE	Personal Protective Equipment
PSA	Professional Services Agreement
PT	*Performance Testing*
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCSR	Quality Control Summary Report
%R	Percent Recovery
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TRG	Target Remediation Goal
TSS	Total Suspended Solids
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

Title and Approval Page

Quality Assurance Project Plan
Facility Remediation Program
Vicksburg Chemical Company
Vicksburg, Mississippi

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1. Project Organization and Responsibility

The project organization for the activities to be conducted during remedial operations is presented within the following section. The project activities are being performed under direction of the Mississippi Department of Environmental Quality (MDEQ) for the mitigation of environmental impacts at the Vicksburg Chemical Company (Vicksburg Chemical) site. The project activities are being conducted in accordance with the Mississippi Commission on Environmental Quality Agreed Order No. 5069-05, under the direction of the MDEQ. The Order authorizes Mississippi Bluffs Industrial Park, LLC (Mississippi Bluffs), and ARCADIS in conjunction with MDEQ to conduct remediation activities at the plant site.

The project organizational chart is provided as Appendix A. Contact information for key project team members is presented in Table 1.

This document was prepared using the U.S. Environmental Protection Agency (USEPA) Region 4 *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, November 2001 (EISOPQAM) as specified by MDEQ. The Region 4 EISOPQAM will be used to reference procedures associated with the activities described within this Quality Assurance Project Plan (QAPP).

2. Background Information

The following document presents a site-wide summary Sampling and Analysis Plan (SAP) within the QAPP to conduct additional site assessment to define releases associated with the past activities formerly associated with the Vicksburg Chemical Company (Vicksburg Chemical) site. The QAPP includes a summary of the site history, current site information, and general activities which may be performed to attain the project objectives. Additionally, the SAP includes a summary of the anticipated remediation activities to be conducted at the site.

2.1 Site Description

Vicksburg Chemical was formerly owned by Cedar Chemical Corporation. The facility is located south of Interstate 20 on Rifle Range Road and within the southwest section of the city of Vicksburg, Warren County, Mississippi. The site is composed of approximately 535 acres located in Sections 4, 5, 8, 9 and 10, township 15 north, range 3 east, Warren County, Mississippi (Latitude: North 32° 18' 01", Longitude: West 90° 53' 57"). The site location is shown on Figure 1.

The site included two operational plants, referred to as the North Plant and South Plant areas. The plant is situated within a small valley running north-south and adjacent to the Mississippi River. Stouts Bayou and Hatcher Bayou flow through the valley and join forming Hennessey Bayou which flows along the southern plant boundary. The Kansas City Southern Railroad line runs north-south through the plant with sidetracks for loading areas and warehouses. Notable site features include an inactive landfill, an unlined surface impoundment, numerous warehouses for past storage, buildings and process areas, and areas of contaminated soil. Site buildings in the project areas will be demolished prior to site activities. The site is within the 100-year floodplain of the Mississippi River.

A large surface impoundment (Solid Waste Management Unit [SWMU] 3) was previously used to manage storm water within the operating plants. Adjacent to and southwest of the surface impoundment is an inactive landfill approximately 3 acres in size. The landfill and impoundment are adjacent to the confluence of Stouts Bayou and Hatcher Bayou which form Hennessey Bayou; Hennessey Bayou flows for about 10 miles and into the Mississippi River.

2.2 *Site History*

The North Plant began operation in 1961 and produced potassium nitrate, liquid chlorine, and liquid nitrogen tetroxide. The raw materials for the North Plant included potassium chloride and nitric acid. The South Plant began operation in 1953 manufacturing chlorinated pesticides, nitrogen-based herbicides, and other agricultural chemicals. The only active operations at the South Plant after 1992 were the nitric acid unit constructed in 1986 and a potassium carbonate unit constructed in 1994. During various periods prior to 1987, the South Plant produced dinitro butyl phenol (Dinoseb or DNBP), monosodium methane arsenate (MSMA) diethyl hexyl phosphoric acid (DEHPA), 1-hydroxy-ethylidene-1-1-diphosphonic acid (UNIHIB), toxaphene, methyl parathion, cyanazine (bladex), and Atrazine. Toxaphene and methyl parathion are insecticides, while Atrazine, Dinoseb, and MSMA are herbicides. Raw materials for these operating processes included chlorine, camphene, ortho-secondary butyl phenol (OSBP), sodium arsenate, sodium hydroxide, methyl chloride, sulfuric acid, sodium paranitrophenolate, and phosphorus trichloride.

Originally, the two plants were completely separate, owned and operated by two different companies. The South Plant was originally constructed by Spencer Chemical in 1953. American Metal Climax Corporation (Amax) constructed the North Plant in 1961. After purchasing the South Plant in 1964, Gulf Chemical added a formaldehyde

unit in 1966. According to historical environmental documents, Vicksburg Chemical was formed in early 1972 and purchased both the Gulf Oil and Amax facilities (except the formaldehyde plant) in July 1972. In 1978, Vicksburg Chemical was merged into Vertac, Inc., which merged into Vertac Chemical Corporation (VCC) in September 1979. Cedar Chemical Corporation (Cedar Chemical) acquired the Vicksburg Chemical Plant from VCC in February 1986. Fermenta A.B. of Sweden acquired Cedar Chemical in June 1986. Nine West Corporation (Trans Resources, Inc.) acquired Cedar Chemical in January 1988.

In addition to the above-mentioned operations at the plant, the property was the location of two additional operations: (1) an operation by Reagent Chemical to produce aqueous hydrochloric acid from a by-product of the toxaphene operation; and (2) the Gulf formaldehyde plant. The formaldehyde unit currently owned and operated by Borden Chemical is located inside the former boundary of the South Plant.

Vicksburg Chemical initiated a Resource Conservation and Recovery Act (RCRA) Resource Facility Investigation (RFI) in 1994 and continued through 2001. The *Draft Final RFI Report* and *Groundwater Assessment Report* were completed in August 2001 and November 2001, respectively. Both reports were submitted to USEPA and subsequently approved in December 2001. A draft Corrective Measures Study was developed in the spring of 2002.

On March 8, 2002, VCC and Cedar Chemical filed for bankruptcy in the United States Bankruptcy Court for the Southern District of New York. The bankruptcy was contested by MDEQ, the Arkansas Department of Environmental Quality, USEPA Region 4, USEPA Region 6, and the U.S. Department of Justice. The court eventually approved an agreement allowing Vicksburg Chemical to abandon its properties and authorizing MDEQ to direct the transfer of the Vicksburg Chemical property to any entity identified by MDEQ. Since that time, MDEQ has kept the site under its control while structuring an agreement to clean up the plant site in a manner protective of human health and the environment. On December 19, 2005, MDEQ finalized an agreement for Mississippi Silvertip Development, LLC, to spend $8 million to clean up the abandoned Vicksburg Chemical site in Vicksburg, Mississippi. The developer, Mississippi Silvertip Development, LLC, along with Harcros Chemicals, Inc. (Harcros), Mississippi Bluffs Industrial Park, LLC, and ARCADIS G&M, Inc. (ARCADIS), intends to sustainably reuse the plant site and surrounding acreage once the cleanup begins. Harcros plans to create a number of jobs with its chemical blending, mixing, or distribution operation on the abandoned plant site; and ARCADIS will perform the remediation services with MDEQ oversight and control. Silvertip plans to construct

high-end commercial and residential sites and a championship golf course on a good portion of the remaining acreage.

3. Problem Definition

3.1 Project Objective

The Professional Services Agreement (PSA) referenced in the Agreed Order sets forth the general remediation services which shall be performed. The services defined in the PSA include an initial baseline assessment, implementation of groundwater remediation plan and soil action plan, establishment of institutional controls, and other work as directed by MDEQ. The overall objective is to achieve a remedy in place within 3 years.

3.2 Data Quality Objectives

Data quality objectives (DQOs) established for this QAPP are presented in Table 2. As listed in Table 2, the Problem Definition is based upon the following DQO:

Problem statement: Past industrial operations at Vicksburg Chemical have contributed to residual contamination at the site. The project goal is to achieve remedy in place within 3 years. To achieve this goal, additional assessments of groundwater, soil, sludge, sediment, and surface water shall be performed. A groundwater remediation plan shall be developed and implemented. A soil action plan and institutional controls shall be prepared and implemented as necessary.

Other general project data quality objectives include precision, accuracy, representativeness, comparability, and completeness (PARCC). Brief descriptions of the PARCC parameters are presented below.

3.2.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value, usually stated in terms of standard deviation or coefficient of variation. It also may be measured as the relative percent difference (RPD) between two values. Precision includes the interrelated concepts of instrument or method detection limits (MDL) and multiple field sample variance. Sources of this variance are sample heterogeneity, sampling error, and analytical error.

3.2.2 Accuracy

Accuracy measures the bias of the measurement system. Sources of this error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis. Data interpretation and reporting may also be significant sources of error. Typically, analytical accuracy is assessed through the analysis of spiked samples and may be stated in terms of percent recovery or the average (arithmetic mean) of the percent recovery. Blank samples are also analyzed to assess sampling and analytical bias (i.e., sample contamination). Background measurements similarly assess measurement bias.

3.2.3 Representativeness

Representativeness expresses the degree to which data represent a characteristic of a population, a parameter variation at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with proper design of the measurement program. Sample/measurement locations may be biased (judgmental) or unbiased (random or systematic). For unbiased schemes, the sampling must be designed not only to collect samples that represent conditions at a sample location, but also to select sample locations that represent the total area to be sampled.

3.2.4 Completeness

Completeness is defined as the percentage of measurements performed which are judged to be valid. Although a quantitative goal must be specified, the completeness goal is the same for all data uses: that a sufficient amount of **valid** data be generated. It is important that critical samples are identified and plans made to ensure that valid data are collected for them.

3.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set may be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through the use of standard techniques to collect and analyze samples including the use of USEPA-approved analytical methods.

4. Project Description

The purpose of this project is to stabilize, solidify, consolidate, remove, and/or remediate residual contaminants above the MDEQ Tier 1 Target Remediation Goals (TRGs) as identified during the RFI, Preliminary Assessment (PA), and other site investigations. The TRGs for select chemical compounds are shown in Table 3. Following is a summary of the issues identified within each area of the facility that will be addressed in this project. Should new information obtained in the upcoming field investigations differ from information available at this time, the planned remediation activities may change in each Area. Each Area is shown on Figure 2.

Area 1 – South Plant – (SWMUs 1, 5, 7, 8, 9, 11, 12, 14, 15, 16, and 17)

- After the South Plant area is demolished, cap affected areas with approximately 24 inches of re-compacted clay and 12 inches of topsoil (or equivalent);
- Perform solidification/stabilization on "hot spot" soils where concentrations significantly exceed risk based standards; and
- Install a groundwater interceptor trench and/or barrier wall downgradient of existing shallow groundwater plume.

Area 2 – South Plant – Portion of SW Corner SWMU 20

- Relocate to existing SWMU 2 Landfill area approximately 15,000 cubic yards (cy) of stockpiled soils where concentrations exceed TRG risk-based cleanup standards.

Area 3 – South Plant – SWMU 2

- Incorporate relocated soils from SWMUs (primarily SWMUs 20 and 23) into the existing SWMU 2 landfill;
- Regrade any unstable portions of SWMU 2;
- Install an engineered cap consisting of approximately 24 inches of re-compacted clay and 12 inches of topsoil (or equivalent); and

- Install a groundwater interceptor trench and/or barrier wall in the vicinity of SWMU 2 and downgradient of shallow groundwater plume.

Area 4 – South Plant – Part of SWMU 20 Bounded by MW-1, MW-13, and MW-14

- Install a groundwater interceptor trench and/or barrier wall downgradient of existing shallow groundwater plume; and
- Perform solidification/stabilization on "hot spot" soils where concentrations significantly exceed risk-based standards.

Area 5 – North Plant – SWMU 23

- Solidify and relocate North Plant Pond Sludges to SWMU 2;
- Backfill excavated area with clean soil;
- Install a groundwater interceptor trench and/or barrier wall downgradient of existing shallow groundwater plume; and
- Perform solidification/stabilization on "hot spot" soils having concentrations that significantly exceed risk-based standards, if necessary.

As summarized in Table 2, the project descriptions have been developed to meet the following DQOs:

Identify the decisions:

Area 1

- Confirm as necessary the areal extent of soils where chemical of concern (CoC) concentrations exceed MDEQ Tier 1 restricted TRGs;
- Determine the solidification/stabilization requirements for soil areas that significantly exceed MDEQ TRGs;
- Determine the areal extent and design of the engineered cover; and

- Determine the placement of sentinel wells and the design and alignment of the barrier/interceptor trench.

Area 2

- Confirm as necessary the areal extent of soils where CoC concentrations exceed MDEQ Tier 1 restricted TRGs; and
- Relocate approximately 15,000 cy of stockpiled soils exceeding MDEQ TRGs to the existing landfill area in SWMU 2.

Area 3

- Confirm as necessary the areal extent of soils where CoC concentrations exceed MDEQ Tier 1 restricted TRGs;
- Determine if consolidation of soils and solidified sludges from other SWMUs in SWMU 2 is feasible;
- Place a new engineered cap over SWMU 2; and
- Determine the placement of sentinel wells and the design and alignment of the barrier/interceptor trench, if necessary.

Area 4

- Confirm the areal extent of soils where CoC concentrations significantly exceed MDEQ Tier 1 restricted TRGs;
- Determine the volume of material requiring solidification/stabilization, if any; and
- Determine the placement of sentinel wells and the design and alignment of the barrier/interceptor trench, if necessary.

Area 5

- Confirm the areal extent of soils where CoC concentrations exceed MDEQ Tier 1 restricted TRGs;

- Determine the solidification/stabilization methodology for sludges present in the North Plant Pond;
- Relocate solidified sludges to the existing landfill area in SWMU 2; and
- Determine the placement of sentinel wells and the design and alignment of the barrier/interceptor trench, if necessary.

Identify the Inputs to the Decision

Area 1

- Soil and groundwater data will be evaluated according to Tier 1 Evaluation Procedures specified within MDEQ's Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfields Sites to more accurately determine the extent of remedial activities; and
- A soil sampling and solidification work plan will be prepared and implemented to determine an appropriate solidification/stabilization program.

Area 2

- Soil data will be evaluated according to Tier 1 Evaluation Procedures specified within MDEQ's Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfields Sites to more accurately determine the required extent of remedial activities.

Area 3

- Soil and groundwater data will be evaluated according to Tier 1 Evaluation Procedures specified within MDEQ's Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfields Sites to more accurately determine the extent of remedial activities;
- A slope stability analysis will be conducted on the existing landfill soils; and
- State of Mississippi regulations will be reviewed to ensure that the newly constructed landfill meets MDEQ standards.

Area 4

- Soil and groundwater data will be evaluated according to Tier 1 Evaluation Procedures specified within MDEQ's Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfields Sites to more accurately determine the extent of remedial activities; and

- A soil sampling and solidification work plan will be prepared and implemented to determine an appropriate solidification/stabilization program.

Area 5

- Soil and groundwater data will be evaluated according to Tier 1 Evaluation Procedures specified within MDEQ's Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfields Sites to more accurately determine the extent of remedial activities; and

- A soil sampling and solidification work plan will be prepared and implemented to determine an appropriate solidification/stabilization program.

5. Initial Baseline Assessment

Baseline sampling will be conducted on selected existing groundwater monitor wells. The existing wells were installed during previous assessment activities and may require redevelopment prior to the collection of samples. In addition to the sampling of existing wells, additional soil borings may be advanced to further define hot spot concentrations and/or the boundaries of impacted areas. Some of the soil borings may be converted to temporary wells for the collection of groundwater samples.

As an overview, the assessment program to determine present site conditions will include:

- Collection of soil and groundwater samples at selected locations surrounding known areas of contamination. Locations may deviate from those proposed within this document based upon review of analytical data and approval by MDEQ;

- Soil and groundwater samples will be collected at proposed locations based on field conditions and the use of appropriate tools that may include manual hand augers, a Geoprobe® device, and/or a drilling rig;

- Groundwater samples will be collected from permanent and/or temporary monitor wells. Temporary monitor wells will be plugged and abandoned upon completion of the assessment or will be converted to permanent monitor wells;

- Soil samples will be field-screened using an Organic Vapor Analyzer (OVA) or an Organic Vapor Meter (OVM) and samples will be selected for volatile chemical analyses based upon vapor measurement results or by visual observations. Due to the nature of some of the contaminants at the site (i.e., pesticides and herbicides), OVM readings may not provide an accurate, reliable method for sample selection. Therefore, an on-site mobile laboratory may be used to analyze samples at the site during collection activities; and

- Chemical analyses will be performed on soil and groundwater samples for the site-specific CoC as described in Section 11 (General Project Sampling Requirements). Based on the type of potential impacts identified, the subcontract off-site environmental laboratory will perform analyses to determine the concentrations of applicable chemical parameters

6. Groundwater Remediation

Groundwater concentrations in excess of TRGs at the site will be addressed through the installation of a barrier wall and/or groundwater interceptor trench system. The purpose of these systems is to protect Stouts Bayou and Hennessey Bayou (surface water bodies) from impacted groundwater. Both systems can be designed to control the natural migration of groundwater through the subsurface by altering the potentiometric surface in a controlled manner. Groundwater will be redirected and/or recovered and treated prior to discharge. A sentinel well system will be installed to monitor groundwater concentrations downgradient from the barrier wall and/or groundwater interceptor trench system and upgradient of the surface water bodies. Groundwater CoC concentrations detected in sentinel wells above MDEQ TRGs will trigger reevaluation of the groundwater remediation program. New monitor wells will be located and installed in accordance with a work plan approved by MDEQ.

7. Soil Remediation

Soil remediation will consist of a variety of remedial technologies. A description of the technology along with the proposed locations for its implementation is provided below.

7.1 Engineered Cap Installation

Based on historic analytical data, portions of the site may require the installation of an engineered clay cap or equivalent. The purpose of the engineered cap is to eliminate contact between receptors and storm water at the surface of the cap and the material underlying the cap. The separation of these two environments prevents contact with and exposure to the capped material. Specific performance criteria for the engineered cap system will be submitted to MDEQ in a work plan prior to the start of capping activities. In general, the clay cap will be constructed of not less than 24 inches of re-compacted clay. Geotechnical tests will be performed on the clay cap to ensure that the cap meets minimum State of Mississippi requirements for final cover. The clay layer will be placed directly above the affected areas. Above the clay layer, an approximately 12-inch layer capable of supporting vegetative growth will be installed. The vegetative growth layer will serve to prevent erosion of the clay cap.

7.2 Soil Solidification/Stabilization

Solidification/stabilization activities will be performed on soils that are going to be capped in place, but significantly exceed the Tier 1 TRG concentrations and require augmentation to reduce the leaching potential. Solidification consists of adding soil amendments, typically cement, lime, and/or fly ash, to sludges or soils. Solidification processes serve to impart strength to a material and/or to prepare materials for transport by reducing liquid content. Stabilization reduces the leachability of contaminants by binding the waste matrix in a stable material. The solidified/stabilized material will be analyzed for the CoC using the synthetic precipitation leaching procedure (SPLP) to evaluate the potential for leachate concentrations to exceed the TRGs.

Prior to solidification/stabilization activities, laboratory and/or field studies will be conducted to determine an appropriate soil amendment mixture(s) for each of the materials to be solidified/stabilized. Hot spot locations may be stabilized in place to prevent mobility of CoC. The stabilized soils will be tested for leachability by an analytical laboratory. This testing will establish that the CoC are entrained in the soil matrix and will not be re-released to the environment.

Because portions of the clay cap proposed for this area may be placed over the solidified/stabilized material, the solidification/stabilization program may be designed to also enhance the strength characteristics of these materials. These samples will be analyzed for select geotechnical properties. Approximately 5,700 cy of North Plant

Pond sludges will be solidified/stabilized. The solidified/stabilized material will be relocated to the proposed SWMU 2 landfill area. Subsequent to relocation activities, sampling of the soil underlying the relocated material will be conducted to confirm the removal of the impacted soil, or this material may be capped in place.

7.3 Barrier Wall Installation and/or Interceptor Trench

If required, an interceptor trench may be installed to protect Stouts Bayou and Hennessey Bayou from groundwater impacts. An interceptor trench consists of a barrier material and/or a groundwater recovery system. The barrier material will be installed to alter the natural groundwater flow. The redirected groundwater will be recovered by the interceptor trench and treated in the City of Vicksburg's wastewater treatment plant, or by other means, prior to discharge to the environment. In the event that the recovered groundwater is not discharged through the City's treatment plant, it will be discharged as a permitted point source.

7.4 Consolidation in SWMU 2 Landfill (Area 2, Area 3, and Area 5)

In an effort to minimize the areal extent of contaminated material on site, soils in Area 2, Area 3, and Area 5 will be consolidated in the existing SWMU 2 landfill. Approximately 15,000 cy of stockpiled soil that exceeds the TRGs, which is currently located in the southwest corner of SWMU 20 and in SWMU 23, will be moved to the existing SWMU 2 landfill in Area 3. Relocated soil will be incorporated into the existing landfill. The newly placed material will be contoured and compacted. A cap will be placed over the landfill in accordance with RCRA Subtitle C requirements.

The existing sentinel well system for the SWMU 2 landfill will be sampled as part of the long-term groundwater monitoring at the facility. Additional sentinel wells may be installed if deemed necessary to adequately monitor the landfill and/or known groundwater contamination. Sampling will be conducted at regular intervals as required by MDEQ.

8. Institutional Controls

Based on the results of historical and baseline sampling, institutional controls may be employed as a part of site remediation activities. The purpose of institutional controls is to reduce or eliminate potential exposure pathways to known CoC remaining. Institutional controls will be implemented as the remediation progresses under MDEQ Brownfields restricted Tier 1 TRGs.

9. Sample Design

This section includes descriptions of work to be performed, media to be sampled, CoC, and an overview of field quality assurance/quality control (QA/QC) procedures. The site CoC are presented in Table 4. At a minimum, these CoC will be analyzed by the laboratory. However, the laboratory will also report additional volatile and semivolatile constituents that are in the laboratory's standard operating procedure (SOP) for the SW-846 Method. This list will be confirmed in future work plans and after the laboratory is selected. The proposed locations and numbers of analytical and geotechnical sample collection points will be presented in future work plans developed for each area.

It should be noted that the sampling design described within this section allows for flexibility in relocating, adding/removing sample locations, based on site observations identified during the field investigations. The sample locations will be identified in subsequent Area- or media-specific work plans to adequately identify, characterize, and delineate the site conditions. Modifications to the list of CoC may be warranted if observed conditions indicate the existence of potential CoC not listed in this QAPP.

10. Field Operations

Existing ARCADIS field policies and SOPs will be employed to ensure personnel safety, consistency in procedures, and the collection of representative samples. As required, new policies or SOPs will be developed to encompass additional or different field procedures to address the project objectives. Changes to existing policies will be reviewed and approved by the ARCADIS QA Manager.

10.1 Field Documentation

Field documentation will include field logbook and/or daily logs, field sampling logs, instrument calibration logs, and data forms as necessary to provide sufficient information to allow review of field conditions and sample collection, evaluate potential impacts to sample and data integrity, and enable reconstruction of events that occurred during the field operations when necessary. Daily logs will also document any deviations from the Area-specific work plan, the QAPP, or other applicable planning document and describe the rationale for such changes.

All entries will be made in waterproof ink, and the time of the entry will be recorded. The top of each page of the field documents will contain the date that the entries on

that page were recorded. No pages will be removed from a bound logbook for any reason. Corrections will be made according to the procedures given later in this section.

The daily logs and/or sample logs will include, as applicable:

- Name of the person making the entry (signature);
- Names of team members, subcontractors, and visitors on site;
- Levels of personal protective equipment (PPE): Level of protection originally used; changes in protection, if required; and reasons for changes;
- Drilling information, including method employed; diameter of borehole and well casing; materials used; depth of borehole; and well construction, if appropriate;
- Documentation for samples collected, including, as applicable, sampling location; sampling depth for subsurface soil and surface water samples; sample identification number; sample collection method; sampling date, time, and personnel; sample matrix; sample sequence (order in which samples were collected); equipment used (including the use of fuel-powered units/motors during surface water sampling); type of sample (e.g., grab, composite); quantity of each aliquot if sample is a composite; and sample preservation;
- Types of field QC samples, including when and where they were collected. The description of sample collection equipment should be included for equipment blanks and the actual field samples collected with that equipment prior to collection of the rinsate;
- Samples split with oversight agencies, if applicable;
- Information regarding well purging, including depth to water and total well depth, calculations used for volume purged, volume purged, equipment used, field measurements, length of purge time, and date and time well was purged;
- Drum sampling: type of drum; description of contents; and description of layers sampled;
- Field equipment used, equipment identification numbers, and calibration information;

- On-site measurement data;
- Field observations and remarks;
- Weather conditions and wind direction;
- Equipment decontamination procedures;
- Unusual circumstances or difficulties; and
- Initials or signature of person recording the information.

Field information may be recorded on standard ARCADIS forms. All field documentation associated with field activities will be retained in the project files.

10.2 Corrections to Field Documentation

As with all bound data logbooks, no pages will be removed for any reason. If corrections are necessary on any field documentation, they will be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside it. The correction must be initialed and dated. Where necessary, corrected errors will include a footnote explaining the correction.

10.3 Photographs

Photographs will be taken as directed by the team leader. Documentation by a photograph will ensure the validity as a visual representation of an existing situation. A log will be developed to track the media on which the photos are filed (e.g., compact disc, floppy disk). Photographs, as developed or transferred to electronic media, shall be compiled into a photographic log and information recorded in field notebooks added to the log with appropriate photographs. The following information will be noted in the log for digital or non-digital photographs as applicable to the media utilized for preservation:

- Date, time, location, and direction photograph was taken;
- Description of the photograph taken;
- Reasons why the photograph was taken;

- Sequential number of the photograph and the film roll number or electronic media identification; and
- Camera lens system used.

10.4 Field Sampling Equipment Procedures

Field supplies and equipment will be obtained from a reputable and reliable distribution company. The Field Operations Manager will inspect all supplies and equipment upon receipt at the site to verify that the correct materials were received. ARCADIS has established a program for maintaining field equipment to ensure that the equipment is available in good working order when and where it is needed. This program consists of the following elements:

- A list of reputable and reliable equipment rental suppliers to provide equipment or specialized instrumentation as necessary to meet project requirements;
- An equipment manual library is maintained and field personnel are trained in the proper use and care of equipment on an as-needed basis. Equipment manuals will be kept on site during field activities as a guide to calibration and maintenance;
- ARCADIS field instrument SOPs will be followed. New SOPs shall be prepared, as necessary, to encompass appropriate field activities;
- The Field Operations Manager is responsible to ensure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before use at the job site;
- A calibration/maintenance log will be maintained for each piece of equipment. The log may be used to identify drift in the calibration over time, which might indicate the need for replacement of sensors or factory calibration; and
- The maintenance log or daily logs will document all repairs, adjustments, and calibrations and will be retained in the project file. The field equipment logbooks will clearly document the date, description of the problems, corrective action taken, result, and person who performed the work.

ARCADIS will rent equipment as necessary to complete field operations and acquire the necessary data. All equipment will be inspected upon receipt to ensure that it is in

working order. Supplier, type of instrument, and instrument identification numbers will be recorded in the field documentation. Calibration of all rental equipment will be verified.

Some of the standard field instrument calibration procedures described in Table 5 will be used to test and/or evaluate the instrument's performance. Field equipment will be inspected daily before use to ensure that no visual defects are present. In the event of major equipment failure in the field, a back-up instrument will be available or a replacement unit can be at the field site within 24 hours or less.

10.5 Field Equipment Decontamination

Sampling methods and equipment are chosen to minimize decontamination requirements and the possibility of cross contamination. Equipment or supplies that cannot be effectively decontaminated (e.g., sample tubing or rope) will be disposed of after sampling. Investigation/sampling equipment will be cleaned at the site prior to use, between sampling locations, and prior to transport back to the storage facility. Decontamination of field equipment, such as monitoring equipment, stainless steel sampling equipment, and drilling equipment, will be noted in the project logbook. Decontamination will consist of hand-washing with phosphate-free soap and a water rinse. Additionally, equipment may be steam cleaned with phosphate-free soap and high-pressure hot water as an alternative to hand-washing. If it is necessary to make decontamination procedure changes in the field, the changes will be noted in the logbook. Otherwise, a notation will be made each day that decontamination was conducted as specified in the project documents. Decontamination procedures will be conducted in accordance with those specified in the QAPP and also presented in the EISOPQAM.

Equipment blanks will be collected to verify the effectiveness of the decontamination procedures. If equipment blanks indicate poor techniques, the Project Chemist and Field Operations Manager/Field Coordinator will ensure techniques are modified and samplers trained appropriately to completely clean equipment prior to use. Evaluation of sampling techniques will be conducted in accordance with the procedures outlined in Section 10.12.3.

10.6 Sample Collection Protocols

For each Area, ARCADIS technical personnel will review the project requirements and determine the best technology to obtain the samples and information required

for achieving the stated goals. Investigation methodologies; sample collection procedures; sample types, numbers, and locations; and sampling equipment will be in accordance with intended use of the data and quality protocols established in the site QAPP.

The primary CoC at Vicksburg Chemical are volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, herbicides, and arsenic. The QAPP also lists other potential analytical methods which may be required to support the remedial objectives and waste characterization necessary for disposal of investigation-derived waste (IDW).

In general, sampling at each location will progress from clean areas to contaminated areas. This practice lowers the potential for cross contamination of samples and, subsequently, eliminates data anomalies or misinterpretation of the extent of contamination. The order of sample collection at a specific location normally proceeds as follows:

1. VOCs;
2. SVOC, pesticides, and chlorinated herbicides;
3. Metals; and
4. Other parameters such as anions/cations and general chemistry parameters.

This sequence helps maintain the integrity of the samples and minimize the potential loss of volatile constituents. Soil samples requiring determination of VOCs will primarily be collected in accordance with SW-846 Method 5035 (USEPA 1997) protocols utilizing the Encore® sampling device. The Encore® capsule will be shipped to the laboratory for preservation in accordance with protocols established in SW-846 Method 5035. Alternatives to the Encore® device may be utilized which include a commercially available tool designed to capture 5 grams or 25 grams of sample for field preservation in laboratory pre-weighed vials containing sodium bisulfate or methanol. Vials will then be re-weighed by the laboratory to determine exact sample weight. Where collection of discrete 5- or 25-gram samples is inappropriate (i.e., rocky or unconsolidated material such as sludge or sediment), a 2- or 4-ounce wide-mouth glass jar will be packed full and as tightly as possible and will then be shipped to the laboratory for analysis.

If sufficient sample volume is unavailable to perform all desired parameters, the preferred parameters will be identified on a case-by-case basis.

Overall, the Field Operations Manager will be responsible for ensuring the correct sample collection methods are employed, documenting any problems, and verifying required corrective actions. The Project Manager will approve any necessary corrective actions associated with sample collection. Corrective actions will be documented in field logs or addenda to field logs. Any changes to the sampling program, including sample locations, will be approved by the Project Manager.

10.7 Field Sample Identification Protocols

Each sample will be identified by a unique sample identification number in the logbook and on the chain-of-custody record using an alphanumeric code. Geographic location will be determined for field samples as necessary for report preparation and data display. Field samples will be identified using the following convention in the order presented below:

- The Area number in the format "A#" as based on the Area location designated in the facility layout.
- Groundwater, surface water, sludge, and sediment sample identifications (IDs) will end with the date (in "mmddyy" format).
- For existing groundwater monitor wells, the current well ID will be incorporated into the sample ID.
- Soil samples will end with the depth interval (in feet).
- Blind duplicate samples will be labeled sequentially, starting at 1, in the form A#DUP01[location type code](yymmdd).

Following are some examples:

- Surface Water Sample 1 taken from Area 1 on October 6, 2006, would be: A1SW001(100606).
- Surface Soil Sample 4 taken from 0 to 6 inches in Area 2 would be: A2SS004(0-0.5).

The location type codes that will be used in the sample IDs are listed below:

- MW - monitor well;
- TW - temporary well;
- SB - soil boring (by drilling);
- GP - soil by direct push (or Geoprobe®);
- SS - surface soil by trowel or other hand collection method;
- EX - excavation;
- SW - surface water by any collection method;
- SE - sediment by any collection method;
- IDW – investigation-derived waste; and
- PS - Pilot Study.

Equipment rinsate blanks will be identified using the sample type code (i.e., EB) followed by the date as MMDDYY as a parenthetical statement. If more than one equipment blank is generated for a single day, an alphanumeric character will be added to differentiate the blanks.

For trip blanks, the sample code of "TB" will be followed by the cooler identification number. For example, the trip blank associated with Cooler Number 3-121406 submitted on December 12, 2006, would be identified as TB3-121406.

10.8 Sample Containers

The volumes and containers required for the sampling activities are listed in Table 6. The laboratory will provide new, pre-cleaned sample containers. The laboratory shall use an approved specialty container supplier that prepares the containers in accordance with USEPA bottle preparation procedures. The laboratory must maintain a record of all sample bottle lot numbers shipped to Vicksburg Chemical in the event of a contamination problem.

Sample container lids will not be mixed. All sample lids must stay with the original containers as provided by the supplier. Bottle lids (with any associated bottle) exhibiting cracks, splits, or chips shall be appropriately discarded.

10.9 Sample Container Labels

Sample labels affixed to the sample container will be used to properly identify all samples collected in the field. Each sample container will be marked in ink with the following information:

- Unique identification number for each sample in accordance with Section 10.7;
- Date and time of sample collection;
- Preservative/filtration utilized;
- Required analysis; and
- Sampler's initials.

10.10 Sample Preservation and Holding Times

Sample containers with appropriate preservatives will be obtained from the laboratory. Reagents used for preservation will be reagent-grade chemicals supplied by the laboratory. The laboratory shall maintain traceability records for all preservatives in the event of potential contamination of samples. The laboratory must ensure that preservatives used in containers supplied for Vicksburg Chemical sample collection will not expire within the anticipated time of sample collection completion. Each bottle received from the laboratory must be clearly labeled with the type of chemical preservative. Sample containers will not be stored at the site for longer than 30 days. Sample preservatives are listed in Table 6.

In the event that samples must be preserved in the field, samples will be preserved at the time of collection using the following procedure. Preservatives will be supplied by the laboratory and will be properly labeled and include the expiration dates. A clean, disposable pipette or a pre-measured, single-use, glass ampoule/vial will be used to transfer liquid preservatives to the sample container. Care will be taken to avoid contact between the pipette or ampoule and the sample or sample container. Solid preservatives will be transferred to the sample container using a clean, stainless steel spoon. After preservation, the sample will be gently shaken to mix the preservative,

and a small amount of the sample will be poured into a clean cup and tested with pH paper to determine whether a sufficient amount of preservative has been used. The field personnel will record the manual addition of preservatives (type and volume) in the field logbook.

Sample container orders will be submitted to the laboratory 5 working days prior to commencement of field operations to allow supplies of clean, fresh containers and preservatives to be shipped to the facility. Residual preservatives will be returned to the laboratory or appropriately disposed. No preservatives will be used beyond the expiration date.

Sample preservation will be verified on receipt at the laboratory with the exception of aqueous VOC samples. VOC sample preservation shall be verified prior to analysis. The preservation or pH check will be recorded on the sample receipt form or other appropriate logbook. If the samples are improperly preserved, a corrective action form will be submitted to the laboratory project manager for follow-up action. The laboratory will notify the ARCADIS Field Coordinator or Project Chemist to implement corrective actions in the field to ensure sufficient preservative is added at the time of sample collection.

Sample holding times will be based on published USEPA guidance and will be calculated for the date and time of collection. A list of preservatives and holding times for each type of analysis is presented in Table 6. Additional preservation requirements and holding times for non-target analyses are listed in 40 Code of Federal Regulations (CFR) Part 136. Preservatives and holding times not listed in Table 6 applicable to a specific Area will be listed in the Area-specific work plan.

10.11 Sample Handling and Custody Requirements

Field and laboratory personnel will, at all times, be aware of the need to maintain all samples, whether in the field or in the laboratory, under strict chain-of-custody protocols and in a manner to retain physical properties and chemical composition. The following sections detail sample handling and sample custody requirements from collection to ultimate disposal.

10.11.1 Sample Handling

The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also documents sample custody.

Regulations for the packaging, marking, labeling, and shipping of hazardous materials are promulgated by the U.S. Department of Transportation (DOT) in 49 CFR 171 through 177.

10.11.2 Sample Packaging

Samples will be packaged carefully to avoid breakage or cross contamination and will be shipped to the laboratory at proper temperatures. The following sample packaging guidelines will be followed:

- The sample bottles will be placed in the cooler in a manner to minimize potential cross contamination;
- Sample bottles from specific sampling locations will be placed in the same cooler where possible;
- In cases where samples for volatile analysis will be shipped in several coolers on a single day, VOC vials may be consolidated into a single cooler to minimize the number of required trip blanks;
- Wet ice will be used to cool samples during shipping. Ice will not be used as a substitute for packing materials;
- Shipping coolers will be filled with packing materials (e.g., bubble wrap). Packing material may be placed between or wrapped around glass containers to prevent the bottles from shifting and to minimize potential breakage during shipping;
- Temperature blanks will be included in each cooler to allow the laboratory to check cooler/sample transportation upon receipt. Temperature blanks will consist of a 250-milliliter plastic bottle filled with deionized water. Temperature blanks may be provided by the laboratory or prepared in the field prior to sealing coolers;
- Under no circumstances will packing material such as sawdust or sand be used;
- A chain-of-custody record will be placed in a sealable plastic bag and taped to the inside of the cooler lid;

- Custody seals will be affixed to the sample cooler in such a way as to indicate any tampering during shipment and then dated and initialed; and
- All sample containers will generally be segregated according to sample matrix and expected contaminant concentration where possible. Soil samples will not be shipped with water samples, and low-concentration samples will not be shipped with medium- and high-concentration samples.

10.11.3 Shipping Containers

Environmental samples will be properly packaged and labeled for transport and dispatched to the analytical laboratory. A separate chain-of-custody record will be prepared for each shipping container. Sample shipping containers will generally be commercially purchased coolers (e.g., Coleman, Igloo). Any water spouts must be sealed with tape to prevent leaking of melted water or samples from broken bottles. Each shipping container will be custody-sealed for shipment as appropriate. The container custody seal will consist of packing tape wrapped around the package at least twice and custody seals affixed in such a way that access to the container can be gained only by cutting the tape and breaking a seal. Field personnel will make arrangements for transportation of samples to the laboratory. In most cases, samples will be shipped using an overnight express carrier (e.g., Federal Express). Field personnel will provide the laboratory with a shipment schedule and notify them of deviations from planned activities. The field personnel will notify the laboratory no later than 3 p.m. (Central Time) on Thursday prior to scheduling samples for Saturday delivery.

Sample coolers will be identified with a unique number that will incorporate the cooler number and the date shipped to the laboratory. Cooler Number 1 for samples shipped on December 14, 2006, would be would be identified as 1-121406. The chain-of-custody record included in this cooler will carry the same number as the cooler.

10.11.4 Sample Custody

Formal sample custody procedures begin when sample collection is initiated. Sample identification documents will be carefully prepared so that sample identification, chain of custody, and integrity are maintained and sample disposition controlled. Sample identification documents include:

- Field notebooks;
- Sample labels;
- Custody seals;
- Chain-of-custody records; and
- Disposal records.

The primary objective of the chain-of-custody procedures is to provide an accurate, traceable record of the possession and handling of a sample from collection through completion of all required analyses and final disposal. A sample is in custody if it is:

- In a sampling team member's physical possession;
- In a sampling team member's view;
- Locked in a vehicle;
- In a custody-sealed container during shipment via commercial courier; or
- Held in a secured area that is restricted to authorized personnel.

The laboratory must follow internal written and approved procedures for shipping, receiving, logging, and internally transferring samples.

10.11.4.1 Field Sample Chain-of-Custody Procedures

All sample transfers will be documented under complete chain-of-custody procedures. An example of a chain-of-custody form is presented within Appendix B.

As part of the chain-of-custody procedures, all sample containers will be labeled with sample identification, date and time collected, initials of sample collector, and the test parameters required. The field supervisor will be responsible for the custody and care of collected samples until the containers have been transferred to the laboratory or commercial shipping company. After sample collection, the containers will be placed in a cooler with wet ice and custody seals affixed to the cooler exterior to prevent tampering.

The field sample collection team will ensure that the sample containers are in the sampler's physical possession, in view at all times, or are stored in a locked area to prevent tampering. The completed chain-of-custody form will be sealed inside the cooler if shipment to the laboratory is via commercial carrier. If samples are directly transferred to the laboratory courier or sample custodian, the chain-of-custody form will be signed by the field supervisor (or his designee) at the time of physical transfer.

When a commercial courier service is utilized, the field supervisor (or designee) will sign the chain-of-custody form and retain a copy for the field records prior to sealing the cooler. When the samples have been delivered to the laboratory, the laboratory sample receipt personnel will sign the chain-of-custody form. The fully executed original chain-of-custody form will be included in the analytical report. The analytical laboratory has internal standard operating procedures described within the Quality Assurance Manual (QAM) for receipt of samples, maintenance of custody, sample security, tracking the analyses of samples, and assembling the completed data.

The following sampling guidelines will be followed to ensure that appropriate chain-of-custody protocols are employed:

- Use as few people as possible to handle samples;
- Coolers or boxes containing cleaned bottles should be maintained in a clean, secure environment;
- In cases where samples for volatile analysis will be shipped in several coolers on a single day, VOC vials may be consolidated into a single cooler to minimize the number of required trip blanks;
- The field supervisor has ultimate responsibility for the care and custody of the samples collected until they are transferred or dispatched to the laboratory;
- When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody form;
- Samples will be packaged properly for shipment and delivered to the laboratory for analyses without breakage or leaking;

- All deliveries will be accompanied by the chain-of-custody form identifying its contents. The original form will accompany the shipment, and a copy will be retained by the Project Manager; and

- All coolers used for sample shipment will be sealed with a custody seal (example in Appendix B).

10.11.4.2 Chain-of-Custody Form

The chain-of-custody form must be completed by the technical staff designated by the Field Operations Manager/Field Coordinator as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations), the person completing the chain-of-custody form should note these constraints in the "Remarks" section of the chain-of-custody form. The chain-of-custody form should also indicate any special preservation techniques necessary or whether the samples need to be filtered and clearly indicate field QC samples for matrix spike/matrix spike duplicate (MS/MSD), trip blanks, and equipment blanks. The original signed chain-of-custody form accompanies the samples from the field to the laboratory where receipt is documented by appropriate signatures and dates. Copies of the chain-of-custody form are maintained with the project file. The original, fully executed chain-of-custody record will be included in the hard copy report.

Each chain-of-custody form will include the cooler number which identify the chain of custody for sample tracking purposes. A copy of the chain-of-custody form will be retained with the field records. If samples are shipped by commercial carrier, the shipping records will be maintained in the project files with the field records.

10.11.4.3 Custody Seals

Custody seals are preprinted, adhesive-backed seals with security slots designed to break if the seals are disturbed. Custody seals are applied to each DOT-approved sample shipping container to ensure security. Two seals will be utilized per cooler. Seals are signed and dated upon use. Upon receipt at the laboratory, the custodian checks the custody seal for tampering and documents on a cooler receipt form that seals on shipping coolers/boxes are intact.

10.12 *Field Quality Control Samples*

The field QC samples listed below will be collected and analyzed at the frequency listed in Table 7.

10.12.1 Field Duplicate Samples

Field duplicate samples provide insight as to the homogeneity of the sample matrix and enable consideration of variations in contaminant concentrations present in the matrix. Duplicate sample data establish a degree of confidence that the sample is representative of site conditions. Duplicate samples will be collected at the rate of 1 duplicate per every 20 project samples of similar matrix. For VOC analyses, duplicate soil samples will be prepared by collecting equal aliquots from the same sample source and placing them in separate sample collection devices, preserved vials, or sample bottles. For all other methods, soil from the desired sample interval/location will be placed in a stainless steel bowl and thoroughly mixed prior to filling necessary sample containers for the primary sample and field duplicate. Duplicate water samples will be prepared by equally distributing water collected among all sample bottles to be filled for both the field sample and the field duplicate sample. Duplicate samples will be shipped with the samples they represent and will be analyzed in the same manner. Duplicate samples will be labeled so as to be blind to the laboratory. The RPD between the concentration in the original and duplicate sample measures the overall precision of the field sampling and analytical method. Field duplicate RPDs will be calculated by ARCADIS after receipt of the analytical data. The RPD will be calculated as follows:

$$RPD = \left(\frac{PR - DR}{\frac{1}{2}(PR + DR)} \right) \times 100$$

Where:

PR = primary sample result

DR = duplicate sample result

The precision of field duplicates is evaluated by using approximately two times the laboratory QC criteria for duplicates (i.e., RPDs of 40 percent for water and 70 percent for soils). If all other laboratory QC criteria are met, RPD results outside control limits

indicate potential matrix effects or non-homogeneity of samples. Significant deviations in the RPD results of field duplicates are assessed to evaluate whether data met all DQOs for the project. Results for duplicates that exceed the above criteria may be qualified as estimated. Professional judgment will be used to determine the applicability and extent of qualification to other field samples.

10.12.2 Trip Blanks

Trip blanks are collected to establish that the transport of sample containers to and samples from the field does not result in the contamination of the sample from external sources. Trip blanks will be included in all coolers containing samples requiring VOC determination. Trip blanks will be prepared by the laboratory by filling 40-milliliter vials with analyte-free water, sealed, and labeled in a clean area. A set of two or three analyte-free water-filled VOC vials prepared by the laboratory will constitute a trip blank. The above protocol for trip blanks applies to both aqueous and non-aqueous samples. Trip blanks will be treated in the same manner as the VOC samples they represent.

If contamination is present in the trip blank, the sample results will be qualified as non-detect at the value reported when the sample concentrations are less than five times the level found in the trip blank. If constituent levels in the sample are greater than five times the levels in the trip blank, no qualification will be necessary unless the compounds reported are considered common laboratory contaminants. Concentrations of common laboratory contaminants detected in the trip blank and reported in samples at less than ten times the trip blank concentration will be qualified as non-detect at the value reported. If trip blank contaminants also are present in the method blank or are not present in the project samples, then no further action is required. All other sources of contamination must be investigated as part of the corrective action process.

10.12.3 Equipment Rinsate Blanks

Equipment rinsate blanks (equipment blanks) are designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use and that cleaning procedures between samples are sufficient to minimize cross contamination. Equipment blanks will be prepared in the field using a contaminant-free (deionized or distilled water) water source. The field equipment blank will be preserved, documented, shipped, and analyzed in the same manner as the samples it represents. Equipment blanks will be collected at a rate of 1 per 20 field samples of similar matrix. The location and equipment used to collect this blank shall be clearly documented on the Field

Sampling Logs. Samples collected with dedicated or disposable equipment will not require equipment blank samples at the 1 per 20 sample frequency. One equipment blank will be collected per sampling event or one per lot where single use or dedicated equipment is used, as appropriate. Examples of single use or dedicated equipment include acetate sleeves for direct push soil samples, disposable bailers, or dedicated bailers.

If low-level contamination is present in the equipment blank, the sample results should be greater than five times the level found in the blank. The equipment blank will be linked to samples collected the same day, utilizing similar equipment. If contaminant levels in the sample are less than five times the levels in the equipment blank, the sample results will be qualified as non-detect at an elevated reporting limit. Sources of contamination will be investigated as part of the corrective action process. If blank contamination results in qualification of data as non-detect at levels above the applicable screening standard, resampling may be necessary. Sample results that do not meet DQOs after qualification may require resampling. The QA Manager, Project Chemist, and Field Operations Manager/Field Coordinator will determine potential changes in the field procedures to eliminate contamination sources prior to resampling.

10.12.4 Miscellaneous Field QC Samples

Miscellaneous QC samples may also include the analysis of source water and filters. Because the water supply source is used in decontamination and well drilling activities, it may be necessary to determine the possibility for the introduction of outside contaminants. Filters may be used to evaluate dissolved constituents in groundwater. Filter blanks will be prepared to evaluate the potential contribution of CoC to the samples. Filter blanks will be collected, preserved, and analyzed in the same manner as the field samples that they represent.

10.13 Investigation-Derived Waste

Any IDW generated during field activities will be handled in a manner consistent with USEPA guidance for managing IDW associated with site sample collection (USEPA 1992) and applicable federal and state regulations. IDW includes disposable equipment and PPE, purge and development waters, drilling fluids, soil cuttings, and decontamination fluids. IDW will be managed and disposed in accordance with state and federal regulations. Visual contamination or analytical results of site samples may indicate the need for analysis of IDW. Method references for toxicity characteristic

leaching procedure (TCLP), toxicity, corrosively, ignitability, and reactivity analyses that may be used to characterize IDW are included in Table 6.

11. General Project Sampling Requirements

The activities described in this section will serve as the general SAP for the initial assessment to be performed. The initial assessment activities are designed to collect additional data where data gaps exist and to finalize CoC delineation. The Project Manager will serve as the individual responsible for implementing corrective action for problems or inconsistencies associated with the project sampling requirements. Descriptions of field procedures and analytical programs that will be used during the investigation are included in the following subsections.

As summarized in Table 2, the project sampling and analyses program has been developed to meet the project DQOs:

Develop the decision rule: If soil and groundwater quality data indicate concentrations above Tier 1 Evaluation TRG, the affected media will be addressed by the inclusion of these areas in the remedial actions set forth in this QAPP.

Specify limits on decision errors: Because the assessment includes a biased sampling design (judgment based), a statistical evaluation of decision error is not possible. The use of biased sampling prevents the results of the investigation from being used to evaluate areas beyond the immediate study area boundaries. Data quality and usability will be determined in accordance with the criteria set forth in the QAPP. Rejected data will not be used for decision-making purposes.

11.1 Field Program

During the field program, site activities will be conducted in accordance with procedures described within Section 5 (Sampling Design and Quality Assurance Procedures) of the EISOPQAM and as described in this QAPP. These procedures include the decontamination process implemented between sample collection locations and proper collection of field samples and QA/QC samples. The Health and Safety Plan (HASP) for the field sampling protocol will be provided as a separate document.

11.2 Soil Boring/Sampling Geoprobe® Device

As part of the soil boring and field corrective action baseline activities, soil borings will be advanced with a Geoprobe® device (where possible) in order to collect undisturbed subsoil samples in the Areas requiring additional information as presented in future work plans. No drilling fluids (i.e., bentonite-based drilling mud) will be utilized as part of this drilling method for shallow zone monitor wells.

Samples will be obtained using a disposable 1.5-inch diameter clear acetate sample collection tube within the Geoprobe® device. The sample tube will be placed at the desired depth and hydraulically advanced the length of the tube (4.0 feet) in one continuous movement. Following retrieval, the sample will be removed from the Geoprobe® device.

Upon retrieval of soil samples, the top and bottom ends of the soil samples may be discarded because they are potentially disturbed. Visual inspection and lithologic characterization will precede the collection of a discrete soil sample from the soil core. A qualified geologist or hydrogeologist will describe all samples and all relevant data will be recorded onto the Sample/Core Log (i.e., soil type, color, physical characteristics, texture, mineralogy, moisture content, and any observed evidence of contamination). Appendix B includes an example of a Sample/Core Log that will be used to record lithologic characteristics during the assessment.

During the soil sampling program, each collected sample will be segmented with clean stainless-steel spoons or knives for field and laboratory analysis. Duplicate sets of soil samples from each cored interval may be removed from the interior portion of the core with a stainless-steel sampling device and placed directly into separate containers designated for field screening and potential submission to the laboratory for analysis. In the event that sufficient volume is unavailable to generate a duplicate set of samples, an additional soil boring will be advanced within a 3-foot radius of the initial boring. Soil samples will be sent to the laboratory from selected intervals determined by the "headspace" analysis described below. Samples held for possible confirmatory analyses will be maintained in coolers at approximately 4 degrees Celsius (°C) until shipped to the laboratory or discarded. The container designated for field screening will be sealed with aluminum foil and set aside to allow volatilization of site contaminants within the "headspace" of the sample container. All soil samples will be field-screened with either an OVA or an OVM. Disposable chemically resistant gloves will be used during the entire process and discarded after each sample collection to eliminate the possibility of cross contamination of samples.

After a minimum of 5 minutes, "headspace" in the container will be tested for the presence of organic vapors by inserting the instrument probe through the septum (typically an aluminum foil seal) of the sample container. All measured vapor concentrations will be recorded on Sample/Core Logs by the site geologist or hydrogeologist. All instruments will be operated and calibrated according to manufacturer's instructions. Recalibration of the instrument will be performed, at a minimum, prior to use each work day and at the end of each work day. All calibration events will be recorded by the site geologist or hydrogeologist on instrument calibration forms.

Samples will be retained from subsurface intervals that appear to be the most highly contaminated and from intervals exhibiting a change in lithology. In the event that no contamination is indicated by the field screening, at least one sample per borehole will be sent to the laboratory for determination of the suspected CoC. The sample will be selected from the interval within the borehole that has the highest probability of being contaminated (i.e., first permeable layer), as determined by the on-site geologist or hydrogeologist. The analytical methods, sample volumes, and preservation requirements are summarized on Table 6. After collection, samples will be immediately placed on wet ice and maintained at 4°C until received by the laboratory. Samples will be forwarded to the laboratory under complete chain-of-custody procedures. Samples will be stored in the receiving laboratory at approximately 4°C until the analyses are performed.

11.3 Soil Sampling – Hand Auger

If required, surficial soil samples will be collected with the use of a stainless-steel hand auger. In order to minimize the potential for cross contamination between sample locations, the hand auger will be decontaminated as described in Subsection 10.5 (Field Equipment Decontamination). Once surficial soil samples are collected, the field hydrogeologist will record sample collection times and soil characteristics (e.g., sample color, lithology, presence of natural organic material) on a Soil/Sediment Sampling Log. Appendix B presents a Soil/Sediment Sampling Log that will be used to document surficial soil samples collected with a hand auger. Surficial soil samples will be containerized, stored in a cooler with ice, and transported to the laboratory under strict chain-of-custody procedures.

11.4 Temporary Monitor Well Installation Program

Upon completion of the soil sampling activities, selected soil boring sites will be converted into temporary monitor wells to collect groundwater samples. Prepackaged monitor wells will be placed within the boreholes using the Geoprobe® device. Construction details for monitor wells installed during the investigation will be recorded on the Well Construction Logs shown in Appendix B.

The monitor wells will be installed with the screened interval to intersect the top of the water table. The monitor wells will be installed using a Geoprobe® direct-push rig to minimize the generation of soil cuttings and provide minimal disturbance to the surrounding area. The monitor well installation process will begin by initially driving and/or hydraulically pushing the Geoprobe® 3.25-inch outside diameter (2.65-inch inside diameter) drill rods into the subsurface to the desired depth. The drill rod will be equipped with an expendable stainless-steel drive point/monitor well anchor assembly. Upon retraction of the drive unit, a Geoprobe® 5-foot long by 1.5-inch diameter Schedule 40 polyvinyl chloride (PVC) well screen, encased within a 2.5-inch diameter stainless-steel 0.011-inch mesh, pre-packed filter, will be inserted inside the drive casing. The well screen will be threaded to the appropriate length of PVC riser pipe, and the well assembly will be lowered into the drill casing. The 3.25-inch diameter drill rods will then be retracted, leaving the drive point, well screen, and riser in place.

To complete the monitor well installation, the annulus of the well surrounding the well screen will be filled to the extent possible with 20/40 grade silica sand or equivalent to a height approximately 1 to 2 feet above the top of the well screen. An approximately 2-foot thick bentonite seal will be poured above the sand pack using pelleted bentonite. The bentonite pellets will be hydrated with water and allowed to swell for 24 hours to create an appropriate well seal. Upon hydration, the remainder of the well annulus will be filled using an approximately 95 percent neat cement/5 percent bentonite slurry mixture pumped into the well annulus to the surface using the Tremie method. Because the property is largely inactive and no traffic is anticipated over the site area, approximately 3 feet of riser pipe ("stickup") will remain above the ground surface to provide access to the monitor wells. Colored flagging will be tied to the well and/or nearby vegetation as necessary to aid in field location.

Each temporary well will be developed using a bailer or low-flow purging and sampling procedures via a peristaltic pump equipped with new silicon pump-head tubing and Teflon® or Teflon-lined sample collection tubing for each well location. During development of each well, the on-site hydrogeologist will collect representative

samples of discharge water and record measurements of field parameters (i.e., pH, specific conductivity, and temperature) of these samples within field logs. Development at each well site will proceed until corresponding field measurements stabilize and until the discharge water is clear and free of suspended particles. Purging will continue until turbidity is less than 10 Nephelometric Turbidity Units (NTUs). Where 10 NTUs cannot be achieved, both total and dissolved metals will be collected to evaluate the potential impact of solids on the actual concentrations of metals. Total suspended solids (TSS) and total dissolved solids (TDS) will also be determined at the locations where total and dissolved metals samples are collected.

Purged water will be containerized during development of each monitor well. An off-site treatment/disposal determination will be made upon receipt of groundwater analytical data.

Upon completion of groundwater sampling, water level measurements will be collected for the newly installed wells. The top elevation of each monitor well casing will be surveyed. The resulting data will be used to evaluate groundwater flow patterns beneath the site. The temporary wells will be removed from probeholes (preferred), or abandoned in-place if depths negate their removal. Probeholes and/or the monitor wells will be encapsulated by backfilling the borehole with a cement-bentonite slurry mix in accordance with American Society for Testing and Materials (ASTM) procedures using the Tremie method.

11.5 Permanent Monitor Well Installation

Permanent monitor wells will be installed by a water well contractor licensed by the State of Mississippi. All wells will be installed in accordance with the July 1, 2005, *Minimum Specifications for Drilling Services* document (Appendix C).

11.6 Groundwater Sampling Procedures

Groundwater samples will be collected from the temporary monitor wells during one sampling event. Monitor wells will be purged of three to five well volumes with a bailer, or through the use of low-flow purging methods, prior to sampling. Low-flow monitor well sampling procedures entail purging and sampling the monitor well at flow rates between 0.1 and 0.5 liter per minute, to achieve a drawdown of not more than 0.1 meter during the sampling process (this drawdown is considered a "goal" because the actual drawdown is dependent upon geologic factors).

The groundwater purged from the well is monitored via an in-line flow cell with appropriate water quality instrumentation to evaluate when various water quality field parameters (pH, temperature, dissolved oxygen, specific conductance, oxidation reduction potential, and turbidity) stabilize. Upon stabilization, the water in the well is deemed representative of the formation water within the aquifer and samples are collected at the same low flow rates in laboratory-supplied containers. All field measurements, purge volumes, and water level measurements will be recorded at the time of sample collection on Water Sampling Logs by the field technician. Appendix B presents a copy of a Water Sampling Log that may be used during the assessment.

The purging and sampling procedure for each well will be performed using a bailer or peristaltic pump equipped with new silicon pump-head tubing and Teflon® or Teflon-lined tubing. This process will eliminate the necessity for field decontamination of pumping equipment between each well. Purging will continue until turbidity is less than 10 NTUs. Purge water and used tubing, along with other solid materials generated during the investigation, will be collected as part of the solid waste generated in the project and will be properly disposed as IDW.

Clean laboratory-provided sample containers with appropriate preservative will be used for sample collection. The sample parameters, sample volumes, and preservation requirements are summarized in Table 6. After collection, samples will be immediately placed on ice and maintained at a temperature of approximately 4°C until they are received by the laboratory. Samples will be shipped to the laboratory utilizing complete chain-of-custody procedures described within Subsection 10.11.4.1 (Field Sample Chain-of-Custody Procedures). Samples will be stored in the receiving laboratory at 4°C until the analyses are performed.

12. Special Training Requirements/Certification

ARCADIS is committed to providing rigorous training in hazardous waste operations and emergency response, health and safety procedures, the proper use of protective equipment, and overall policy objectives. General training requirements for the on-site Vicksburg Chemical activities are described below.

ARCADIS employees who participate in the types of activities defined in the Occupational Safety and Health Administration (OSHA) requirements under CFR 1910.120 at Vicksburg Chemical must have completed the 40-hour health and safety training program. Each employee must successfully complete a minimum

of 8 hours of refresher training annually to maintain the certification. Employee training records are maintained in the ARCADIS office where the employee resides. Current HAZWOPER training certificates will be maintained by ARCADIS for all personnel performing work at Vicksburg Chemical where 40-hour training is required.

All analytical chemistry laboratories performing analyses on samples collected at Vicksburg Chemical will be required to maintain current National Environmental Laboratory Accreditation Program (NELAP) accreditation for the parameters of interest if accreditation is available. Accreditation certificates, audit reports, and performance testing data will be reviewed by the Project Chemist to ensure that laboratory capabilities meet or exceed project requirements. Laboratories must also maintain internal training records for technical staff in accordance with standard laboratory practices and certification requirements. The laboratory will provide the applicable training records, including Initial Demonstration of Competence documentation, for review, as deemed necessary, by the ARCADIS Project Chemist.

All subcontractors and their employees will have current and applicable performance and certifications required to perform the assigned scope of work. Subcontract agreements will include the specific training and certification requirements and applicable records will be reviewed as appropriate. Subcontractor training and certification documentation will be maintained at the subcontractors' offices.

13. Laboratory Analytical Program

13.1 Analytical Laboratories

Independent environmental analytical laboratories will be subcontracted as appropriate for the various project requirements including contaminant delineation, confirmation sampling, routine monitoring, and pilot/bench-scale studies. Analytical chemistry laboratories shall be accredited, under NELAP, for the analytical parameters required for the project for which accreditation is available through the primary accrediting state. The laboratory QA programs will be reviewed by the ARCADIS Project Chemist. The laboratory will assign an experienced Project Manager to coordinate analytical support for field operations with the ARCADIS Field Manager and Project Chemist. The laboratory staff will include a qualified QA Manager/Coordinator, who reports directly to laboratory management independently of the technical operations of the laboratory, to oversee technical adherence to the laboratory QA programs and the Vicksburg Chemical QAPP. The specific duties of the laboratory Project Manager and QA Manager/Coordinator include:

- Reviewing the Vicksburg Chemical QAPP and any applicable site-specific work plans to verify that analytical operations will meet project requirements as defined in the project documents;

- Documenting and implementing project-specific QA/QC requirements in the laboratory and reviewing analytical data (minimum 10 percent review by laboratory QA Officer) to verify the requirements were met;

- Reviewing receipt of all sample shipments and notifying the Field Operations Manager/Field Coordinator and Project Chemist of any discrepancies within 1 day of receipt;

- Conducting internal laboratory audits to assess implementation of the laboratory QAM and procedures and providing written records of those audits;

- Rapidly notifying the Field Operations Manager and Project Chemist regarding laboratory nonconformance with the QAPP or analytical QA/QC problems affecting project samples; and

- Coordinating with project and laboratory management to implement corrective actions as required by the QAPP and internal laboratory QAM.

The laboratory QAM is incorporated by reference into this QAPP and will be included as Appendix D when the laboratory subcontract is executed. The primary analytical laboratory will provide all off-site analytical support for work performed under a specified scope of work and contractual agreement with ARCADIS. All off-site laboratories contracted will maintain current accreditation under NELAP encompassing the appropriate parameters/methods required to meet investigation, monitoring, assessment, and remediation activities. The laboratory reporting, detection, and quality control limits will be utilized to evaluate data quality and will be incorporated into this QAPP when the laboratory is selected. Laboratory SOPs will be evaluated by the project chemist as appropriate to ensure method performance is acceptable. Data will be uploaded to an electronic project database to facilitate data evaluation and report preparation.

An on-site mobile laboratory may be utilized for "hot spot" evaluation. The laboratory selected will exhibit sufficient experience in the parameters required to ensure reliability in the data generated and the associated decisions. On-site laboratory data will be considered quantitative if the methodologies employed closely follow USEPA-approved methods. If screening methods are used, only qualitative data will be generated.

At a minimum, site-specific parameters listed on Table 4 will be analyzed during the investigations and remedial actions. Additional VOCs and SVOCs may be added to individual task work plans, if requested by MDEQ. The primary analytical methods to be used by the laboratory include:

- VOCs by SW-846 Method 8260;
- Organochlorine Pesticides by SW-846 Method 8081;
- SVOCs by SW-846 Method 8270; and
- Metals by SW-846 Method 6010 or 6020.

It should be noted that modifications to the analytical program may be required if any conditions are encountered during the field program that would warrant modification. Changes in the program will be recommended and addendums to the QAPP will be made as appropriate and supplemental documents will be prepared if warranted.

13.2 Geotechnical Laboratories

Geotechnical laboratories will be selected based on project need. Selection criteria for geotechnical laboratories will be based on previous performance on ARCADIS projects or satisfactory recommendations.

13.3 Analytical Quality Assurance Program

The following section describes QA procedures that will ensure data usability. These protocols are established to ensure that analytical data generated during field and laboratory operations are usable for the intended purpose. Appropriate field QC samples as described in Table 7 will be collected/prepared and analyzed to provide information regarding sample collection techniques, matrix effects, and laboratory performance. Laboratory QC samples are prepared and analyzed to provide information relative to laboratory performance, instrument calibration, and matrix impacts on the usability of data. The analytical data are reviewed against defined criteria to ensure that data of known and acceptable quality are available to assist with project decisions and verification of attainment of project goals. Laboratory Quality Control Sample Analysis Guidelines are shown on Table 8. The compliance with data quality criteria will yield consistent results that are representative of the media and

conditions measured and useful for meeting the intended project objectives. Analytical precision and accuracy are QA criteria utilized for evaluation of potential data bias associated with sample collection or analysis and matrix or non-homogeneity impacts to reproducibility.

13.3.1 Laboratory Quality Assurance Analyses

Analytical performance is monitored through various QC samples and spikes, such as laboratory method blanks, surrogate spikes, laboratory control sample (LCS), MS, MSD, and replicate samples. All QC samples are performed on the basis of a laboratory batch. Two basic types of batches are used: the preparation batch and the analytical batch. The preparation batch includes all samples processed as a unit during organic sample preparation, metals digestion, or wet chemistry preparation. Preparation batches will not exceed 20 samples excluding associated QC samples. The analytical batch consists of all samples analyzed together in the actual analytical sequence and is also limited to a maximum of 10 or 20 samples based on the method. The QC samples associated with sample preparation include method blanks, LCS, MS, and duplicates. Surrogates are introduced into samples during preparation for extractable organic constituents or prior to purging for VOCs. For some analyses, such as volatile organics, the analytical batch is equivalent to the preparation batch. The analytical sequence includes calibration standards, instrument blanks, and reference standards.

Instances may arise where elevated concentrations of target analytes/compounds, non-homogeneous samples, or matrix interferences preclude achieving the detection limits or associated QC target criteria in a specific sample. In such instances, data will be examined on a case-by-case basis during the data validation process to determine the usability of the reported values. The laboratory will report the reason for deviations from these detection limits or noncompliance with QC criteria in the case narrative. The laboratory QC samples listed below will be collected and analyzed at the frequency listed in Table 8.

13.3.1.1 Laboratory Method Blank

A laboratory method blank is an analyte-free material of similar matrix processed in the same manner, in the same analytical batch, and at the same time as a project sample. The blank is prepared using ASTM Type II water when analyzing water samples and, where practical, pre-cleaned sand or other solid material, such as sodium sulfate, when analyzing solid samples. The laboratory method blank sample is

prepared in the same batch with the project samples at a frequency of 1 laboratory method blank per batch of 20 (or fewer) project samples for the given matrix type. The laboratory method blanks serve to demonstrate a contamination-free environment in the laboratory, reagents, and glassware utilized in sample preparation and analysis. The goal is for method blanks to be free of contamination or at a maximum less than the reporting limit. Low-level contamination may be present, but must be less than reporting limits for undiluted samples. If contaminants are present in the method blank but not in project samples, no further action is required. Where blank contamination exceeds general method guidance criteria, the laboratory shall re-prepare and re-analyze the samples or shall contact the ARCADIS Project Chemist for determination of appropriate corrective action. Qualification of constituents detected in method blanks and in associated field samples will be based on the criteria set forth in the validation section of this QAPP. All sources of contamination that are not common laboratory contaminants as defined in the method SOPs must be investigated as part of the corrective action process.

Qualification criteria for samples associated with contaminated blanks are listed in Section 18.5.

13.3.1.2 Surrogate Standards

For certain organic methods, all samples, including the method blanks and QC samples, are spiked with a set of specific surrogate standards to monitor the accuracy of the analytical determination. Surrogate spikes are added at the start of the laboratory preparation process. Surrogate compounds are not typically found in environmental samples. QC criteria for surrogate recoveries are method- and matrix-specific. Surrogate recoveries must be within QC limits for method blanks and LCS samples to demonstrate acceptable method performance. If surrogate recoveries are outside QC criteria for method blanks or LCS samples, corrective action is required and the Project Chemist should be notified. The percent recovery of surrogates in a specific sample provides an indication of the total accuracy of the analytical method in that specific sample only. Surrogate recoveries that are outside QC criteria for a sample indicate a potential matrix effect. Matrix effects must be verified based on review of recoveries in the method blank or LCS, sample reanalysis, or evaluation of interfering compounds. Sample cleanup procedures required by the laboratory SOPs must be implemented to alleviate potential matrix problems. Surrogate recoveries are calculated using the following formula:

$$\%R = \frac{SR}{SA} \times 100$$

Where:

%R = % Recovery

SR = Sample Result

SA = Surrogate Concentration Added

The QC criteria for surrogate recoveries will be as established in the analytical laboratory QA Program. The QC limits will be listed for each laboratory.

13.3.1.3 Laboratory Control Samples

An LCS or LCS Duplicate (LCSD) consists of ASTM Type II water and, where practical, pre-cleaned sand or sodium sulfate for solid matrices, or a purchased performance testing sample. Type II water is defined (D1193-91- Standard Specification for Reagent Water) by ASTM as "water that has greater than 1 megaohm-cm resistivity". The referenced ASTM method covers requirements for water suitable for use in methods of chemical analysis and physical testing. The source of the chemicals utilized for LCS spiking will be from a different supply source than the calibration standards. Where second source standards are not available, the LCS must be spiked with materials from a separate manufacturing lot of the standard. The analytical laboratory will maintain complete records of standards tracking and preparation which will be available for review as necessary. Any deviation from the utilization of second source standards will be approved by the Project Chemist.

The LCS is generally spiked with all of the analytes of interest near the mid-point of the calibration range as defined by the method. In some instances, spiking with a subset of the target compounds will be acceptable for the LCS where permissible in the SW-846 method protocol and with approval of the Project Chemist. The LCS is processed under the same sample preparation, surrogate and internal standards addition, and analytical protocols as the project samples. LCSs are analyzed at the frequency of 1 per batch of 20 samples or fewer of similar matrixes. The recovery of target analytes in the LCS provides an evaluation of method performance and accuracy. Method control may be established based on the subset of compounds listed in the method. LCSDs are analyzed with some methods but are not required QA components.

LCSDs are prepared and analyzed by the same protocols as the LCS. LCSD analyses provide precision evaluation of the method performance in addition to the accuracy information.

Laboratory QC criteria for LCSs and LCSDs are established for each method and matrix. Control limits for the laboratories performing analyses for Vicksburg Chemical will be determined. The laboratory will update the QC limits annually. The LCS recovery of the method-specific control compounds/analytes must be within the laboratory-established control limits to demonstrate acceptable method performance. If the LCS recoveries are outside QC criteria for more than a few target analytes, recoveries are significantly low (<10 percent) and corrective action is required. After corrective action is complete, sample re-analysis is required for the failed parameters. If LCS recoveries exceed the QC criteria, and that parameter is not detected in any of the samples, re-analysis is not necessary. For any other deviations from the LCS control limits that cannot be resolved by sample re-analysis within holding times, the Project Chemist must be notified immediately. If critical samples are affected, the ARCADIS Field Operations Manager/Field Coordinator may determine that resampling is required.

13.3.1.4 Matrix Spike Sample

The MS sample consists of a project sample split into two parts and processed as two separate samples. Additional sample volume will be collected in the field, identified on the chain-of-custody form, and provided to the laboratory for use as the MS sample. In addition to the regular monitoring standards (internal standards, surrogate), spiking analytes are added to the second sample aliquot. Generally, all method target analytes, if compatible, are added. A subset of target analytes may be used if indicated in the method SOP and approved by the Project Chemist. An MS sample will be prepared for every batch of 20 samples (or fewer) for a given matrix unless sufficient sample volume is not available. Where site-specific MSs cannot be performed, the laboratory shall include a batch MS or blank spike for additional evaluation of method performance in accordance with SW-846 method and SOP protocols. Percent recoveries for batch-specific MSs will be utilized only to evaluate method performance. Site samples will not be qualified based solely on the spike recoveries in matrices from other locations where the batch LCS is in control. Equipment and trip blanks must not be utilized for MS evaluation. MS recoveries are a measure of the performance of the method on the matrices of samples being analyzed. MS recoveries outside the control limits for batches where the LCS is demonstrated to be in control indicate potential matrix effects. Sample cleanup procedures may be warranted for samples with severe

matrix effects. The laboratory shall notify the Project Chemist of instances of extreme matrix effects on the analytical data to determine appropriate corrective action.
The percent recovery (%R) formula is as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spike Sample Result

SR = Sample Result

SA = Spike Added

Matrix spike recoveries for the project will be based on laboratory established control limits for the methods performed. The Project Chemist will review the laboratory control limits prior to approval for use for project samples.

13.3.1.5 Matrix Spike Duplicate Sample

The MSD sample is prepared in conjunction with the MS sample for organic methods and, as applicable, for inorganic methods (e.g., metals, cyanide). The MSD is prepared and analyzed from a third portion of the same site sample as the MS. Acceptable method performance may be exhibited by acceptable recoveries for both the MS and MSD if the batch LCS fails for specific compounds. The spike recoveries are calculated and reported the same as the matrix spike. The RPD between the spiked compound concentrations detected in the MS and MSD provides an indication of the precision of the analytical method on the actual site samples of similar matrix. The RPD is calculated by the laboratory utilizing the following formula.

$$RPD = \left(\frac{PR - DR}{\frac{1}{2}(PR + DR)} \right) \times 100$$

Where:

PR = Primary Sample Result

DR = Duplicate Sample Result

The laboratory-derived advisory control limit for RPD will be utilized for evaluation of precision for MS pairs.

13.3.1.6 Laboratory Replicate Sample

A laboratory replicate consists of a second aliquot selected by the laboratory from the same project sample. Selection of replicate samples from a heterogeneous matrix requires homogenization to ensure that representative portions are analyzed. Note that samples to be analyzed for volatile compounds shall not be homogenized. One sample per batch of 20 samples or fewer per matrix is analyzed in lieu of an MSD. The duplicate is prepared for methods that typically show concentrations of target analytes above MDLs, such as wet chemistry methods. The RPDs, between the recoveries in the original and duplicate, measure the precision of the analytical method on the actual project samples. These limits will be utilized to evaluate laboratory precision for replicate samples prepared in the laboratory for methods where MSDs are not appropriate. If all other QC criteria are met, RPD results outside control limits indicate potential matrix effects and non-homogeneity of the sample. The laboratory shall investigate significant deviations in the RPD results by observing the sample to determine any visual heterogeneity or reviewing sample data for matrix interference. If visual observation does not indicate a potential problem, the sample may be re-analyzed. Potential matrix effects are reported and discussed in the case narrative. The RPD is calculated using the same formula as the RPD for the MS/MSD.

13.3.1.7 Instrument Blanks

Instrument or reagent blanks are analyzed in the laboratory to assess laboratory instrument procedures as possible sources of sample contamination and establish background levels in the analytical system. If method blanks show contamination or the analysts suspect carryover from a high concentration sample, an instrument blank will be used to determine the appropriate corrective action. Instrument blank results are included in the analytical report.

13.3.1.8 Calibration Verification Standards

A standard is obtained from a different source or, at a minimum, a different lot from that of the calibration standard. A check standard result is used to verify an existing calibration or calibration curve. The check standard provides information on the accuracy of the instrumental analytical method independent of various sample matrices. Calibration verification standards are analyzed with each analytical batch as applicable to the analytical method and SOP.

13.3.1.9 Method-Specific QC Samples

The laboratory will follow all specific quality processes as defined by the analytical method and laboratory SOP. Method-specific QC samples may include analysis of other QC samples or standards identified in the specific method SOP. Method-specific QC samples or standards include internal standards for gas chromatography (GC) and/or GC/mass spectroscopy (GC/MS) methods, post-digestion spikes, and serial dilutions for metals analysis, and interference check samples for inductively coupled plasma (ICP) analysis.

13.3.1.10 Performance Checks

The laboratory will perform analyses of performance testing (PT) samples as required to maintain NELAP and other applicable accreditations. The Project Chemist will review laboratory PT sample results on a semiannual basis. In the event that the laboratory fails any PT parameters that impact the project samples, the laboratory will immediately notify the Project Chemist to identify appropriate corrective action implementation and to determine if any project data have been impacted.

13.4 Laboratory Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All laboratory instruments and equipment used for sample analysis will be serviced and maintained only by qualified personnel. Procedures will be implemented to ensure that instruments are operating properly and that calibrations are correct prior to analysis and reporting of any sample parameters.

13.4.1 Laboratory Equipment Maintenance

The laboratory must maintain an adequate stock of spare parts and consumables for all analytical equipment. Routine preventive maintenance procedures should be

documented in the laboratory SOPs and/or QAM. Maintenance performed on each piece of equipment must be documented in a maintenance logbook. Daily checks of the laboratory deionized water and other support systems will be performed. The laboratory will have backup instrumentation or a process in place for most of the analytical equipment to minimize potential adverse impacts on data quality due to instrument malfunction. For example, the laboratory should have duplicate instrumentation and/or maintain service agreements for rapid response with the manufacturer of major laboratory instruments (e.g., GC/MS, ICP). Laboratory instrument maintenance procedures will be evaluated during the laboratory selection process and during the project, as necessary, to verify that there will no impacts on analyses of project samples due to instrument malfunction.

13.4.2 Instrument Calibration and Frequency

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations, as well as criteria set forth in the applicable analytical methodologies and SOPs. The laboratory QAM will provide brief descriptions of instrument calibration procedures to be performed by the analytical laboratories. Personnel properly trained in these procedures will perform operation, calibration, and maintenance of all instruments. Documentation of all routine and special maintenance and calibration information will be maintained in an appropriate logbook or reference file and will be available for inspection. All laboratory instrument calibration is set forth in analytical method SOPs.

Field instrument calibration will be performed in accordance with the applicable ARCADIS policy. Table 5 lists typical monitoring equipment used during fieldwork with general calibration information. This equipment is representative of instruments typically required for site groundwater and field sampling operations. All field personnel receive annual refresher training on the field operation of all health and safety related equipment, which includes calibration procedures. All equipment calibration performed in the field must be recorded on the field instrument calibration forms. The forms will be retained in the project file.

Qualitative field methods may be utilized to evaluate remedial action performance prior to collection and submission of samples to the off-site analytical laboratory for quantitative evaluation.

13.5 Inspection/Acceptance Requirements for Supplies and Consumables

Acquisition and/or purchase of material, equipment, and services will be prepared, reviewed, and approved in accordance with the requirements set forth in the ARCADIS subcontracting procedures.

13.5.1 Standard Reagent Receipt and Traceability

For analytical laboratory operations, all standards are obtained directly from USEPA or through a reliable commercial supplier with a proven record for quality, traceable standards. All commercially supplied standards must be traceable to USEPA or National Institute of Standards and Technology (NIST) reference standards, and appropriate documentation will be obtained from the supplier. The certificates will be kept on file in a central location. When standards are received, they will be documented with the following: date received, chemical, lot number, concentration, and date opened or expiration date. When standards are prepared from these source materials, information will be included in a logbook with date of preparation, lot source, amount used, final volumes, resulting concentration, and preparer's initials. Laboratory SOPs and standards/reagent records will be reviewed during laboratory audits or if QC problems arise to ensure traceability requirements are met.

For field operations, standards are primarily applicable to chemical preservatives as described in Table 6 and field instrument calibration solutions for pH, conductivity, and turbidity. Chemical preservatives are typically obtained from the laboratory that is responsible for maintaining the traceability records. Field instrument calibration standards are obtained from chemical suppliers and records maintained by ARCADIS.

14. Data Documentation and Data Management

All field records and laboratory analytical data will be maintained and managed in accordance with procedures described in Section 3.5 (Field Records) and Section 3.6 (Documents Control) of EISOPQAM and as further defined in this QAPP. A field logbook, with sequentially numbered pages, will be utilized during fieldwork to document field activities and sample collection.

14.1 Documentation and Records

The primary documentation for the project includes field records, analytical data packages, and summary and closure reports. All documentation generated in support

of the Vicksburg Chemical monitoring and remedial actions will be retained in the Baton Rouge, Louisiana, office of ARCADIS for a period of 6 years.

Requirements for retention of field records are presented in previous sections. Requirements for analytical data packages for Vicksburg Chemical activities are described in the following sections. The Area-specific work plans will provide additional requirements for any associated field and analytical documentation.

14.2 Laboratory Report Content

Analytical reports prepared by the laboratory will be defined as Level II data packages and will include the information listed in this section. The Level II data packages will include a fully executed chain-of-custody form, sample receipt checklist, cross-reference table of field samples that identifies laboratory and sample number preparation and analytical batch numbers, analytical results, collection and analysis dates, reporting limits, dilution factors, surrogate recoveries, method blank data, LCSs, MSs, laboratory replicates, laboratory control limits, and explanation of data flags, as well as a case narrative and fully executed chain-of-custody form. The hard copy report shall include a laboratory sample receipt checklist that documents sample condition as well as nonconformances at the time the laboratory receives the samples.

The reports also will include the laboratory control limits with appropriate data flags identifying any QC result reported outside control limits and an explanation of all data flags applied by the laboratory. The report-specific case narrative will present an explanation of all QC results reported outside control limits and samples analyzed at dilutions where all results are non-detect. The case narrative shall include discussions of any observations during sample preparation and analysis which could impact data quality. The laboratory report will include copies of any nonconformance or corrective action forms associated with data generation.

Laboratory reports will not include calibration information or raw data.

Soils will be reported on a dry weight basis. The reporting limits (RLs) and MDLs will be corrected for percent moisture (soils only) and all dilution factors. Any compounds found less than the RL, but greater than the MDL, should be reported and qualified with a "J" flag as estimated.

The laboratory will provide an electronic data deliverable (EDD) that matches all data reported on the hard copy analytical report. Electronic data report requirements are described in Section 14.4.2.

14.3 Laboratory Record Retention

All records related to the analytical effort will be maintained at the laboratory in access controlled areas for at least 1 year. All records will then be retained by the laboratory in a secure location for a period of 6 years after the final report is issued. Types of records to be maintained in addition to the analytical report for the Vicksburg Chemical activities include the following:

- Complete chain-of-custody forms from sample receipt to destruction. Sample destruction records must contain information on the manner of final disposal;
- Supporting documentation for any nonconformance or corrective action forms supplied in the analytical report or related to the analysis of project samples;
- Computer records on disk with magnetic tape backup of cost information, scheduling, raw data, Laboratory Information Management System (LIMS) data, and laboratory management records;
- All laboratory notebooks including raw data such as readings, calibration details, and QC results;
- Hard copies or scanned images of data system printouts (e.g., chromatograms, mass spectra, and ICP data files);
- Sample receipt documentation; and
- Hard copy analytical reports or scanned electronic images.

Electronic data and media retention policies will correlate with hard copy data retention at the laboratories as well as other points of electronic data generation. Additionally, electronic data must be subject to backup routines that will enable recovery of data that may become corrupted or lost due to instrument, computer, and/or power failures. Electronic media will be stored in climate-controlled areas to minimize potential for degradation. Storage areas will be access limited.

14.4 Electronic Data Management

Electronic data management provides the ability to track samples and results from work plan implementation to the final report. The field data include approved work planning tables, labels, field sampling forms, chain-of-custody forms, and logbooks. The surveyor will provide coordinates for all sample locations in hard copy and electronic format. The Field Operations Manager/Field Coordinator will review all field data for accuracy. Field data not provided by the laboratory will be manually entered into a database or spreadsheet.

ARCADIS will use a Microsoft® Access database to handle environmental data for the Vicksburg Chemical remediation project. Use of electronic data storage will allow access to the data for efficient data evaluation, display, and reporting.

14.4.1 Field Data

Field data such as pH, turbidity, conductivity, oxidation-reduction potential, temperature, and dissolved oxygen will be incorporated into the database by manual input.

Spatial data (geographic coordinates) for each sampling location will be collected as necessary and incorporated into the database for display via the geographic information system (GIS). Consistent units for the x, y, and z coordinates will be used.

14.4.2 Laboratory Electronic Data Deliverables

ARCADIS will utilize a standard Microsoft® Excel spreadsheet for the laboratory EDD. The laboratory will prepare the spreadsheet directly from the LIMS that is utilized for generating the hard copy report. The following information shall be included in the spreadsheet:

- Sample Identification;
- Date and Time Sampled;
- Date and Time Analyzed;
- Matrix;

- Parameter;
- Chemical Abstract Number;
- Results with appropriate units;
- Method performed;
- Applicable Laboratory Qualifiers;
- Laboratory Name;
- Sample Delivery Group or Laboratory Project Number;
- RL;
- Dilution Factor; and
- MDL.

The Project Chemist or designee will review 5 percent of electronic laboratory and field data to verify the results against the hard copy and check for transcription errors. A greater than 15 percent discrepancy rate in two consecutive data sets will require additional review and verification. Electronic data will match the hard copy data for all results including significant figures. The results will be transferred to the centralized Environmental Quality Information Systems (EQuIS) database. The ARCADIS Project Chemist will add any data qualifiers and the Data Manager will create data tables for the data report. The Project Chemist and Field Operations Manager will resolve discrepancies between the planned activities and actual data collected and document the findings in a summary report. The central database will be stored in a secure area with access limited to data management specialists designated by the Project Manager. The central database will allow direct linking to GIS/computer-aided design (GIS/CAD) systems, risk assessment programs, and other final data user models and statistical programs. Data users may enter additional electronic data such as risk-based criteria for comparison of the results. This data will be stored in separate tables in the database and linked to the actual results. Any data from outside sources will include a description of the data, a reference to the source, and the date updated. The outside data will be checked prior to use in order to verify that the most current values are used.

15. Laboratory Measurements and Data Acquisition

This section of the QAPP contains descriptions of all aspects of the implementation of field, laboratory, and data handling procedures to meet the requirements of Vicksburg Chemical activities. The site-wide QAPP provides the basis for ensuring that appropriate methods are used and thoroughly documented. These procedures will be adapted, as appropriate, to meet the objectives of each Vicksburg Chemical project as described in the Area-specific work plan.

15.1 Laboratory Custody Procedures

Internal laboratory custody protocols must maintain a system that provides for and identifies custody during sample log in, sample analysis, data storage and reporting, and sample disposal. These procedures must ensure continuous documentation of sample custody from receipt to disposal. Laboratories must complete a cooler or sample receipt form documenting the temperature and condition of the samples on receipt. The form must be included in the laboratory data package.

15.2 Analytical Method Requirements

The primary analytical methods anticipated to be utilized for samples collected during Vicksburg Chemical activities are listed in Table 4. Analytes/compounds that may be reported for samples collected are listed in Table 4. All methods will be USEPA-approved unless nonstandard methods are required to evaluate the presence of unanticipated or unusual compounds. The Project Chemist will review performance data with the laboratory for any nonstandard method prior to utilization of the procedure for determination of any analytical parameters for Vicksburg Chemical. Additional USEPA-approved methods that may be utilized are published in references listed in Section 15.3. Specific performance criteria, including QA protocols, for each analytical method are documented in the published methods and laboratory SOPs and the laboratory QAM. The QAM for each analytical laboratory performing work at Vicksburg Chemical will be reviewed as part of the procurement process and laboratory SOPs will be examined during on-site audits or as necessary. "QAM" is a generic term for the laboratory quality assurance document that describes the laboratory program to ensure data of known quality are generated. The primary laboratory QAM will be included as Appendix D when the laboratory is selected.

15.3 Standard Laboratory Analytical Procedures

All standard analytical methods performed in conjunction with Vicksburg Chemical remedial activities will be USEPA approved. The analytical methods are referenced in:

- *Test Methods for Evaluating Solid Waste, Physical Chemical Methods*, 3rd edition, SW-846 (1997);
- 40 CFR Part 136, *Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act*; and
- *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, Revised March 1983.

The primary laboratory and any subcontract laboratories shall be accredited under NELAP for the parameters and methods applicable to Vicksburg Chemical investigations where accreditation is available through the primary accrediting authority under which accreditation is maintained by the laboratory. The laboratory will perform all methods in accordance with the appropriate USEPA-approved methods and the laboratory-specific SOPs for compliance with this QAPP and other project-specific requirements. The laboratory shall have method-specific SOPs for all methods performed. The SOPs will detail method set-up, calibration, performance, and reporting criteria in accordance with SOP preparation under NELAP guidance and requirements. Method performance will be in strict compliance with the SOP and referenced method. Laboratory SOPs will include any modifications to the published method and will indicate actual performance protocols performed by the laboratory. The laboratory will update SOPs in accordance with NELAP requirements. The ARCADIS Project Chemist must approve any changes to the method performance acceptance criteria. Laboratory SOPs may be reviewed during on-site laboratory audits, as appropriate. Determination of any parameters by methods other than those identified in this QAPP or the Area-specific work plan will require approval prior to application to Vicksburg Chemical samples.

The laboratory RLs for all target analytes/compounds will be compared to the health-based screening values (e.g., USEPA Region 4 Tier 1 TRGs and Region 4 Ecological Screening Values) or drinking water maximum contaminant levels (MCLs) that are anticipated to be used as screening values and/or cleanup goals for remedial actions at Vicksburg Chemical. Any RLs that exceed the proposed screening values are flagged with an asterisk. The flagged analytes will be evaluated as part of the preparation of the Area-specific work plan to determine whether it is critical for the parameters to meet the

screening values for the specific Area. The Area-specific work plan will indicate the most current reporting and detection limits for the analytical methods required for the specific location or project if the limits differ from the site-wide QAPP. The laboratory must notify the Project Chemist of any updated or revised RLs prior to initiation of field operations. Required sample or extract dilutions to complete the analyses within method performance criteria may also impact RLs. All required sample dilutions will be noted in the analytical report and explained in the case narrative. The laboratory shall make every effort to report all compounds/analytes at the lowest technically achievable limit to meet the risk screening standard requirements. The changes/elevations in RLs will be evaluated to determine potential impact on DQOs or risk evaluation. Any additional methods required for future projects will be specified in the Area-specific work plan. A notification addendum to the QAPP will be prepared annually to provide a current listing of laboratory RLs and control limits. The addendum will also include summaries of any significant changes to laboratory method SOPs. Significant changes may include deletion of a method, changes in calibration ranges, and new SOPs for detection and quantitation of CoC at Vicksburg Chemical.

15.4 Nonstandard Laboratory Analytical Procedures

The laboratory may be required to develop, validate, and use nonstandard analytical techniques for specific purposes. These methods may be proposed to meet specific data needs for the project or where it can be shown that substantial cost or timesaving can be achieved in comparison to standard procedures. In these instances, the laboratory will provide a method performance package including initial precision and accuracy data, MDL studies, and an SOP. Potential Vicksburg Chemical parameters that may warrant nonstandard methods include various explosives. Any nonstandard performance-based methods and supporting documentation will be incorporated as addenda to the QAPP.

15.5 Mobile Laboratory

A mobile laboratory may be utilized to provide rapid screening during "hot spot" identification and delineation. Method performance will adhere to the current standard operating procedure developed specifically for Vicksburg Chemical application. Calibration verification and method blanks will be analyzed daily. Calibrations will be performed as necessary to ensure that data are reliable and representative of the site characteristics. Calibration verification will be based on the SOP, which includes monitoring of response factors and retention time windows.

Data generated by the field laboratory will be utilized for screening purposes only. Approximately 10 percent of the samples collected will also be submitted to the contract laboratory for verification of field screening data and to provide definitive data, if necessary. The contract laboratory will utilize SW-846 methods or modified equivalents. Additional details will be amended to the QAPP if a mobile laboratory is contracted to support "hot spot" evaluations at the site.

15.6 Field Screening Methods

OVAs or OVMs will be used to screen soil cores to select the interval with the highest potential for elevated contaminant concentrations. The instruments will be calibrated in accordance with manufacturer's specifications. Calibration verification will be performed as described in Table 5.

In general, method performance will be in accordance with the applicable screening kit or method manufacturing guidance. Deviations from the guidance or USEPA-approved method will be identified in a method-specific SOP as necessary or in the field notes.

16. Assessment and Oversight

Assessment and oversight procedures for the Vicksburg Chemical activities will be implemented in accordance with this QAPP. The QAPP outlines general roles and responsibilities for the project team. Additional procedures will be developed as necessary to meet the DQOs of a specific Vicksburg Chemical Area and/or SWMU and presented in an addendum to or a revision of the QAPP or included in the Area- or SWMU-specific work plan.

Upon completion of field activities and analytical data validation, the project draft and final reports will be prepared. The draft and final reports will contain descriptions of all field activities, data validation reports, results of data evaluations, copies of field records, copies of analytical data packages, and supporting figures and data summary tables. The final report will be sealed by a Mississippi-registered geologist.

16.1 Assessments and Response Actions

Assessment activities include management and assessments, technical systems audits, and performance evaluations. Management assessments include routinely scheduled meetings and conference calls to evaluate staff utilization. Assignment of qualified personnel to Vicksburg Chemical activities, maintenance of schedules and

budgets, and quality of project deliverables are verified as part of these assessments. Performance evaluations are used to ensure that trained and qualified staff is utilized for the project. Technical assessment activities applicable to Vicksburg Chemical activities include peer review, data quality reviews, and technical system audits (i.e., laboratory and field). Technical systems audits include review and evaluation of field and laboratory performance to assess the implementation of quality programs and directives specifically for Vicksburg Chemical activities. Procedures for assessment and audits of data quality are described in Section 18 (Data Validation) of this QAPP. Procedures for peer review and technical assessments are summarized briefly below. Both the overall and direct technical assessment activities may result in the need for corrective action. The procedure for implementing a corrective action response program for both field and laboratory situations are summarized briefly below.

16.2 Peer Review

All project deliverables including work plans, QAPPs, draft and final reports, and technical memoranda will be peer reviewed by ARCADIS. The peer review process provides for a critical evaluation of the deliverable by an individual or team to determine whether the deliverable will meet the established criteria, DQOs, technical standards, and contractual obligations. The Project Manager or Remediation Task Manager will assign peer reviewers, depending on the nature and complexity of the project, when the publications schedule is established. The Project Manager will be responsible for ensuring all peer reviewers participate in the review process and approve all final deliverables. For technical memoranda and other project documents, the Remediation Task Manager will be responsible for obtaining principal review and approval. The QA Manager is responsible for verifying that project documents are generated in accordance with the project requirements.

16.3 Technical Systems Assessments

The entire project team is responsible for ongoing assessment of the technical work performed by the team, identification of nonconformance with the project objectives, and initiation, implementation, and documentation of corrective action. Independent performance and systems audits are technical assessments that also are an integral part of the overall QA/QC program for Vicksburg Chemical activities. The following describes the types of audits conducted, the frequency of these audits, and the personnel responsible for conducting the audits.

16.3.1 Field Audits

Field audits for specific project will be conducted as necessary during the project to ensure compliance with all project requirements. Field audits are performed under the direction of the QA Manager. The field audit report will be prepared and submitted to management.

16.3.2 Field Inspections

The Field Operations Manager will be responsible for inspecting all field activities to verify compliance of the activities with the project plans.

16.3.3 Laboratory Audits

The primary laboratory and any subcontracting laboratory must implement a comprehensive program of internal audits to verify the compliance of their analytical and management systems with the SOPs and QAMs. The laboratory may be requested to perform a project-specific audit to verify compliance with Vicksburg Chemical project requirements. The laboratory must be accredited and maintain current accreditation for Vicksburg Chemical methods and parameters where accreditation is available through the primary accrediting authority.

The Project Chemist may also audit laboratories. These audits are typically performed to verify the laboratory capabilities and implementation of any complex project requirements or in response to a QC nonconformance identified as part of the data review process.

16.4 Corrective Action

Corrective actions will be implemented as determined by project reviews, data quality assessments, and other procedural evaluations. In conjunction with the QA Manager and Project Chemist, the Field Operations Manager/Field Coordinator is responsible for initiating and implementing corrective action in the field. The Project Manager and/or Remediation Task Manager are responsible for implementing, as necessary, corrective action in office settings. The laboratory Project Manager, in conjunction with the laboratory technical staff and QA Manager, is responsible for implementing corrective action in the laboratory. It is their combined responsibility to ensure that all analytical procedures are followed as specified and that the data generated meet the prescribed

acceptance criteria. Specific corrective actions necessary will be clearly documented in the logbooks or analytical reports.

16.4.1 Field Corrective Action Scenarios

The need for corrective action in the field may be determined by technical assessments or by more direct means such as equipment malfunction. Once a problem has been identified, it may be addressed immediately or an audit report may serve as notification to project management staff that corrective action is necessary. Immediate corrective actions taken in the field will be documented in the project logbook. Corrective actions may include, but are not limited to:

- Correcting equipment decontamination or sample handling procedures if field blanks indicate contamination;
- Recalibrating field instruments and checking battery charge;
- Training field personnel in correct sample handling or collection procedures; and
- Accepting data with an acknowledged level of uncertainty.

After a corrective action has been implemented, its effectiveness will be verified. If the action does not resolve the problem, appropriate personnel will be assigned to investigate and effectively remedy the problem.

16.4.2 Laboratory Corrective Action Scenarios

Out-of-control QC data, laboratory audits, or outside data review may determine the need for corrective action in the laboratory. Corrective actions may include, but are not limited to:

- Reanalyzing samples, if holding times permit;
- Correcting laboratory procedures;
- Recalibrating instruments using freshly prepared standards;
- Replacing solvents or other reagents that give unacceptable blank values;

- Training additional laboratory personnel in correct sample preparation and analysis *procedures; and*

- Accepting data with an acknowledged level of uncertainty.

Specific laboratory corrective actions for analytical deficiencies must be consistent with the analytical method. The laboratory corrective actions must be defined in analytical SOPs. Any deviations from the analytical SOP require corrective actions and documentation with approval of the ARCADIS Project Chemist. Whenever the ARCADIS Project Chemist deems corrective action necessary, the laboratory Project Manager will ensure that the following steps are taken:

- The cause of the problem is investigated and identified;

- Appropriate corrective action is determined;

- Corrective action is implemented and the effectiveness verified by the laboratory QA Officer; and

- Documentation of the corrective action verification is provided to the Project Chemist in a timely manner.

17. Project Reports

Following receipt of all analytical data and upon completion of the data evaluation and validation process, a project summary report will be prepared. The draft and final reports will include summaries of all project activities, analytical data packages, data validation reports, and data evaluations. Conclusions and recommendations will also be presented within the summary reports. Supporting figures, interpretations of the geophysical survey, copies of logs, data validation forms, chain-of-custody forms, and the chemical analytical report(s) will also be included within the project reports. The final report will be sealed by a Mississippi-registered geologist.

17.1 Quality Assurance Reports

The following reports may be prepared for management as applicable for activities conducted at Vicksburg Chemical. These reports will be retained in the project files.

Field Reports - The Field Operations Manager/Field Coordinator will prepare summary reports at the end of each sampling week. The reports will document field progress and

any concerns in the field. Adjustments to the field scope of work and other problems will be reported immediately. The report will be provided to the Field Operations Manager and Project Manager.

Audit Reports - Audit reports will be prepared by the audit team leader immediately after completion of the audit. The report will list findings and recommendations and will be provided to the Project Manager, Remediation Task Manager, and Project Chemist.

Data Validation Reports - Data validation reports will be completed by the Project Chemist as soon as possible after receipt of the data from the laboratory (i.e., the goal is within 4 weeks). Impacts on the usability of the data will be tracked by adding qualifiers to individual data points as described in Section 18.

18. Data Validation

Data generated will be reviewed for conformance with the QAPP, Area-specific work plans, and project requirements. QA information provided by the laboratory will be evaluated relative to the methods performed, the laboratory SOPs, the laboratory QAM, chain-of-custody requests, Laboratory Task Orders (LTOs) or similar directive document, and Vicksburg Chemical QAPP, as appropriate. The laboratory will be responsible for internal review of all calibrations, raw data, and calculations. The final analytical report will be reviewed by the laboratory Project Manager and other appropriate laboratory management personnel for compliance with the above listed documents including peer and supervisory review prior to releasing data to ARCADIS.

The ARCADIS Project Chemistry Team will perform additional verification and validation of laboratory data as well as review field documentation and data. Data verification will include completeness, correctness, and conformance evaluations against project requirements set forth in the site-wide QAPP, Area-specific work plans, LTOs, laboratory QAM, and analytical methods. Data validation will be performed to assess the quality and usability of the data generated.

Field record review will include instrument calibration logs, sampling logs, chain-of-custody forms, field notes, and field parameter results. The field information assessment will evaluate the potential for impact to sample integrity and chemical data quality.

18.1 Verification and Validation Methods

The data review scheme for analytical results from the receipt of the analytical data through the validated report is described below. The laboratory is responsible for performing internal data review. The data review by the analytical laboratory will include 100 percent analyst review, 100 percent peer review, and 100 percent review by the laboratory Project Manager to verify that all project-specific requirements are met. The laboratory QA Officer will perform a review on 10 percent of the data packages. All levels of laboratory review will be fully documented and available for review if requested or if a laboratory audit is performed.

After receipt from the laboratory, project data will be verified and validated by ARCADIS or experienced contract personnel using the following steps.

18.2 Validation Reports

Data validation reports will be generated for each data package to record the results of the validation effort. The data validation reports will identify all deficiencies and the impact on the results. The Database Manager will amend qualifiers generated during the validation process to the EQuIS database and a summary table of the data qualifiers will be included with the analytical report.

For Vicksburg Chemical activities, ARCADIS will implement the general procedures for data validation and usability described below. These procedures will be adapted, if necessary, to meet project-specific or activity-specific requirements. Data validation and usability criteria set forth in this QAPP shall be followed unless otherwise amended in the Area-specific work plan. The Area-specific work plans will also address any modifications to data review criteria not included in this QAPP.

Review of completed laboratory reports will be conducted by the laboratory prior to submission to ARCADIS. The review of the laboratory report by the laboratory Project Manager will be performed to ensure that all applicable laboratory procedures have been conducted in accordance with USEPA-approved methodologies and the Vicksburg Chemical QAPP.

The ARCADIS Project Chemist or qualified designee will review the analytical report case narratives and perform a cursory review of laboratory reports for completeness and compliance with project objectives. Chemical analytical data collected in support of the remedial and monitoring programs at Vicksburg Chemical will be reviewed and

qualified using guidelines established in the USEPA National Functional Guidelines (NFGs) modified to incorporate method- and project-specific requirements. For samples collected in support of remedial decisions, 10 percent of the data will undergo Vicksburg Chemical project Level II data verification and validation. If no significant deficiencies are identified, additional data validation will not be performed. If deficiencies are identified that warrant further evaluation of the analytical data, the Project Chemist and the Project Manager will determine additional verification protocols to ensure data usability. Samples collected in support of long-term operations and maintenance of selected remedies, pilot or bench-scale studies, wastewater discharge and storm water compliance, or waste disposal will not be validated. The Level II validation components are presented in Section 18.3.

Method performance evaluation will be based on the laboratory method control criteria presented in the laboratory QAM or associated documentation as well as the validation protocols presented in the USEPA NFG. A review of field records and chain-of-custody logs will also be included in the validation procedure.

18.3 Level II Validation Components

Project Level II data validation includes a review of all sample documentation. Sample documentation includes sample collection logs and chain-of-custody forms. The analytical report will be reviewed for completeness and for compliance with chain-of-custody requests, LTOs, and the Area or SWMU work plan. The following parameters will be evaluated:

- Blank contamination
  - Method blanks
  - Trip blanks
  - Equipment blanks;
- MS and MSD recoveries;
- MS/MSD precision;
- LCS and LCSD recoveries;
- LCS/LCSD RPDs (when available);

- Surrogate recoveries;
- Field duplicate precision;
- Reporting limits relative to the project requirements;
- Holding time compliance;
- Data package completeness;
- Sample receipt information;
- Fully executed chain-of-custody documentation;
- Report completeness and conformance with chain of custody, LTO, QAPP, Area-specific work plan, and other project requirements; and
- Case narrative describing any out-of-control events and summarizing analytical observation or non-conformances.

If the data package is incomplete, the Project Chemist will contact the laboratory, which must provide all missing information within a reasonable timeframe (i.e., 1 to 2 days). Based upon a review of the data, the quality (usability) of the data will be determined as described within Section 19 (Data Usability).

18.4 Field Data Review

Field data are generated from in-field measurements, which may include geophysical surveys, well development, groundwater sampling, and surface water sampling. The quality objective for the in-field measurement activities is to obtain accurate measurements of sample characteristics, including pH, conductivity, temperature, turbidity, dissolved oxygen, and/or oxygen reduction potential, using appropriate equipment. Data are recorded in field logbooks or on field sampling sheets and instrument calibration logs. Calibration logs will be reviewed with other field documentation to identify any potential impacts to data quality and usability. Field logbooks are reviewed as part of the QC inspections, audits, and data validation. Field data are typically provided as an appendix to final reports. Field and laboratory data are generally assessed against specific criteria determined to be applicable for the project. All criteria must be evaluated prior to the assessment to verify the current values and applicability of the guidance. Regulatory and other guidance that may be used for risk comparisons are presented in the references section of this QAPP. Field data

packages will be reviewed by the Project QA Manager and Project Manager for completeness and accuracy. The validation of the field data package will consist of the following:

- A review of field data contained in notebooks, Sample/Core Logs, Soil/Sediment Sampling Logs, Water Sampling Logs, and Well Construction Logs for completeness;
- A verification that equipment blanks, field blanks, field replicates, and trip blanks were properly prepared, identified, and analyzed;
- A check on field analyses for equipment calibration and instrument condition; and
- A review of chain-of-custody forms for proper completion, signatures, and dates. These records will be reviewed in conjunction with the sample receipt forms completed by the laboratory to ensure adequate sample transfer procedures.

18.5 Data Qualification

Based on the Level II validation, the following qualifiers will be applied as applicable to the analytical data.

Data Qualifier	Definition of Data Qualifier
J	Estimated value below laboratory quantitative reporting limit but detected above the method detection limit or estimated value due to quality assurance deficiency.
UB	Parameter is considered non-detect at the reported value due to associated blank contamination.
UJ	Parameter is non-detect but the value is considered estimated due to quality assurance deficiency.
U	Not detected above laboratory quantitative reporting limit.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte may not be verified. This flag may be used to designate samples with high or low surrogate recovery.

Serious analytical problems will be reported immediately to the ARCADIS Project Chemist by the laboratory Project Manager. The ARCADIS Project Chemist will notify the ARCADIS Field Operations Manager/Field Coordinator and Project Manager to evaluate the necessity for resampling or additional sample collection. Time and type of corrective action (if needed) will depend on the severity of the problem and will be related to the overall project importance of the data points. Corrective actions may include altering procedures in the field, conducting an audit, resampling, or modifying laboratory protocol.

19. Data Usability

The objective of this project is to delineate soil, sediment, sludge, surface water, and groundwater impacted by release of CoC during previous site activities and to achieve site remediation. Analytical data generated in accordance with USEPA SW-846 or other USEPA-approved methodologies will be considered definitive and quantitative based upon completion of the validation processes.

Data, qualified during validation, will be utilized in the final site assessment based upon the following criteria:

Data Qualifier	Definition of Qualifier	Criteria for Data Usability
U or UJ	Analyte not detected above the laboratory Quantitative Reporting Limit.	Data usable for intended purposes and parameter is considered not present at the listed value.
J	Estimated value either below the laboratory Quantitative Reporting Limit or Estimated due to minor data quality deficiency.	Data will be used as valid for risk evaluation.
UB	Analyte is not present in sample above listed value based on associated blank contamination.	Data will be used as quantitative for risk evaluation.
R	Sample result is considered unusable due to serious deficiencies in method performance. The presence or absence of the analyte cannot be verified.	Data may not be used for decision-making purposes.

19.1 Reconciliation with Data Usability Requirements

For routine assessments of data quality, ARCADIS will implement the data validation procedures described in Section 18 and assign appropriate data qualifiers to indicate limitations on the data. The Project Chemist will be responsible for evaluating precision, accuracy, representativeness, comparability, and completeness of the data using procedures described in Section 3.2 of this site-wide QAPP. Any deviations from the analytical DQOs for the project will be documented in the data validation memorandum provided to the data users for the project. The Project Chemist will work with the final users of the data in performing data quality assessments. The data quality assessment may include some or all the following steps:

- Data that are determined to be incomplete or not usable for the project will be discussed with the project team. If critical data points are involved which impact the ability to complete the project objectives, the data users will report immediately to the Field Operations Manager/Field Coordinator. The Field Operations Manager/Field Coordinator will discuss the resolution of the issue with the ARCADIS Project Manager and implement the necessary corrective actions (for example, resampling);

- Data that are non-detect but have RLs elevated due to blank contamination or matrix interference will be compared to screening values (see Table 3). If reporting limits exceed the screening values, then the results will be handled as appropriate for data use; and

- Data qualified as estimated will be utilized if it is determined that the data are useable for their intended purpose. If an estimated result is close to a screening value, then there is uncertainty in any conclusions as to whether the result exceeds the screening value. The data user must evaluate the potential uncertainty in developing recommendations for the site. If estimated results become critical data points in making final decisions on the site, the Field Operations Manager/Field Coordinator should evaluate the use of the results and may consider the data point incomplete.

The ultimate data assessment process involves comparing analytical results to screening values and background concentrations to determine whether the contamination present is site related (i.e., above background levels) or significant (i.e., above screening values). Additional data assessment may be performed on a site-by-site basis. Any additional procedures for data quality assessment will be provided in the Area- or SWMU-specific work plan.

20. References

Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act. 40 CFR Part 136.

USEPA. 1983. Methods for Chemical Analysis of Water and Wastes. EPA-60014-79-020. March.

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USEPA. 1997. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Update IIIA and subsequent updates. SW-846, Office of Solid Waste and Emergency Response, Washington, D.C.

USEPA. 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review. Office of Emergency and Remedial Response. EPA-540/R-99-008 (PB99-963506). October.

USEPA. 2001. Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual.

USEPA. 2000. Guidance for the Data Quality Objective (DQO) Process, EPA QA/G-4. Office of Environmental Information, EPA/600/R-96/055. August.

USEPA. 2001. Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5. Office of Environmental Information, EPA/240/B-01/003. March.

USEPA. 2002a. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. Office of Emergency and Remedial Response, EPA-540/R-01-008 (OSWER 9240.1-35). July.

USEPA. 2002b. Guidance for Quality Assurance Project Plans, EPA QA/G-5. Office of Environmental Information, EPA/240/R-02/009. December.

Table 1. Facility Remediation Technical Team Members, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Name and Contact Information	Telephone/E-Mail	Project Function
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Table 2. Data Quality Objectives, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Data Quality Objective	Project Specific Action
Problem statement	Past industrial operations at VCC have contributed to residual contamination at the site. Do any of the environmental concerns that have previously been identified prevent the redevelopment of the VCC site? The development of this site is dependent upon the successful control of known contamination. The project goal is to achieve remedy in place within 3 years. To achieve this goal, additional assessments and remediation of groundwater, soil, sludge, sediment, and surface water may be required and shall be performed in accordance with this QAPP. A groundwater remediation plan shall be developed and implemented. A soil action plan and institutional controls shall be prepared and implemented as necessary.
Identify the decisions	• Area 1: Confirm the areal extent of soils with CoC concentrations above MDEQ TRGs, determine solidification/stabilization requirements, design the clay cap, and design a groundwater remediation system that may consist of a barrier wall and/or interceptor trench and determine the location of additional sentinel wells; • Area 2: Confirm the areal extent of soils with CoC concentrations above MDEQ TRGs and relocate approximately 15,000 cubic yards (cy) of stockpiled soils to the existing landfill (SWMU 2); • Area 3: Confirm the areal extent of soils with CoC concentrations above MDEQ TRGs, determine if consolidation of soils and sludges from other areas is feasible, design the new landfill cap, design barrier wall and/or recovery trench, and determine the location of additional sentinel wells; • Area 4: Confirm the areal extent of soils with CoC concentrations above MDEQ TRGs, determine solidification/stabilization requirements, and design barrier wall/interceptor trench and determine the location of additional sentinel wells; and • Area 5: Determine the areal extent of soils with CoC concentrations above MDEQ TRGs, determine solidification/stabilization requirements, relocate solidified sludges to the existing landfill (SWMU 2), and determine the location of additional sentinel wells.
Identify the inputs to the decision	• Area 1: Compare CoC data to MDEQ TRG and conduct a solidification study; • Area 2: Compare CoC data to MDEQ TRG; • Area 3: Compare CoC data to MDEQ TRG, analyze results of slope stability analysis, and review State of Mississippi regulations for landfill cap design; • Area 4: Compare CoC data to MDEQ TRG and conduct a solidification study; and • Area 5: Compare CoC data to MDEQ TRG and conduct a solidification study.

Table 2. Data Quality Objectives, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Data Quality Objective	Project Specific Action
Define the boundary of the property	The extent of remedial action will be limited to areas previously assessed and any areas requiring remedial action based on the results of the historical and additional baseline assessment within the North and South Plants.
Develop the decision rule	If soil and groundwater quality data indicate concentrations above Tier 1 Evaluation TRG, the affected media will be addressed by the inclusion of these areas in the remedial actions set forth in this QAPP.
Specify limits on decision errors	Because the assessment includes a biased sampling design (judgment based), a statistical evaluation of decision error is not possible. The use of biased sampling prevents the results of the investigation from being used to evaluate areas beyond the immediate study area boundaries. Data quality and usability will be determined in accordance with the criteria set forth in the QAPP. Rejected data will not be used for decision-making purposes.

CoC Chemical of Concern.
MDEQ Mississippi Department of Environmental Quality.
QAPP Quality Assurance Project Plan.
SWMU Solid Waste Management Unit.
TRG Target Remediation Goal.
VCC Vicksburg Chemical Company.

Table 3. Mississippi Department of Environmental Quality Tier 1 Target Remediation Goals, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg,

Chemical of Concern	Soil Tier 1 TRG Restricted (mg/kg)	Soil Tier 1 TRG Unrestricted (mg/kg)	Groundwater Tier 1 TRG (µg/L)
Arsenic	11.8*	0.426	50 (MCL)
Acetophenone	2,630	2,630	0.416
Atrazine	25.8	2.88	3 (MCL)
Benzene	1.36	0.887	5 (MCL)
Bis-(2-Ethyl)Hexyl Phthalate	409	45.6	6 (MCL)
Bromodichloromethane	1.89	1.24	0.168
Bromoform	90.1	58.8	8.48
Carbon Tetrachloride	0.569	0.371	5 (MCL)
Chloroform	0.478	0.312	0.155
Cyanazine	6.81	0.76	0.0797
Dibromochloromethane	68.1	7.6	0.126
1,2-Dichloroethane	0.621	0.406	5 (MCL)
Dinoseb	204	78.2	7 (MCL)
Methylene Chloride	21.9	14.3	5 (MCL)
4-Nitrophenol	16,400	626	0.0292
Pentachlorophenol	23.8	2.66	1 (MCL)
1,1,1,2-Tetrachloroethane	220	24.6	0.406
Tetrachloroethene	18.2	11.9	5 (MCL)
Toxaphene	5.2	0.581	3 (MCL)
Trichloroethene	7.92	5.17	5 (MCL)
1,2,4-Trimethylbenzene	102,000	3,910	12.3
1,3,5-Trimethylbenzene	436	436	12.3
Vinyl Chloride	0.939	0.426	2 (MCL)

* 11.8 mg/kg based on MDEQ approval of the Upper Confidence Limit (UCL) of the mean of the background concentration.
mg/kg Milligram per kilogram.
MCL Maximum contaminant level.
MDEQ Mississippi Department of Environmental Quality.
TRG Target Risk Goal as of February 28, 2002.
µg/L Microgram per liter.

Table 4. Compound and Analyte Lists, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Parameter	Analytical Method	Chemical of Concern
Volatile Organic Compounds	Method 8260	Benzene
		Bromodichloromethane
		Bromoform
		Carbon Tetrachloride
		Chloroform
		Dibromochloromethane
		1,2-Dichloroethane
		Methylene Chloride
		1,1,1,2-Tetrachloroethane
		Tetrachloroethene
		Trichloroethene
		1,2,4-Trimethylbenzene
		1,3,5-Trimethylbenzene
		Vinyl Chloride
Semivolatile Organic Compounds	Method 8270	Acetophenone
		Atrazine
		bis-(2-Ethyl)hexyl Phthalate
		Cyanazine
		4-Nitrophenol
		Pentachlorophenol
Organochlorine Pesticides	Method 8081	Toxaphene
Organochlorine Herbicides	Method 8151	Dinoseb
Metals	Method 6010 or 6020	Arsenic

Table 5. General Field Equipment and Calibration Procedures, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Instrument or Equipment	Description	Field Calibration Procedure	Performance Criteria	Responsible Personnel
pH/Conductivity, Temperature Meter	Meter designed for field use with battery operation. Range pH: 0 to 14 S.U. Range conductivity: 0 to 2,000 µS	Instruments are factory-calibrated and automatically compensate for temperature. Calibration of the meters for pH will be completed each day immediately prior to use in accordance with ARCADIS SOPs T106 and/or T131 and the manufacturer's recommendations. In general, pH meter calibration will include two pH buffers bracketing expected pH range of samples to be measured (i.e., 7.00 and 4.00) with a verification of the slope using a third buffer (4.00 or 10.00). The electrode will be rinsed between buffers and stored in the manufacturer-recommended solutions between field measurements. Conductivity calibrations are conducted similar to the pH calibration utilizing two calibration standards and adjusting the meter to the appropriate values. Calibrations will be verified with a pH buffer at least every 4 hours and at the end of the sampling day.	pH: ± 0.01 S.U. Conductivity: at ± 2% FSD The instrument will be checked with a pH buffer every 4 hours and at the end of the sampling day. If the response is greater than ± 0.2 S.U. from the standard, complete re-calibration will be conducted. Conductivity will be checked every 4 hours.	Sample Collection Personnel
pH/Conductivity, Temperature, DO, ORP Meter	YSI Model 600 XL probe with YSI Model 610-D display instrumentation or the QED FC4000. Units must automatically correct for salinity at low DO readings by estimating salinity from temperature and conductivity measurements, then internally adjusting the DO reading. The probes must contain separate pH, temperature, conductivity, DO, and ORP probes in one unit.	Each day prior to use, the pH, specific conductance, DO, and ORP probes will be calibrated or tested for responsiveness in accordance with ARCADIS SOPs and the manufacturer's recommendations. The pH probe will be calibrated utilizing two buffers (pH 7.00, then pH 4.00), and a verification buffer. The ORP probe is then calibrated with the ORP standard solution (Zobell), and the DO probe is checked with saturated air in accordance with the manufacturer's guidance. The probes should be rinsed with deionized water between each calibration solution and following calibration. Used calibration solution is to be discarded. Finally, the conductivity probe is checked with a solution of known conductivity.	Turbidity and DO: ± 10% pH: ± 0.01 S.U. Conductivity: at ± 2% FSD The instrument calibration will be verified every 4 hours and at the end of the sampling day. For pH, if the calibration check is greater than ± 0.2 S.U. from the true value, complete calibration will be conducted.	Project Geologist, Sample Collection Personnel

Table 5. General Field Equipment and Calibration Procedures, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Instrument or Equipment	Description	Field Calibration Procedure	Performance Criteria	Responsible Personnel
Turbidimeter	Nephelometer designed for field use with battery operation. Range 0.01 to 1,000 Nephelometric Turbidity Units.	The unit is factory calibrated. Unit responsiveness will be checked prior to use each day with appropriate standards provided by the supplier. The responsiveness is checked on the 0 to 10 range, 0 to 100 range, and 0 to 1000 range.	± 10%	Sample Collection Personnel
PID	Photoionization detector that is a portable, non-destructive trace gas analyzer. Units must be Class I, Division 2, Grade A, B, C, or D. Unit must have rechargeable battery, a range of 0 to 2,000 ppm, and a 10.2 or 11.7 eV lamp. Calibration check gas (e.g., isobutylene must be provided with unit).	Instrument is calibrated internally prior to shipment from the warehouse or every 6 months, whichever is more frequent. In the field, PIDs will be calibrated at the start of each day in accordance with manufacturer's instructions. If a significant change in weather occurs during the day (i.e., change in humidity or temperature) or if the unit is turned off for an extended period, the instrument will be recalibrated prior to use. When a PID is used to screen samples in the field, periodic ambient readings will also be recorded in the log book. The general calibration procedures include: • Turn unit on and allow for 5-minute warm-up; • Set span control for probe being used (10.2 or 11.7); • Set function switch to standby position and adjust to zero using zero adjust knob; • Set function switch to the 0 to 200 ppm range; • Connect the analyzer to the regulator and calibration gas *cylinder*; • Open the regulator valve and allow the meter reading to stabilize; and • Using the span knob, adjust the meter to the concentration indicated on the calibration gas cylinder.	Meter must be able to adjust properly using the span knob or the lamp may require cleaning.	Site Safety Officer

µS Micro Siemens
DO Dissolved Oxygen
eV electron volts
FSD Full Scale Deflection
ORP Oxidation/ Reduction Potential
PID Photoionization Detector
ppm parts per million
S.U. Standard Units (S.U.)
SOP Standard Operating Procedure

Table 6. Summary of Methods, Containers, Preservatives, and Holding Times, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
General Parameters						
VOCs	Water	5030, 5032	8260/624	3 x 40-mL vial with Teflon-lined septum	pH < 2 with HCl, Cool 4°C	14 days
	Water	5030, 5032	8260/624	3 x 40-mL vial with Teflon-lined septum	If effervescence is observed, eliminate HCl preservative and Cool 4°C	7 days
	Solid	5035	8260	3 x Encore™ OR 2 x Sodium Bisulfate vial and 1 x Methanol vial	Cool 4°C	48 hours to preservation for Encore™, then 14 days to analysis
SVOCs	Water	3510, 3520 [d]	8270 (Low Level)/625	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8270 (Low Level)	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Organochlorine Pesticides	Water	3510, 3520 [d]	8081/608	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8081	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Organochlorine Herbicides	Water	3510, 3520 [d]	8151	2 x 1-L amber G	Cool 4°C [e]	7 days to extraction and 40 days to analysis
	Solid	3540, 3550 [d]	8151	1 x 4-oz or 8-oz G	Cool 4°C	14 days to extraction and 40 days to analysis
Metals (except Mercury)	Water	3005, 3010	6010/6020/200.7	1 x 1-L HDPE	pH < 2 with HNO_3, Cool 4°C	6 months
	Solid	3050, 3051	6010	1 x 8-oz G	Cool 4°C	6 months
Mercury	Water	NA	7470/245.1	1 x 1-L HDPE	pH < 2 with HNO_3, Cool 4°C	28 days
	Solid	NA	7471	1 x 8-oz G	Cool 4°C	28 days
Cyanide (Total)	Water	NA	9010/9012/9014	1 x 1-L HDPE	pH > 12 with NaOH, Cool °4C	14 days
	Solid	NA	9010/9012/9014	1 x 4-oz or 8-oz G	Cool 4°C	14 days
SPLP	Solid	1312 to generate Leachate	Above Methods for determination of CoCs in Leachate	1 x 4-oz G packed full for VOCs and 1 x 8-oz wide-mouth G for other parameters	Cool 4°C	14 days from collection to Leach

Table 6. Summary of Methods, Containers, Preservatives, and Holding Times, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
Waste Characterization Parameters						
TCLP Metals [f] (including Mercury)	Solid Waste Material	1311 for Leach/ 3005, 3010	6010 and 7470 (for Leachate)	1 x 8-oz wide-mouth G	Cool 4°C	28 days from collection to Leach; 28 days to analysis of Leachate
TCLP VOCs [f]	Solid Waste Material	1311 for Leach/ 5030	8260 for Leachate	1 x 4-oz G packed full	Cool 4°C	14 days from collection to Leach; 14 days to analysis of Leachate when preserved with HCl to pH < 2
TCLP SVOCs [f]	Solid Waste Material	1311 for Leach/ 3510, 3520	8270 for Leachate	1 x 8-oz wide-mouth G	Cool 4°C	14 days from collection to Leach; 40 days to analysis of Leachate
TCLP Pesticides [f]	Solid Waste Material	1311 for Leach/ 3510, 3520	8270 for Leachate	1 x 8-oz wide-mouth G	Cool 4°C	14 days from collection to Leach; 40 days to analysis of Leachate
TCLP Herbicides [f]	Solid Waste Material	1311 for Leach/ 3510, 3520	8270 for Leachate	1 x 8-oz wide-mouth G	Cool 4°C	14 days from collection to Leach; 40 days to analysis of Leachate
Ignitability	Aqueous Waste	NA	1010	500 mL G	NA	NA
	Solid Waste Material	NA	1010	1 x 8-oz wide-mouth G	NA	NA
Reactivity	Aqueous Waste	NA	USEPA Region 4 Guidance for Sulfide	500 mL HDPE	pH > 9 with 2 mL ZnAc and NaOH, Cool 4°C	7 days
	Aqueous Waste	NA	9010/9012/9014 for Cyanide	1 x 1-L HDPE	pH > 12 with NaOH	14 days
	Solid Waste Material	NA	USEPA Region 4 Guidance for Sulfide	1 x 8-oz wide-mouth G	Cool 4°C	7 days
	Solid Waste Material	NA	9010/9012/9014 for Cyanide	1 x 1-L HDPE	Cool 4°C	Sulfide 7 days

Table 6. Summary of Methods, Containers, Preservatives, and Holding Times, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
Corrosivity (pH)	Aqueous Waste	NA	9040	250 mL HDPE	NA	24 hours
	Solid Waste Material	NA	9045	1 x 8-oz wide-mouth G	NA	24 hours
General Chemistry Parameters						
Alkalinity	Water	NA	310.1	250 mL HDPE	Cool 4°C	14 days
Ammonia	Water	NA	350.3	250 mL HDPE	pH < 2 with H_2SO_4, Cool 4°C	28 days
Biochemical Oxygen Demand (BOD)	Water	NA	405.1	1 x 1-L HDPE	Cool 4°C	48 hours
Chloride	Water	NA	325.3/300.0/9056	250 mL HDPE/ 2 x 40 mL vial	Cool 4°C	28 days
Ferrous Iron	Water	NA	SM3500-FE-D/ *7199 Modified*	250 mL HDPE/ 2 x 40 mL vial for 7199 Modified	Cool 4°C for SM3500/ pH < 2 with HCl for 7199 Modified	Analyze ASAP/ 48 hours for 7199 Modified
Hardness	Water	NA	130.2/6010	250 mL HDPE	Cool 4°C for 130.2/ pH < 2 with HNO_3, Cool 4°C for 6010	6 months
Nitrate	Water	NA	353.2/300.0/9056	250 mL HDPE/ 2 x 40 mL vial	Cool 4°C	2 days
Nitrite	Water	NA	354.1/300.0/9056	250 mL HDPE/ 2 x 40 mL vial	Cool 4°C	2 days
Nitrate/Nitrite	Water	NA	Hach 8192	250 mL HDPE	pH < 2 with H_2SO_4	28 days
Phosphate	Water	NA	365.3/300.0/9056	250 mL HDPE/ 2 x 40 mL vial	pH < 2 with H_2SO_4	28 days
Sulfate	Water	NA	375.4/300.0/9056	250 mL HDPE/ 2 x 40 mL vial	Cool 4°C	28 days
Sulfide	Water	NA	376.1	4 x 125 mL HDPE	2 mL ZnAc and NaOH to pH > 9, Cool 4°C	7 days
Total Dissolved Solids (TDS)	Water	NA	160.1	500 mL HDPE	Cool 4°C	7 days

Table 6. Summary of Methods, Containers, Preservatives, and Holding Times, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

Parameter	Matrix	Preparation Method	Analytical Method [a]	Container [b]	Preservative	Holding Time [c]
Total Suspended Solids (TSS)	Water	NA	160.2	500 mL HDPE	Cool 4°C	7 days
Total Organic Carbon (TOC)	Water	NA	415.1/9060	250 mL amber G	pH < 2 with HCl or H_2SO_4, Cool 4°C	28 days
Dissolved Organic Carbon (DOC)	Water	NA	415.1/9060	250 mL amber G	AFTER FILTRATION: pH < 2 with HCl or H_2SO_4, Cool 4°C	28 days
Chemical Oxygen Demand	Water	NA	HACH 8000	125 mL HDPE	pH <2 with H_2SO_4	28 days

(a) The 8000 series methods will be used for assessment and remediation; the 600 series methods will be used only for wastewater or storm water analyses performed in accordance with discharge permits.
(b) Sample volumes may be combined for MNA parameters where preservatives are the same and adequate sample volume is supplied to the laboratory. Volumes listed are based on sample containers and not minimum volumes required for some of the General Chemistry Parameters listed under the MNA heading only. All other volumes are minimum volumes required to be submitted to the laboratory.
(c) Maximum holding time allowed from date of collection.
(d) Cleanup methods may be applicable if matrix interference is encountered. Cleanup methods may include alumina (Method 3610), florisil (Method 3620), silica gel (Method 3630), gel permeation chromatography (GPC) (Method 3640), and sulfur (Method 3660). Selection of appropriate method is based on nature of interference and target compounds.
(e) If residual chlorine is present, requires sodium thiosulfate in each sample container.
(f) Waste Characterization addresses solid (soils, sludge, waste) material analysis for waste disposal purposes. Liquid (aqueous or organic) wastes will be characterized using the appropriate methods for determination of total constituent concentrations in accordance with waste disposal requirements under the Resource Conservation and Recovery Act (RCRA). TCLP analyses will be performed as required on wastes containing > 0.5% solids in accordance with RCRA waste characterization and disposal requirements.
(g) This holding time is a contractual holding time that has been established by ARCADIS and is established in the USEPA Region 4 Laboratory Operations and Quality Assurance Manual.

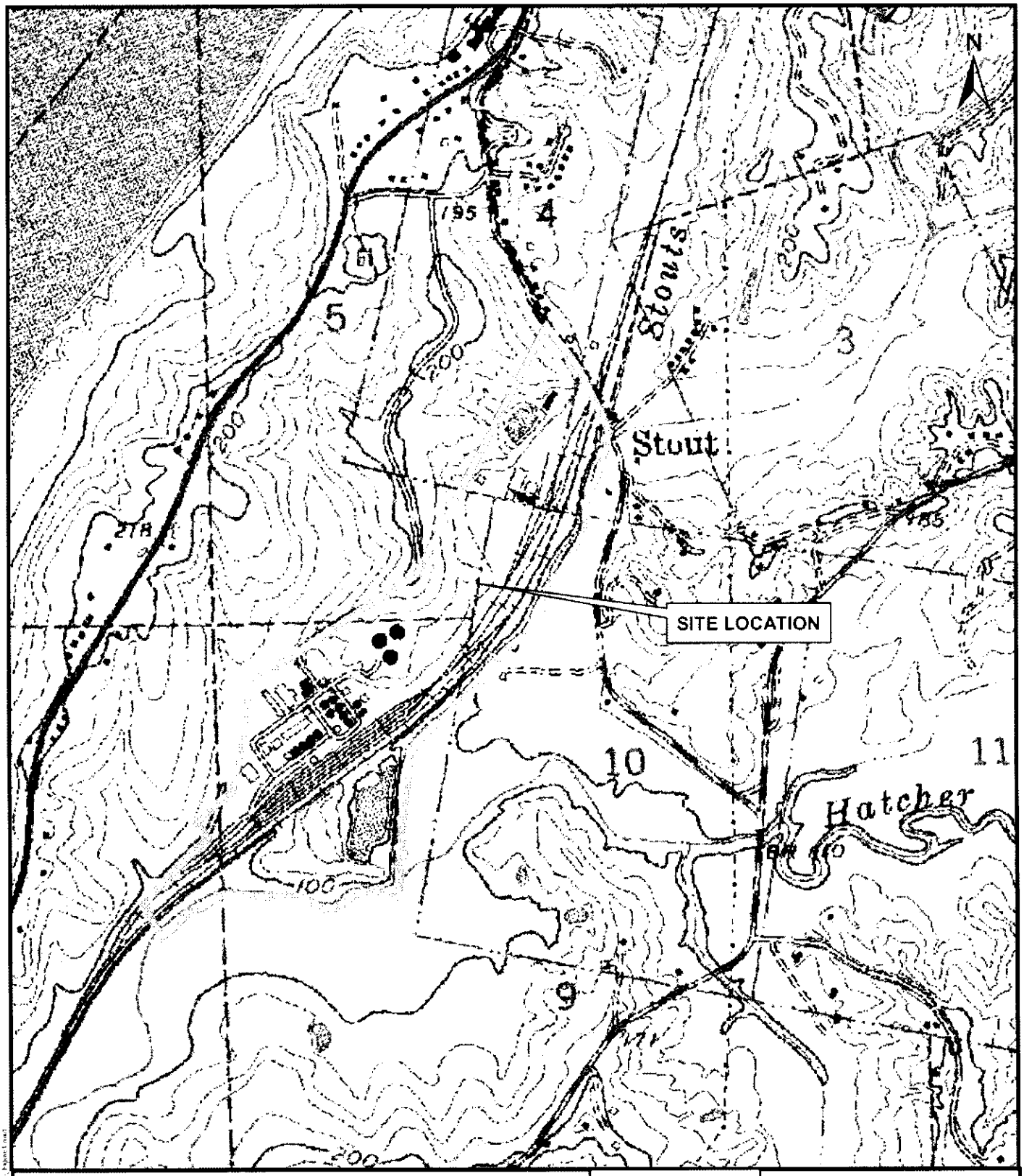
°C – Degrees Centigrade.
G – Glass.
H_2SO_4 – Sulfuric acid.
HCl – Hydrochloric acid.
HDPE – High Density Polyethylene.
HNO_3 – Nitric acid.
L – Liter.
mL – Milliliter.
MNA – Monitored Natural Attenuation.
NA – Not Applicable.
NaOH – Sodium hydroxide.
SVOCs – Semivolatile Organic Compounds.
TAL – Target Analyte List.
TCL – Target Compound List.
TCLP – Toxicity Characteristic Leaching Procedure.
VOCs – Volatile Organic Compounds.
ZnAc – Zinc acetate.

Table 7. Field Quality Control Sample Collection Guidelines, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

QC Sample	Description
Field Duplicate	One per matrix per 20 samples for each analysis.
Equipment Rinsate Blank	One per equipment set per 20 samples collected for each analysis. Only equipment sets that are dedicated or disposed of do not require equipment blanks.
Trip Blank	One per shipment for each cooler in which samples for volatile analysis are shipped. Trip blanks are analyzed for all volatile methods designated for the samples. Trip blanks are shipped for both solid and aqueous matrices.

Table 8. Field Quality Control Sample Analysis Guidelines, Vicksburg Chemical Company, Quality Assurance Project Plan, Vicksburg, Mississippi.

QC Sample	Description
Method Blank	One per matrix per preparation batch for each analysis.
Lab Replicate	One per matrix per preparation batch for each analysis.
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD)	One LCS per matrix per preparation batch for each analysis. LCSD performance is optional.
Surrogate Spiking	All samples analyzed for organic methods as method and Standard Operating Procedure (SOP) appropriate.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One pair per matrix per preparation batch for each analysis. The spike solution must contain a broad range of the analytes of concern at Vicksburg Chemical. The overall frequency of MS/MSD on the project samples must be at least 1 set per 20 samples.



Former Plant Site

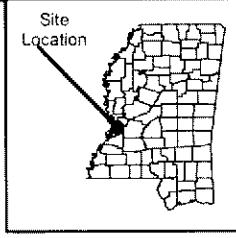
Note: **Approximate Property Boundary**

10352 Plaza Americana Drive
Baton Rouge, Louisiana 70816
Tel: 225.292.1004 Fax: 225.218.9677

SITE LOCATION MAP

VICKSBURG CHEMICAL COMPANY

VICKSBURG, MISSISSIPPI



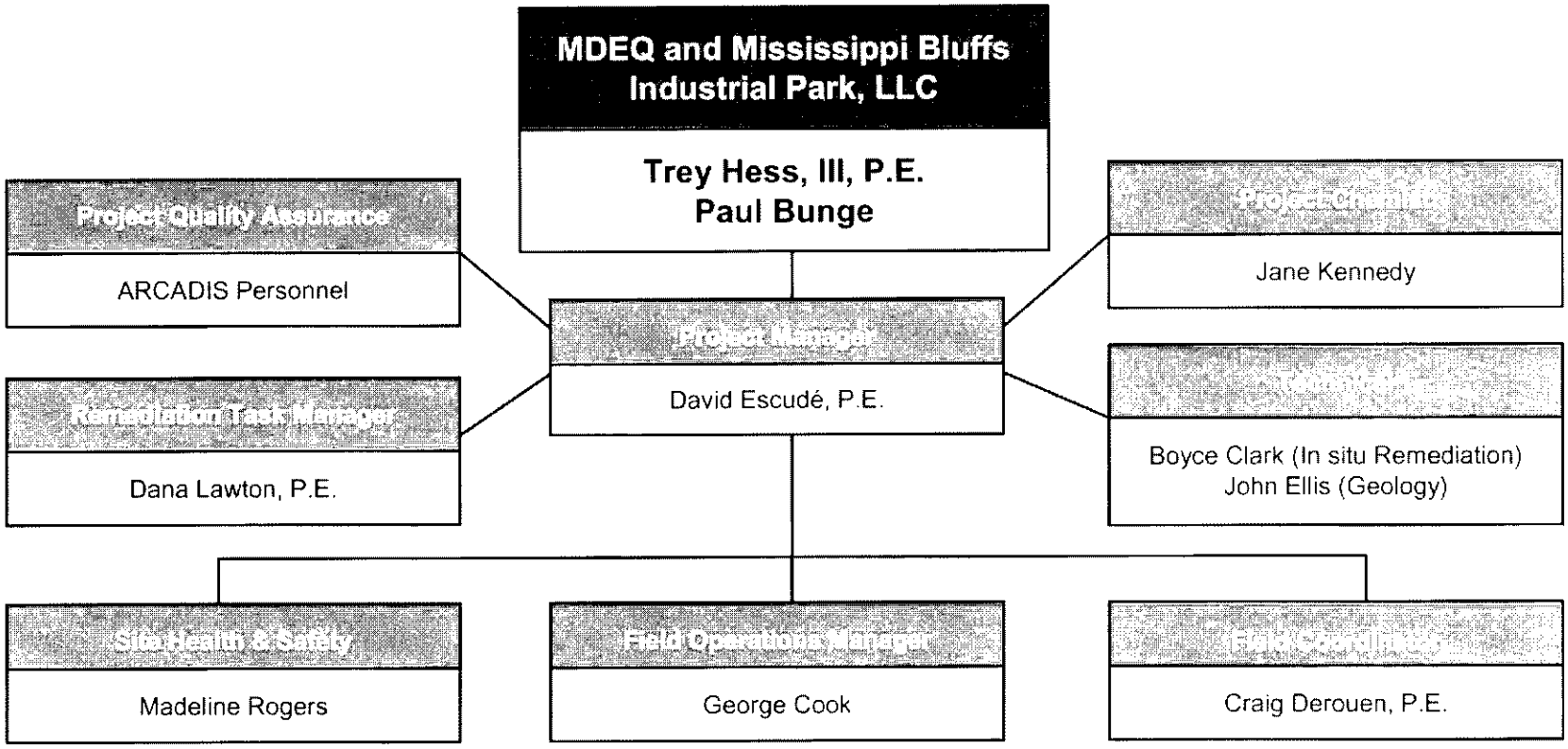
500 0 500 1,000 Feet

Project Manager: JE	Completed By: AB
Task Manager: CD	Date: 07/31/2006
Project No.: LA002656.0001	Figure No.: 1

REFERENCE:

USGS, Vicksburg West Quadrangle, Mississippi
7.5 Minute Series (Topographic)

Vicksburg Chemical Facility Remediation Project
Organizational Structure



Appendix B

Typical Field Forms

ARCADIS

Laboratory Task Order No./P.O. No. _____ **CHAIN-OF-CUSTODY RECORD** Page ____ of ____

Project Number/Name _____

Project Location _____

Laboratory _____

Project Manager _____

Sampler(s)/Affiliation _____

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE						Remarks	Total

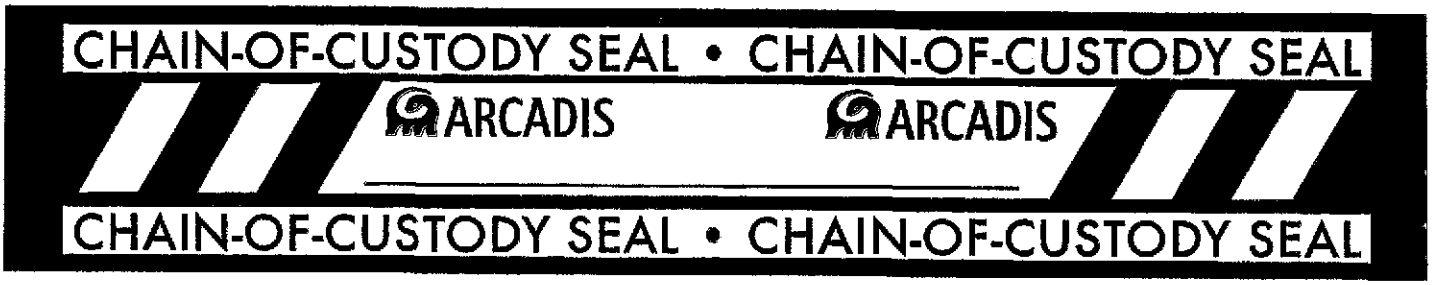
Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers

Relinquished by: _____	Organization: _____	Date ___/___/___	Time _____	Seal Intact?
Received by: _____	Organization: _____	Date ___/___/___	Time _____	Yes No N/A
Relinquished by: _____	Organization: _____	Date ___/___/___	Time _____	Seal Intact?
Received by: _____	Organization: _____	Date ___/___/___	Time _____	Yes No N/A

Special Instructions/Remarks: _____

Delivery Method: ☐ In Person ☐ Common Carrier _____ SPECIFY ☐ Lab Courier ☐ Other _____ SPECIFY


CHAIN-OF-CUSTODY SEAL • CHAIN-OF-CUSTODY SEAL
ARCADIS
ARCADIS
CHAIN-OF-CUSTODY SEAL • CHAIN-OF-CUSTODY SEAL

ARCADIS G & M, Inc.
10352 Plaza Americana Drive
Baton Rouge, LA 70816

SAMPLE / CORE LOG

Boring/Well: _____ Project No.: _____

Site Location: _____ Drilling Started: _____ Drilling Completed: _____

Land-Surface Elev.: _____ Surveyed: ____ Estimated: ____ Datum: _____

Drilling Fluid: _____ Drilling Method Used: _____

Drilling Contractor: _____ Driller: _____ Helper: _____

Prepared By: _____ Hammer Weight: _____ Hammer Drop (inches): _____

Fill | Silty Clay | Silt | Sandy Silt | Silty Sand | Acetate Sleeve | Water First Encountered

Clay | Sandy Clay | Clayey Silt | Sand | Clayey Sand | Split Spoon | Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	OVA (wo/F) (ppm)	OVA (w/F) (ppm)	REMARKS
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

MONITOR WELL INSPECTION CHECKLIST

Project Name: _____ Project Number: _____

Inspectors Name: _____ Inspection Date: _____

Monitor Well ID: _____ Site Location: _____

Type of Well: ☐ Flush Mounted ☐ Above Grade

A. Condition of protective casing: _____

B. Condition of concrete pads (note cracks, breaks, slope direction): _____

_____

C. Condition of guard posts: _____

D. Is the well locked? _____

E. Is well identification number clearly marked? _____

F. Is the TOC elevation mark clearly visible on the well ? _____

G. Condition of well casing: _____

H. Condition of well cap: _____

I. Condition of surrounding grounds (i.e., overgrowth, is the well accessible, etc.): _____

J. Does water adequately drain from the well site?: _____

K. Total depth of well (properly decon tape between wells): _____

_____

L. Depth to top of grout from protective casing - length of protective casing above concrete pad: _____

M. Comments/Recommendations: _____

_____

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SOIL/SEDIMENT SAMPLING LOG

PROJECT NAME: _____

PROJECT NUMBER: _____ DATE: _____

SITE LOCATION: _____

SAMPLE ID NUMBER: _____ CODED/REPLICATE NO.: _____

TIME SAMPLING BEGAN: _____ ENDING: _____

WEATHER: _____

SITE DESCRIPTION: _____

SAMPLING DATA

COLLECTION METHOD: _____

DEPTH: _____ MOISTURE CONTENT: _____

COLOR: _____ ODOR: _____

DESCRIPTION: _____

ANALYSES REQUIRED	*CONTAINER DESCRIPTION* FROM LAB: X OR G&M:
_____	_____
_____	_____
_____	_____
_____	_____

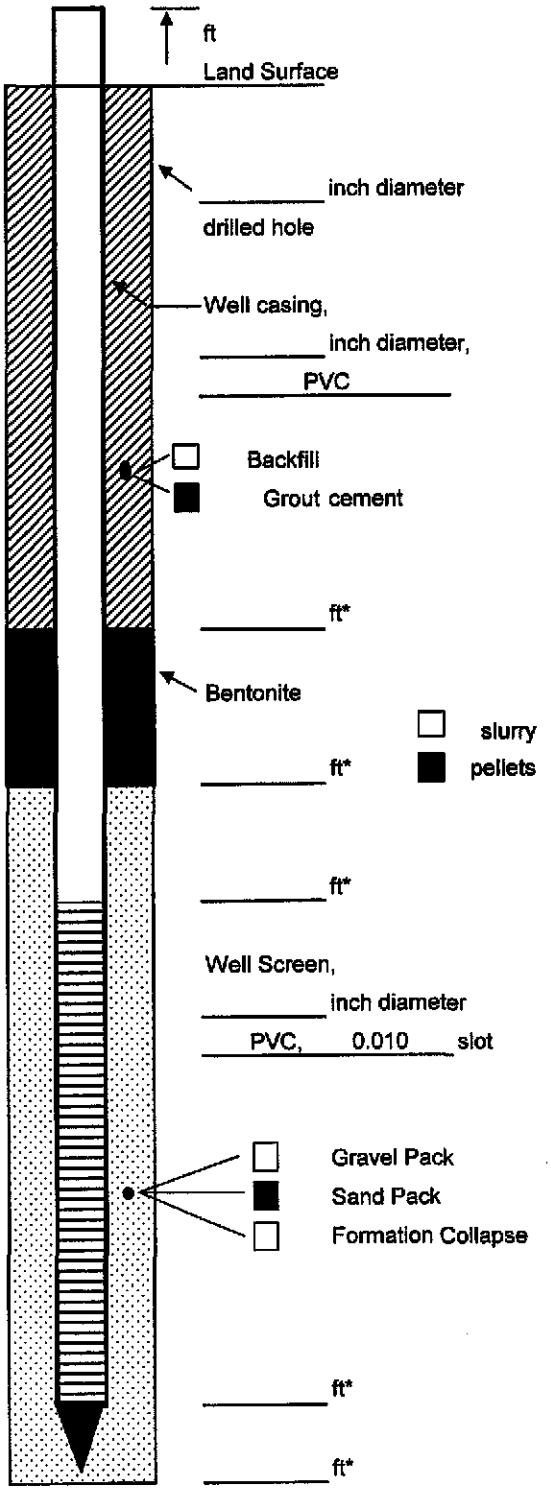
SAMPLING MONITORING (TIP, OVA, HNU, etc.) _____

REMARKS: _____

SAMPLING PERSONNEL: _____

ARCADIS

WELL CONSTRUCTION LOG



Measuring Point is Top of Well Casing Unless Otherwise Noted.
* Depth Below Land Surface

Project _____ Well _____
Town/City _____
County/Parish _____ State Louisiana
Permit Number _____
Land-Surface Elevation
and Datum _____ feet ☐ Surveyed ☐ Estimated

Installation Date(s) _____
Drilling Method _____
Drilling Contractor _____
Drilling Fluid _____

Development Technique(s) and Date(s)
Purged with rediflow

Fluid Loss During Drilling _____ gallons
Water Removed During Development _____ gallons
Static Depth to Water _____ feet below M.P.
Pumping Depth to Water _____ feet below M.P.
Pumping Duration _____ hours
Yield _____ gpm Date _____
Specific Capacity _____ gpm/ft
Well Purpose _____

Remarks _____

Prepared by _____

ARCADIS

Water Sampling Log

Project _____ Project No. _____ Page ____ of ____

Site Location _____ Date _____

Site/Well No. _____ Replicate No. _____ Code No. _____

Weather _____ Sampling Time: Begin _____ End _____

Evacuation Data

Measuring Point _____

MP Elevation (ft) _____

Land Surface Elevation (ft) _____

Sounded Well Depth (ft bmp) _____

Depth to Water (ft bmp) _____

Water-Level Elevation (ft) _____

Water Column in Well (ft) _____

Casing Diameter/Type _____

Gallons in Well _____

Gallons Pumped/Bailed Prior to Sampling _____

Sample Pump Intake Setting (ft bmp) _____

Purge Time begin _____ end _____

Pumping Rate (gpm) _____

Evacuation Method _____

Field Parameters

Color _____

Odor _____

Appearance _____

pH (s.u.) _____

Conductivity (mS/cm) _____

(µmhos/cm) _____

Turbidity (NTU) _____

Temperature (°F) _____

Dissolved Oxygen (mg/L) _____

Salinity (%) _____

Sampling Method _____

Remarks _____

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel _____

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Millisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

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FIELD PARAMETERS

Well Identification Number:

Job Name/Number: _____ Date: _____

Water Level (TOC): _____ Total Depth: _____

OVM Reading: _____ 3 Well Volumes: _____

Start Time: _____ Total Volumes Removed _____

Time	Water Level (ft gmp)	Temp (°F)	Spc. Cond. (µmhos/cm)	Salinity (ppt)	Turbidity (NTU)	DO (mg/L)	pH (s.u.)	REDOX/ORP (mv)

Observations/Comments:

Ferrous Iron _____ Sulfide: _____

ARCADIS

Appendix C

MDEQ Minimum Specifications for Drilling Services

Mississippi Department of Environmental Quality
Minimum Specifications for Drilling Services
July 1, 2005

ITEM 1 - MOBILIZATION AND DEMOBILIZATION

The driller should leave the site as clean as when he arrived which includes soil disposal, if necessary.

ITEM 2 - DECONTAMINATION

Prior to mobilization any part of the drill rig and/or equipment that comes in contact with the borehole will be thoroughly cleaned to remove all oil, grease, mud, tar, etc. This cleaning process will consist of scrubbing the equipment with a detergent and tap water then using a high-pressure hot water rinse.

Before drilling each boring, the augers, drilling bits, etc. shall be cleaned by at least using a high-pressure hot water rinse. Special attention should be given to the threaded section of the casing. Petroleum based lubricants shall not be used to prevent binding.

Before taking Shelby tube or split-spoon samples, this and associated equipment shall be minimally decontaminated using the following protocol:

(1) Cleaned thoroughly with detergent and tap water,
(2) Rinsed thoroughly with isopropyl alcohol or methanol, and
(3) Then rinsed thoroughly with distilled water.

ITEMS 3 AND 4 - DRILLING OF BOREHOLES, SPLIT-SPOON SAMPLING, AND ABANDONMENT

Subsurface samples will be collected at five-foot intervals with a cleaned split-spoon or equivalent. Sampling will be carried out to the required depth while using standard ASTM protocols to recover the samples. Borehole abandonment will require grouting by the tremie method (95% Portland cement and 5% bentonite by weight) to begin at the bottom of the boring and proceeds to land surface. The patch at the land surface shall be the same material surrounding the borehole (i.e. asphalt, concrete, etc.).

ITEMS 5, 6, AND 7 - INSTALLATION OF MONITORING WELLS

All monitoring wells shall be at least PVC schedule 40 with 0.010-inch factory slotted screen openings and drilled using hollow stem technology. Each screen will be continuously slotted and at least 10 foot in length. The well will consist of a least a schedule 40 (ASTM) body with threaded flush joints. No solvents or lubricating compounds will be used to aid pipe connection. PVC plugs will be threaded onto the bottom of each well screen to prevent the intrusion of filter material. The driller will place the threaded caps onto the well pipe opening at the surface. The well caps shall be watertight and lockable. If the wells are to be less than/greater than standard 4" inside diameter, prior approval from the MDEQ must be granted *before* the wells are installed.

The annular space between the monitoring well and the borehole wall shall be at least 2.0 inches and will be backfilled with a clean medium to coarse grain sand (20/40 sand) to a level approximately 1.0 foot above the top of the screen.

A two-foot bentonite seal of bentonite pellets will be placed immediately above the sand and firmly tamped in place.

The remainder of the annular space should be grouted to land surface with a grout mixture (95% Portland cement and 5% bentonite by weight) to approximately land surface.

ITEM 8 - WELL DEVELOPMENT

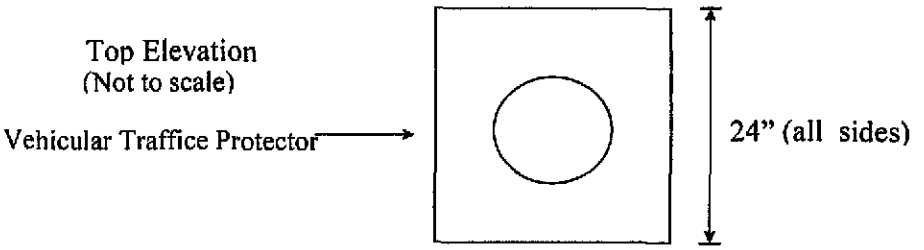
Upon completion of the monitoring well installation, the well should be developed by bailing, pumping, surge block, etc. At least three to five well volumes should be pumped or the well should be pumped dry. The final water from the well should not be turbid. The engineering firm's field geologist or engineer shall determine the decision as to when the well is properly developed.

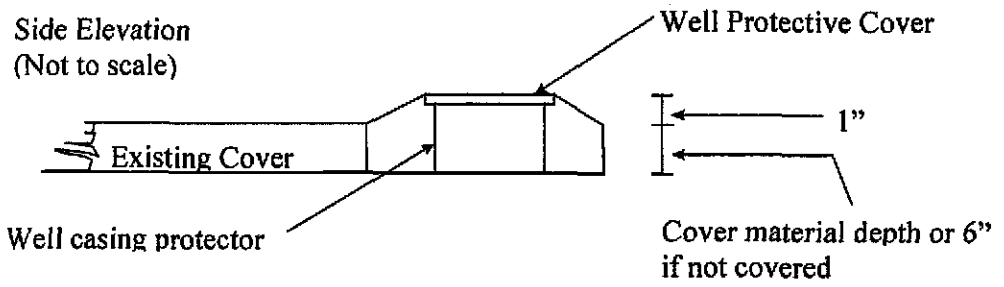
ITEM 9 - FABRICATION/INSTALLATION OF MONITOR WELL HEAD PROTECTION

In most cases the site will utilize concrete or asphalt as a covering material. Before installation of monitor well head protection, the engineer shall review the attached drawing to assure proper excavation prior to the pouring of concrete, which forms the vehicular traffic protector. If the location of the monitor well is within a covered area (asphalt or concrete), the existing surface about the monitor well must be removed utilizing either mechanical sawing or pneumatic hammer equipment to a depth of existing cover and the width and length as specified on the drawing. Loose materials on the exposed earthen surface shall be removed or compacted to assure a smooth surface upon which to pour the concrete mixture. If the monitor well is to be located outside a covered area, the earthen material should be removed using a shovel or pickaxe to a depth of six inches and a width and length as specified on the attached drawing. The monitor well should then be cut to the proper height so that the security casing cover will extend 2 inches above the well casing considering the requirements as outlined in the attached drawing and the security casing set.

The concrete mixture to be used as the vehicular traffic protector shall consist of the addition of five (5) pounds of Portland cement to each 80-pound bag of "Quickcrete" or other commercially available brand concrete mixture when the poured material is to be derived from bagged dry mix. Water should be added to the mixture in an amount necessary for desired consistency before the concrete is poured. If the poured material is to be delivered from a concrete supplier by truck, 2500 psi concrete should be specified. The concrete surface of the protector should then be trialed so that the surface of the concrete on any side of the security casing is flush with the monitor well security casing well cap and mating cover material. A flush mounted protective cover should be installed on the well casing protector to protect the monitoring wells against damage from site activities. The words "Monitoring Well" or a similar designation should be *embossed* on the protective cap.

MONITORING WELLHEAD PROTECTION





The laboratory Quality Assurance Manual (QAM) will be provided when the analytical laboratory is selected.

ARCADIS

Imagine the result

Copy

Mississippi Department of Environmental Quality

and

MISSISSIPPI BLUFFS
INDUSTRIAL PARK, LLC

Site-Specific Health and Safety Plan

Corrective Action
Vicksburg Chemical Company
Vicksburg, Mississippi

30 August 2006

ARCADIS

Site-Specific Health and Safety Plan

Corrective Action
Vicksburg Chemical Company
Vicksburg, Mississippi

Prepared for:
Mississippi Department of Environmental Quality and Mississippi Bluffs Industrial Park, LLC

Prepared by:
ARCADIS G&M, Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677

Our Ref.:
LA002656.0001.00001

Date:
30 August 2006

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ARCADIS

Site-Specific Health and Safety Plan

Corrective Action
Vicksburg Chemical Company
Vicksburg, Mississippi

Review and Approval

Site Name: **Vicksburg Chemical Company, Vicksburg, Mississippi**

David R. Escudé Project Manager	Signature	Date
Dana A. Lawton Construction, Site, or Task Manager	Signature	Date
Site Health and Safety Officer	Signature	Date
Project Health and Safety Manager	Signature	Date
Craig A. Derouen Designated Health and Safety Plan Writer	Signature	Date
Designated Health and Safety Plan Reviewer	Signature	Date

Employee Acknowledgement

The employee's signature below indicates his/her understanding, acceptance, and compliance with the requirement of this Health and Safety Plan (HASP).

Site Name: **Vicksburg Chemical Company, Vicksburg, Mississippi**

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

Health and Safety Plan Addendum Log

Changes in the scope of the project or introduction of new hazards to the project shall require revision of the Health and Safety Plan (HASP) by the HASP writer and reviewer and approval by the Project Manager. The HASP Addendum Form is included as Appendix A. *Addenda are to be added to every copy of the HASP and logged in the following table to verify that all copies of the HASP are current:*

Addendum Number	Date of Addendum	Reason for Addendum	Person Completing Addendum
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

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DRAFT

Executive Summary

Introduction

The provisions of this Site Health and Safety Plan (HASP) are mandatory for all ARCADIS personnel involved in the Project. Operational changes to this HASP that could affect the health or safety of personnel, the community, or the environment will not be made without prior approval of the ARCADIS Project Manager and the cognizant ARCADIS Project Health and Safety Manager (PHSM). This HASP meets the requirements for health and safety protection and planning as required by the Occupational Safety and Health Administration (OSHA) in Title 29 Code of Federal Regulations (CFR), Part 1910 and 1926, as applicable.

ARCADIS Policy

As a company, we will operate in compliance with all federal, state, and local regulations regarding health and safety. Senior management is responsible for ensuring that adequate resources are available to comply with health and safety regulations. Senior management is responsible for developing health and safety programs that comply with health and safety regulations.

Regional and local management is responsible for implementing and fostering a positive and proactive regard for company health and safety programs and policies. Employees are responsible for complying with company health and safety policies and programs to ensure their own safety as well as the safety of their coworkers.

D R A F T

1. *Project Description*

1.1 Project Type and Activities

ARCADIS' responsibilities at the site will consist of activities to support delineation of soil and groundwater impacts and oversight of the construction activities associated with site remediation.

The following table shows project tasks as well as approximate start dates for each activity.

X	Type	Start Date	X	Activities	Start Date
X	Remediation			Geophysical Survey	
X	Site Assessment/Investigation		X	Site Visit	
	Phase I Site Assessment		X	Drum Sampling	
	Regulatory Compliance Audit		X	Surveying	
	Compliance Program		X	Excavation	
X	Property Decommission		X	Soil Sampling	
	Demolition		X	Groundwater Sampling	
	Decontamination			Surface Water Sampling	
	Industrial Hygiene Study			Sediment Sampling	
X	Construction			Air Sampling	
	Phase II Site Assessment		X	Drilling	
	Risk Assessment			Desk Work	
X	Site Observations and Inspections			Other	

1.2 Site Background

The Vicksburg Chemical Company (Vicksburg Chemical) was formerly owned by Cedar Chemical Corporation. The facility is located south of Interstate 20 on Rifle Range Road and within the southwest section of the city of Vicksburg, in Warren County, Mississippi. The site is composed of approximately 535 acres located in Sections 4, 5, 8, 9 and 10, township 15 north, range 3 east, Warren County, Mississippi (Latitude: North 32° 18' 01", Longitude: West 90° 53' 57").

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The site included two operational plants, North Plant and South Plant, which are situated within a small valley running north-south and adjacent to the Mississippi River. Stouts Bayou and Hatcher Bayou flow through the valley and join, forming Hennessey Bayou, which flows south to the Mississippi River. The Kansas City Southern Railroad line runs north-south through the site with sidetracks for loading areas and warehouses. Notable site features include an inactive hazardous waste landfill, an unlined surface impoundment, numerous warehouses for past storage, buildings and process areas, and areas of contaminated soil. The site is within the 100-year floodplain of the Mississippi River.

A large surface impoundment was previously used to manage storm water within the operating plants. Adjacent to and southeast of the surface impoundment is an inactive hazardous waste landfill approximately 3 acres in size. The hazardous waste landfill and impoundment are adjacent to the confluence of Stouts Bayou and Hatcher Bayou, which form Hennessey Bayou. Hennessey Bayou flows for about 10 miles and into the Mississippi River.

The North Plant began operation in 1961 and produced potassium nitrate, liquid chlorine, and liquid nitrogen tetroxide. The raw materials for the North Plant included potassium chloride and nitric acid. The South Plant began operation in 1953 manufacturing chlorinated pesticides, nitrogen-based herbicides, and other agricultural chemicals. The only active operations at the South Plant after 1992 were the Nitric Acid Unit constructed in 1986 and the Potassium Carbonate Unit constructed in 1994. During various periods prior to 1987, the South Plant produced dinitro butyl phenol (Dinoseb or DNBP), monosodium methane arsenate (MSMA) diethyl hexyl phosphoric acid (DEHPA), 1-hydroxy-ethylidene-1-1-diphosphonic acid (UNIHIB), toxaphene, methyl parathion, cyanazine (bladex), and Atrazine. Toxaphene and methyl parathion are insecticides, while Atrazine, Dinoseb, and MSMA are herbicides. Raw materials for these operating processes included chlorine, camphene, ortho-secondary butyl phenol (OSBP), sodium arsenate, sodium hydroxide, methyl chloride, sulfuric acid, sodium paranitrophenolate, and phosphorus trichloride.

In addition to the above-mentioned operations at the plant, the property was the location of two additional operations: (1) an operation by Reagent Chemical to produce aqueous hydrochloric acid from by-products of the toxaphene operation and (2) the Gulf Oil Formaldehyde Plant.

The Formaldehyde Unit owned and operated by Borden Chemical was located inside the boundary of the South Plant. It was previously owned by Gulf Oil and, later,

D R A F T

Perkins Company. The small portion of the South Plant occupied by the Formaldehyde Unit was not separated from the rest of the plant. There was no fence or other barrier. During an October 2002 visit by the Mississippi Department of Environmental Quality (MDEQ), Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Section, it was observed that the Formaldehyde Unit was removed.

1.3 List of Project Tasks and Scope of Work

1.3.1 Task 1 – Soil and Groundwater Sampling and Drilling

Baseline sampling will be conducted on selected existing groundwater monitor wells. The existing wells were installed during previous assessment activities and may require redevelopment prior to the collection of samples. In addition to the sampling of existing wells, additional soil borings may be advanced to further define hot spot concentrations and/or the boundaries of impacted areas. Some of the soil borings may be converted to temporary wells for the collection of groundwater samples.

As an overview, the assessment program to determine present site conditions will include:

- Soil and groundwater samples will be collected at selected locations surrounding known areas of contamination. Locations may deviate from those proposed within this document based upon a review of analytical data and approval by MDEQ;
- Soil and groundwater samples will be collected at proposed locations based on field conditions and the use of appropriate tools that may include manual hand augers, a Geoprobe® device, and/or a drilling rig;
- Groundwater samples will be collected from permanent and/or temporary monitor wells. Temporary monitor wells will be plugged and abandoned upon completion of the assessment or will be converted to permanent monitor wells;
- Soil samples will be field-screened using an Organic Vapor Analyzer (OVA) or an Organic Vapor Meter (OVM) and samples will be selected for volatile chemical analyses based upon vapor measurement results or by visual observations. Due to the nature of some of the contaminants at the site (i.e., pesticides and herbicides), OVM readings may not provide an accurate, reliable method for sample selection. Therefore, an on-site mobile laboratory may be used to analyze samples at the site during collection activities; and

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- Chemical analyses will be performed on soil and groundwater samples for the site-specific chemicals of concern (CoC) as described in the Quality Assurance Project Plan (QAPP). Based on the type of potential impacts identified, the subcontracted off-site environmental laboratory will perform analyses to determine the concentrations of applicable chemical parameters.

1.3.2 Task 2 – Engineered Cap Installation

Based on historic analytical data, portions of the site may require the installation of an engineered clay cap or equivalent. The purpose of the engineered cap is to eliminate contact between receptors and storm water at the surface of the cap and the material underlying the cap. The separation of these two environments prevents contact with and exposure to the capped material. Specific performance criteria for the engineered cap system will be submitted to MDEQ in a work plan prior to the start of capping activities. In general, the clay cap will be constructed of not less than 24 inches of re-compacted clay. Geotechnical tests will be performed on the clay cap to ensure that the cap meets minimum State of Mississippi requirements for final cover. The clay layer will be placed directly above the affected areas. Above the clay layer, an approximately 12-inch layer capable of supporting vegetative growth will be installed. The vegetative growth layer will serve to prevent erosion of the clay cap.

Subcontractors will install the engineered cap. ARCADIS personnel will provide oversight during all installation activities.

1.3.3 Task 3 – Soil Solidification/Stabilization

Solidification/stabilization activities will be performed on soils that are going to be capped in place, but significantly exceed the Tier 1 Target Remediation Goal (TRG) concentrations and require augmentation to reduce the leaching potential. Solidification consists of adding soil amendments, typically cement, lime, and/or fly ash, to sludges or soils. Solidification processes serve to impart strength to a material and/or to prepare materials for transport by reducing liquid content. Stabilization reduces the leachability of contaminants by binding the waste matrix in a stable material. The solidified/stabilized material will be analyzed for the CoC using the synthetic precipitation leaching procedure (SPLP) to evaluate the potential for leachate concentrations to exceed the TRGs.

Prior to solidification/stabilization activities, laboratory and/or field studies will be conducted to determine an appropriate soil amendment mixture(s) for each of the materials to be solidified/stabilized. Hot spot locations may be stabilized in place to

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prevent mobility of CoC. The stabilized soils will be tested for leachability by an analytical laboratory. This testing will establish that the CoC are entrained in the soil matrix and will not be re-released to the environment.

Because portions of the clay cap proposed for this area may be placed over the solidified/stabilized material, the solidification/stabilization program may be designed to also enhance the strength characteristics of these materials. These samples will be analyzed for select geotechnical properties. Approximately 5,700 cubic yards (cy) of North Plant Pond sludges will be solidified/stabilized. The solidified/stabilized material will be relocated to the proposed Solid Waste Management Unit (SWMU) 2 landfill area. Subsequent to relocation activities, sampling of the soil underlying the relocated material will be conducted to confirm the removal of the impacted soil, or this material may be capped in place.

Subcontractors will conduct solidification/stabilization activities. ARCADIS personnel will provide oversight during all activities.

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1.3.4 Task 4 – Barrier Wall Installation and/or Interceptor Trench

If required, an interceptor trench may be installed to protect Stouts Bayou and Hennessey Bayou from groundwater impacts. An interceptor trench consists of a barrier material and/or a groundwater recovery system. The barrier material will be installed to alter the natural groundwater flow. The redirected groundwater will be recovered by the interceptor trench and treated in the City of Vicksburg's wastewater treatment plant, or by other means, prior to discharge to the environment. In the event that the recovered groundwater is not discharged through the City's treatment plant, it will be discharged as a permitted point source.

Subcontractors will install the interceptor trench and sentinel wells. ARCADIS personnel will provide oversight during all interceptor trench/barrier wall installation activities.

1.3.5 Task 5 – Consolidation of Wastes in SWMU 2 Landfill

In an effort to minimize the areal extent of contaminated material on site, soils in Area 2, Area 3, and Area 5 will be consolidated in the existing SWMU 2 landfill. Approximately 15,000 cy of stockpiled soil that exceeds the TRG, currently located in the southwest corner of SWMU 20 and in SWMU 23, will be moved to the existing SWMU 2 landfill in Area 3. Relocated soil will be incorporated into the existing landfill. The newly placed material will be contoured and compacted. A cap will be placed over

the landfill in accordance with Resource Conservation and Recovery Act (RCRA) Subtitle C requirements.

The existing sentinel well system for the SWMU 2 landfill will be sampled as part of long-term groundwater monitoring at the facility. Additional sentinel wells may be installed if deemed necessary to adequately monitor the landfill and/or known groundwater contamination. Sampling will be conducted at regular intervals as required by MDEQ.

Subcontractors will consolidate the waste in the SWMU 2 landfill. ARCADIS personnel will provide oversight during all consolidation activities.

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2. Site Information

Site Name: **Vicksburg Chemical Company – Vicksburg, Mississippi**

Client Safety and Health Contact: **Paul Bunge**

Site Contact Name: **None – Site is inactive**

Operational Description of Site: **Former manufacturer of chlorinated pesticides, nitrogen based herbicides, and other agricultural chemicals.**

Current Site Status: ___ Active __X__ Inactive __X__ Industrial

(check all that apply) ___ Commercial ___ Retail ___ Undeveloped

___ Other (describe) ___

Topography and General Environmental Setting: **Relatively hilly in industrial/commercial area. Pleistocene loess overlying alternating beds of sandy marl, clay marl, montmorillonitic clay, and thin beds of limestone.**

Accessible by:

___ Major Highway __X__ Main Road ___ 2-Lane Road ___ Dirt Road ___ Gravel Road

Description of the Work Area: **Former chemical manufacturing plant. Work areas to be demolished under the direction of a contractor not affiliated with ARCADIS prior to corrective action activities.**

3. Hazard Evaluation and Control

3.1 Project Hazard Analysis

The Project Hazard Analysis below identifies the hazards that are anticipated to be encountered by the Project Team.

Physical Hazards Present: ☐ None	☒ Heat ☒ Cold ☒ Noise ☒ Walking/Working Surfaces (Includes Slips/Trips/Falls & Floor/Wall Openings) ☒ Visible Dust ☐ Laser	☐ Holes/Pits ☐ Ionizing Radiation ☐ Non-Ionizing Radiation ☒ Electricity ☒ Severe Weather ☐ Poor Lighting ☐ Overhead Hazards ☐ Other:
Environmental/ Equipment Hazards Present: ☐ None	☒ Heavy Machinery ☒ Trenching/Excavation ☐ Docks – Marine Operations ☐ Docks – Loading ☐ Diving Operations ☒ Drilling ☐ Forklifts ☐ Water Operations Work ☐ Elevated Heights (Includes Fall Protection) ☒ Overhead/Underground Utilities ☐ Confined Spaces ☐ Power Tools ☐ Cranes/Hoists/Rigging	☐ Ladders ☐ Scaffolding ☐ Man Lifts ☐ Welding ☐ Gas Cylinders ☐ Roadway Work ☐ Railroad Work ☒ Energized Equipment (Lockout/Tagout) ☐ Pressurized Equipment (Lockout/Tagout) ☒ Drums and Containers ☒ Other: Contact With Contaminated Materials
Biological Hazards Present: ☐ None	☐ Animal/Human Fluids or Blood ☐ Animal/Human Tissue(s) ☒ Poisonous/Irritating Plants ☐ Other:	☐ Contaminated Needles ☐ Live Bacterial Cultures ☒ Insects/Rodents/Snakes ☐ Other:
Ergonomic Hazards Present: ☐ None	☐ Repetitive Motion ☒ Awkward Position ☒ Heavy Lifting ☒ Frequent Lifting ☐ Other:	☐ Limited Movement ☒ Forceful Exertions ☐ Vibration ☐ Other: ☐ Other:
Personal Safety/ Security: ☐ None	☐ Personal Safety ☐ Security Issue ☒ Project Site In Isolated Area ☒ Employees Working Alone ☐ Other:	☐ Employees Working Early/Late ☐ Potentially Dangerous Wildlife ☐ Guard or Stray Dogs In Area ☐ No/Limited Cell Phone Service ☐ Other:

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Training Required: ☐ None	☒ 40-Hour HAZWOPER ☐ 24-Hour HAZWOPER ☐ HAZWOPER Site Supervisor ☐ OSHA 30-Hour Construction ☐ OSHA 10-Hour Construction ☒ Personal Protective Equipment ☐ Respiratory Protection ☐ Chemical Hygiene ☒ Hazard Communication ☐ Hazardous Waste ☒ First-Aid/CPR ☐ DOT/IATA Hazmat Transportation ☐ Diving ☐ Other:	☒ Bloodborne Pathogens ☐ Confined Space ☐ Lockout/Tagout ☐ Electricity ☐ Fire Extinguishers ☐ Fall Protection ☒ Noise Exposure ☐ Forklifts ☐ Asbestos ☐ Lead ☐ Cadmium ☐ Spill Prevention, Control, and Countermeasure Plan ☐ Radiation Safety ☐ Client-Specific
Medical Screening: ☐ None	☒ Medical Surveillance Exam (HAZWOPER) ☐ Client Required Drug and/or Alcohol Testing	☐ Blood and/or Urine Screening For Other Hazardous Substances

3.2 Chemical Hazard Information

Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Acetophenone 98-86-2	Keep away from incompatibles such as oxidizing and reducing agents and alkalis.	10 ppm	9.28 eV (NIST)	Inflammation of eye/skin irritant	Use of proper PPE: Goggles/ gloves
Arsenic 7440-38-2	Keep away from strong oxidizers. Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.	0.010 mg/m^3 5 mg/m^3 (IDLH)	9.82 eV (NIST-gas phase)	Ulceration of nasal septum/ dermatitis/ GI disturbances/ peripheral neuropathy/ respiratory irritation/hyper-pigmentation of skin	Use of proper PPE: Goggles/latex gloves/long sleeve shirts/ trousers without cuffs

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Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Atrazine 1912-24-9	Avoid oxidizers, strong acids, and strong bases.	5 mg/m^3	Not available	Eye, skin irritation/ dermatitis/ sensitization skin/difficulty breathing, shortness of breath/ diminished energy/ incoordination/ salivation/ hypothermia/ liver injury	Use of proper PPE: Safety glasses with side shields, butyl rubber, viton, or equivalent gloves
Benzene 71-43-2	Highly flammable. Unsuitable materials consist of natural, butyl, neoprene, or nitrile rubbers	0.5 ppm 500 ppm (IDLH) 2.5 ppm (STEL)	9.24 eV	Eye, skin, nose, respiratory irritation/ dizziness/ headache/ nausea/ staggered gait/ anorexia/ dermatitis/bone marrow depression/ diminished energy	Use of proper PPE: Goggles/ nitrile gloves
Bis (2-ethylhexyl) phthalate 117-81-7	Reacts with nitrates and strong oxidizers, acids, and alkalis.	5 mg/m^3 5000 mg/m^3 (IDLH)	Unknown	Eye, mucous membrane, skin irritation	Use of proper PPE: Goggles/ gloves
Bromodichloro-methane 75-27-4	Avoid bases, oxidizing agents, and magnesium.	200 ppm 2,000 ppm (IDLH)	10.88 eV (NIST)	Eye, mucous membranes, and respiratory tract irritation Nausea, dizziness, and headaches with prolonged exposure	Use of proper PPE: Goggles/ gloves/SCBA in case of emergency
Bromoform 75-25-2	When heated to decomposition, may release irritating vapors. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated.	0.5 ppm 850 ppm (IDLH)	10.48 eV	Eye, skin, respiratory system irritation/CNS depression/liver, kidney damage	Use of proper PPE: Rubber gloves, chemical safety glasses

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Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Carbon Tetrachloride 56-23-5	Reacts explosively with alkali metals and chlorine. Incompatible with zinc and aluminum. Decomposes in open flame or at high temperatures. Inhalation of high concentrations can have a narcotic effect.	5 ppm 10 ppm (STEL) 200 ppm (IDLH)	11.47 eV	Eye, skin irritation/CNS depression/ nausea/ vomiting/liver, kidney injury/ drowsiness/ incoordination	Use of proper PPE: Goggles/viton or polyvinyl-alcohol gloves
Chloroform 67-66-3	Slight fire hazard when exposed to high heat.	10 ppm 500 ppm (IDLH)	11.42 eV	Eye, skin irritation/ dizziness/ mental dullness/ nausea/ confusion/ headache/ diminished energy/ anesthesia/ enlarged liver	Use of proper PPE: Goggles/ gloves/ coveralls
Cyanazine 21725-46-2	Avoid ignition sources and oxidizers.	None established	Not available	No applicable information found	Use of proper PPE: Safety glasses with side shields/ butyl rubber, viton, or equivalent gloves
Dibromochloro-methane 124-48-1	Avoid strong bases, strong oxidizing agents, and magnesium.	None established	10.88 eV (NIST)	Eye, skin, respiratory system irritation Nausea, dizziness, and headaches with prolonged exposure	Use of proper PPE: Safety glasses/ gloves/SCBA if leaked
1,2-Dichloro-ethane 107-06-2	Vapors are heavier than air and may travel to the source of ignition and flash back.	1 ppm (NIOSH REL) 2 ppm (STEL) 50 ppm (IDLH)	11.05 eV	CNS depression/ headache/ dizziness/eye irritation/loss of coordination/ corneal opacity/ liver, kidney, cardiovascular system damage	Use of proper PPE: Goggles/viton or neoprene gloves

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Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Dinoseb 88-85-7	Vapors can travel to a source of ignition and flash back.	Not available	Not available	Dizziness/ nausea/muscle weakness/ narcosis/ respiratory failure	Use of proper PPE: Safety glasses with side shields/ butyl, viton, or equivalent gloves
Methylene Chloride 75-09-2	Exposure to heat or prolonged exposure to sun may cause bursting.	25 ppm (NIOSH REL) 125 ppm (STEL) 2300 ppm (IDLH)	11.32 eV	Eye, skin irritation/ diminished energy/ drowsiness/ dizziness/ numbness/ tingling limbs/ nausea	Use of proper PPE: Goggles/ neoprene or butyl rubber gloves
4-Nitrophenol 100-02-7	Avoid strong oxidizing agents and strong bases.	None established	8.84 eV (NIST – average)	Skin/eye irritation Nausea, dizziness, and headaches with prolonged exposure	Use of proper PPE: Goggles/ chemical resistant gloves
Pentachloro-phenol 87-86-5	Incompatible with strong oxidizing agents, strong bases, acid chlorides, and acid anhydrides.	0.5 mg/m^3 (skin) 2.5 mg/m^3 (IDLH)	Not available	Eye, nose, throat irritation/ sneezing/ coughing/ diminished energy/ anorexia/weight loss/sweating/ headache/ dizziness/ nausea/ vomiting/ difficulty breathing, shortness of breath/chest pain/high fever/ dermatitis	Use of proper PPE: Goggles/ gloves
1,1,1,2-Tetra-chloroethane 630-20-6	Avoid strong oxidizing agents and strong bases.	None established	11.3 eV (NIST – average)	Eye, skin irritation/ diminished energy/ restlessness/ irregular respiration/ muscle incoordination	Use of proper PPE: Goggles/ gloves

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Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Tetrachloro-ethene 127-18-4	Reactive with oxidizing agents, metals, acids, and alkalis.	25 ppm 100 ppm (STEL) 150 ppm (IDLH)	9.32 eV	Eye, nose, throat, skin, respiratory system irritation/ nausea/ flush face/neck/ dizziness/ incoordination/ headache/ drowsiness/skin erythema/liver damage	Use of proper PPE: Safety glasses/vapor respirator/ gloves
Toxaphene (Chlorinated Camphene) 8001-35-2	Avoid heat, sparks, and other sources of ignition.	0.5 mg/m^3 200 mg/m^3 (IDLH)	Not available	Nausea/ confusion/ agitation/tremor/ convulsions/ unconscious-ness/dry, red skin	Use of proper PPE: Goggles/ gloves/ cartridge type respirator with organic vapor cartridges and HEPA pre-filter
Trichloro-ethylene 79-01-6	Avoid strong oxidizing and reducing agents, strong bases, and caustics.	100 ppm 200 ppm (CEIL) 1000 ppm (IDLH)	9.45 eV	Eye, skin irritation/ headache/visual disturbance/ diminished energy/tremor/ dizziness/ drowsiness/ nausea/ vomiting/ dermatitis/ cardiac arrhythmias/skin sensations/liver injury	Use of proper PPE: Goggles/viton or neoprene gloves
1,2,4-Trimethyl-benzene 95-63-6	Flammable. Avoid oxidizers and nitric acid.	TLV/PEL not established 25 ppm (NIOSH REL)	8.27 eV	Eye, nose, throat, skin, respiratory system irritation/nausea/ bronchitis/ hypochromic anemia/ headache/ drowsiness/ incoordination/ vomiting/ confusion/ inflammation of the lungs	Use of proper PPE: Goggles/ gloves/full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) as a backup to engineering controls

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Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
1,3,5-Trimethyl-benzene 108-67-8	Flammable liquid and vapor. Avoid oxidizers and nitric acid.	25 ppm/ 123 mg/m^3 (NIOSH REL)	8.39 eV	Eye, nose, throat, skin, respiratory system irritation/nausea/ bronchitis/ hypochromic anemia/ headache/ drowsiness/ dizziness/ incoordination/ vomiting/ confusion/ inflammation of the lungs	Use of proper PPE: Goggles and/or full-face shield
Vinyl Chloride 75-01-4	Vapors are heavier than air and may travel to the source of ignition and flash back.	1 ppm	9.99 eV	Diminished energy/ abdominal pain/ gastro-intestinal bleeding/ enlarged liver/ pallor or cyanosis of extremities/ frostbite	Use of proper PPE: Goggles/ gloves

*The TLV from the American Conference of Governmental Industrial Hygienists is listed unless the PEL, designated by OSHA, is lower.

CEIL	Ceiling Limit.
CNS	Central nervous system.
eV	Electron volt.
GI	Gastrointestinal.
IDLH	Immediately dangerous to life and health.
mg/m^3	Milligram per cubic meter.
NIOSH REL	National Institute for Occupational Safety and Health Recommended Exposure Limit.
NIST	National Institute for Standards and Technology.
PEL	Permissible Exposure Limit.
PPE	Personal protective equipment.
ppm	Parts per million.
SCBA	Self-contained breathing apparatus.
STEL	Short-Term Exposure Limit.
TLV	Threshold Limit Value.
TWA	Time weighted average.

Comments: Material Safety Data Sheets (MSDSs) for the chemicals listed above are available in Appendix B. Additional health and safety information can be obtained from the Project Health and Safety Manager (PHSM).

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3.3 Hazard Communication (HazCom)

All project-required chemicals will be handled in accordance with OSHA 29 Code of Federal Regulations (CFR) 1910.1200 and ARCADIS-required procedures. The Site Safety Officer (SSO) will act as the HazCom Program Coordinator for the site and will maintain the Master Inventory List of hazardous chemicals kept on the job site. The SSO will maintain MSDSs on site for all chemicals. **MSDSs will be located in each ARCADIS field vehicle.** The SSO will communicate the location of the MSDSs and the hazards associated with these chemicals to all project site ARCADIS employees and subcontractors during the safety orientation. This information will be reviewed during tailgate briefings, especially if new chemicals or materials are introduced on site.

The SSO will ensure that all containers of chemicals (including drums, bags, pails, tanks, vessels, etc.) are labeled appropriately with the contents of the container, the proper name of the chemical, associated hazards and appropriate hazard warnings, and the name and address of the manufacturer/importer. Chemicals that are not properly labeled will not be accepted or allowed on site. If transferred to a secondary container, the new container will be labeled as described.

The SSO will ensure that the personal protective equipment (PPE) necessary for work around the particular chemical is available and that project site employees have been trained in its use.

The Project Manager will ensure that all project personnel have received HazCom training as required in OSHA 29 CFR 1910.1200(h).

3.4 Task Hazard Analysis

Each hazard is evaluated and rated for the level of risk based on the task of the project. A thorough task hazard analysis is completed for each task using the following Relative Hazard Rating Scale:

Hazard Is/Has...	Minimal Health Effects	Moderate Health Effects	Severe Health Effects
Rarely present	LOW	LOW	MED
Sometimes present	LOW	MED	HIGH
Constantly present	MED	HIGH	HIGH

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Administrative and engineering controls for each hazard are evaluated for hazard abatement. PPE required to protect employees from the hazard are indicated, and a summary checklist is provided in Section 4. Prior to initiating field work, a tailgate safety briefing must be conducted with all field staff to review the hazards with the Project Team. Tailgate safety briefings should be conducted daily, or as tasks/hazards change. The Site Activities Tailgate Safety Briefing Sign-in Log is included in Appendix C.

3.4.1 Task 1 – Soil and Groundwater Sampling and Drilling

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA
HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Walking/ Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Poisonous/ Irritating Plants	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Native Flora				
Admin. & Eng. Controls:	Cover exposed skin.			PPE:	NA

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HAZARD:	Insects/Rodents/ Snakes	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Native Species				
Admin. & Eng. Controls:	Do not approach or handle rodents or snakes.			PPE:	NA
HAZARD:	Noise	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Only essential subcontractor personnel in immediate vicinity of drilling equipment - PPE required.			PPE:	Earplugs
HAZARD:	Overhead/ Underground Utilities	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Underground Utilities				
Admin. & Eng. Controls:	Locate all underground utilities prior to drilling; use correct Lockout/Tagout procedures; keep safe distances from all utilities.			PPE:	NA
HAZARD:	Drilling	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Do not wear loose clothing and be aware of moving parts.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Awkward Position	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery, Hand Augering				
Admin. & Eng. Controls:	Use proper lifting technique.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Heavy Lifting	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery, Hand Augering				
Admin. & Eng. Controls:	Use proper lifting techniques, with a partner, if necessary. Use mechanical devices to aid in lifting.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Frequent Lifting	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery, Hand Augering, Handling Sample Coolers				
Admin. & Eng. Controls:	Use proper lifting techniques.			PPE:	Hard hat, safety gloves, steel toe boots

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HAZARD:	Drums and Containers	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Chemical Exposure, Lifting, Excessive Force				
Admin. & Eng. Controls:	Discard all PPE appropriately and do not attempt to move drums inappropriately.			PPE:	Latex or nitrile gloves, Tyvek coveralls

Is air monitoring required for this task? ☐ YES ☒ NO May be required at SSO discretion.

3.4.2 Task 2 – Clay Cap Installation

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA
HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Walking/Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Heavy Machinery	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery				
Admin. & Eng. Controls:	Be aware of moving equipment.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection

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HAZARD:	Noise	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Only essential subcontractor personnel in immediate vicinity of drilling equipment - PPE required.			PPE:	Earplugs
HAZARD:	Visible Dust	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Only essential subcontractor personnel in immediate vicinity of drilling equipment during installation of clay cap - PPE required.			PPE:	Respirator at discretion of SSO
HAZARD:	Contact with Contaminated Soils	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted Soil				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Latex or nitrile gloves, Tyvek coveralls

Is air monitoring required for this task? ☐ YES ☒ NO

3.4.3 Task 3 – Soil Solidification/Stabilization

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA
HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions

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HAZARD:	Walking/Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Heavy Machinery	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery				
Admin. & Eng. Controls:	Be aware of moving equipment.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection
HAZARD:	Noise	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Only essential subcontractor personnel in immediate vicinity of drilling equipment - PPE required.			PPE:	Earplugs
HAZARD:	Contact with Contaminated Soils	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted Soil				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Latex or nitrile gloves, Tyvek coveralls
HAZARD:	Chemical hazards	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted Soil, Soil Amendments				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Goggles/Gloves, Tyvek coveralls
HAZARD:	Awkward Position	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Equipment and Machinery, Lifting of amendments				
Admin. & Eng. Controls:	Operate machinery in accordance with user manuals. Use proper lifting technique, with a partner if necessary.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Heavy Lifting	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Lifting of amendments				
Admin. & Eng. Controls:	Use proper lifting techniques, with a partner, if necessary. Use mechanical devices to aid in lifting.			PPE:	Hard hat, safety gloves, steel toe boots

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HAZARD:	Frequent Lifting	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Lifting of amendments				
Admin. & Eng. Controls:	Use proper lifting techniques, with a partner, if necessary. Use mechanical devices to aid in lifting.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Drums and Containers	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Chemical Exposure, Lifting, Excessive Force.				
Admin. & Eng. Controls:	Discard all PPE appropriately and do not attempt to move drums inappropriately.			PPE:	Latex or nitrile gloves, Tyvek coveralls
HAZARD:	Visible Dust	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Contaminated Surficial Dust				
Admin. & Eng. Controls:	Control with wetting methods.			PPE:	Respirator at discretion of SSO

Is air monitoring required for this task? ☒ YES ☐ NO

3.4.4 Task 4 – Interceptor Trench/Barrier Wall Installation

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA
HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions

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HAZARD:	Walking/Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Heavy Machinery	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery				
Admin. & Eng. Controls:	Be aware of moving equipment.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection
HAZARD:	Contact with Contaminated Soils	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted soil				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Goggles/Gloves, Tyvek coveralls
HAZARD:	Trenching/ Excavation	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery; Slope Failure				
Admin. & Eng. Controls:	Excavation to be properly shored, trenched, or sloped. *Trenching and excavation to be* overseen by a competent person.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection
HAZARD:	Overhead/Under-ground Utilities	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Underground Utilities				
Admin. & Eng. Controls:	Locate all underground utilities prior to activities; use correct Lockout/Tagout procedures; keep safe distances from all utilities.			PPE:	NA

Is air monitoring required for this task? ☐ YES ☒ NO May be required at SSO discretion.

3.4.5 Task 5 – Consolidation of Wastes in SWMU 2 Landfill

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA

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HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Walking/Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Heavy Machinery	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery				
Admin. & Eng. Controls:	Be aware of moving equipment.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection
HAZARD:	Contact with Contaminated Soils	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted soil				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Goggles/Gloves, Tyvek coveralls

Is air monitoring required for this task? ☒ YES ☐ NO

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4. Personal Protective Equipment

This section lists the equipment that must be present on the site and used during the specified protection level. This checklist is used when preparing for the field and is completed with the type of equipment to be worn based on the hazards present. This section applies primarily to the corrective action, but can also be utilized for the soil and groundwater sampling in Task 1.

R = Equipment required to be present on the site.
O = Optional equipment.

Subcontractors must have the same equipment listed here as a minimum.

Description (Put Specific Material or Type in Box)	Level Of Protection		
	D	C	B
Body			
Coveralls – Tyvek (optional during drilling and sampling activities)	R		
Chemical Protective Suit – Impervious clothing such as styrene butadiene rubber (SBR), polyvinyl chloride (PVC), Gore-Tex, special Hazmat Splash or *Level A, B, or C Protective Suit*			
Splash Apron	O		
Rain Suit	O		
Traffic Safety Vest (reflective)	O		
Head			
Hard Hat (if does not create other hazard)	R		
Eyes & Face			
Safety Glasses with Side Shields (incorporate sun protection as necessary)	R		
Goggles (based on hazard)	R		
Splash Guard (based on hazard)			
Full-Face Shield made of polycarbonate, acetate, polycarbonate/acetate, PETG, or thermoplastic			
Ears			
Ear Plugs (drilling, heavy equipment operation)	R		
Ear Muffs (drilling, heavy equipment operation)	O		
Hands and Arms			
Outer Chemical Resistant Gloves – Nitrile, PVC, or Neoprene	R		

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Description (Put Specific Material or Type In Box)	Level Of Protection		
	D	C	B
Inner Chemical Resistant Gloves (specify the type of glove based on chemical hazard)		O	
Insulated Gloves		O	
Work Gloves	O		
Foot			
Safety Boots (steel toe and shank)	R		
Rubber, Chemical Resistant Boots – NBR, PVC, Polyurethane, or Neoprene	O		
Rubber Boots – Latex or PVC – RINSE PRIOR TO REMOVAL AND INSPECT FOR LEAKS.	O		
Disposable Boot Covers – NO NYLON BLENDS.	O		
Respiratory Protection (indicate cartridge type where applicable)			
Half-Mask Air-Purifying Respirator (APR)			
Full-Face APR			
Dust Protection (Worker must have valid fit test to wear a respirator. Cartridge type to be selected from particulate, organic vapor, or pesticide gas as determined by SSO.)		O - ARCADIS employees are required to wear respiratory protection at the discretion of SSO	
Full-Face Canister APR			
Powered APR			
Air Line/Self-Contained Breathing Apparatus			
Other Supplies			
First-Aid Kit	R		
Fire Extinguisher	R		
Mobile Phone	R		
Walkie Talkies			
Traffic Cones			
Water or Other Fluid Replenishment	R		
Eyewash Station	R		
Emergency Shower			
Eyewash Bottle	R		
Wash and Dry Towelettes			
Sunscreen (Sun Protection Factor [SPF] 15 or higher)	O		
Insect Repellant	O		

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5. Decontamination Procedures

Equipment leaving the site will be decontaminated. Pumps, tools, and other equipment that comes into contact with chemicals will be decontaminated by flushing with potable water. Contaminated PPE and clothing will be washed prior to reuse. Completely submerge contaminated clothing or other materials prior to drying. Residual contaminants, if allowed to dry on materials such as paper, fabrics, cotton, leather, wood, or other combustibles, can cause materials to ignite and result in a fire.

Level D Decontamination Steps	
1	Equipment Drop
2	Glove and Boot Wash and Rinse
3	Disposable Garment, Outer Boot, and Glove Removal
4	Field Wash

Place an X by all decontamination equipment that is required at the site.

Decontamination Equipment Checklist			
X	Scrub Brushes	X	Garbage Bags
X	Waste Containers		Paper Towels
X	Soap		Isopropyl Alcohol
X	Plastic Tubs		Showers
	Plastic Drop Cloths		

6. Emergency Planning

6.1 Emergency and Project Telephone Numbers

In the event of a situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list on the following pages. The SSO will post the Emergency Contact page at the project as a ready reference. Where mobile telephones are used for emergency communications, active cellular service will be confirmed from the site before the initiation of daily work activities.

In the event of any emergency situation, site personnel will immediately notify the SSO, who will initiate emergency response actions. The SSO will determine the need for off-

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site emergency response assistance. If the SSO determines that on-site personnel can adequately respond and control the situation, the SSO will oversee the response and ensure site personnel are properly protected and use proper procedures. If not, the SSO will contact appropriate emergency response personnel per the phone list and other personnel as required by the Client for assistance. Personal injury or heat/cold exposure requiring immediate medical help, personal medical emergency, or hazardous chemical exposure situations will require the SSO to immediately call the appropriate emergency number for medical assistance (see the Emergency Phone List). These procedures are included in Appendix E, with the map to the hospital, for reference.

Potential emergencies may include:

- Chemical burns;
- Personal injury;
- Personal exposure;
- Fire;
- Vehicle accidents;
- Severe weather; and
- Heat stress.

The SSO will conduct regular site inspections to identify any potential emergency situations for the purposes of avoiding those emergency situations.

6.2 First-Aid Kits

The site will have first-aid kits that are protected from the weather, available at the site at all times, and inspected and restocked weekly, as necessary. The first-aid kits will be maintained in ARCADIS vehicles.

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6.3 Eyewash Units

Eyewash units meeting the latest requirements of American National Standards Institute Standard 2358.1 will be utilized at the site during Task 2 through Task 5. All units will be capable of supplying hands-free irrigation for both eyes for at least 15 minutes at a flow rate of at least 0.4 gallon per minute.

6.4 Eyewash Bottles

Eyewash bottles offer a short-term, immediate rinse for personnel who get contamination in their eyes, specifically particulates. Once the eyewash bottle has been used, personnel should find a plumbed eyewash station or other device (such as a garden hose) to provide continuous flushing to the eyes. Eyewash bottles should be stored protected from direct sunlight and high temperatures. Additionally, eyewash bottles should be checked frequently to ensure that the liquid has not expired. Eyewash bottles will be utilized during all site activities.

6.5 WorkCare

WorkCare is a 24-hour service that provides professional medical assistance over the telephone for non-emergency injuries or illnesses. The WorkCare nurse or doctor may assess the injury or symptoms, advise the employee as to appropriate care, and assist in identifying a medical facility if necessary.

Note: First aid should be administered and, when needed, emergency medical treatment should be sought prior to contacting WorkCare.

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POST THIS PAGE IN APPROPRIATE LOCATIONS ON SITE

The SSO will coordinate the entry and exit of response personnel during an emergency and make emergency contacts as necessary from the following list. After immediate notifications are made, the SSO will contact the Project Manager.

Emergency Contact	Phone Numbers
Local Police	911
Local Ambulance	911
Local Fire Department	911
Local Hospital (Parkview Regional Medical Center)	601-631-2131
WorkCare	800-455-6155
Poison Control	800-222-1222
National Response Center (all spills in reportable quantities)	800-424-8802
U.S. Coast Guard (spills to water)	804-441-3516
Project Manager – David Escudé (Mobile)	225-205-8250
Client Contact – Paul Bunge (Mobile)	303-888-9191

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Hospital Route

(Parkview Regional Medical Center – 6 miles from 4280 Rifle Range Road)

- North on **Rifle Range Road** and right onto **Warrenton Road**; **Warrenton Road** becomes **Old US-61/Washington Street**;
- Merge onto **I-20 East**;
- **Exit #4B/W. Clay Street** (**US-80**) toward National Park;
- Merge onto **US-80W/Clay Street**;
- Turn **RIGHT** onto **Baldwin Ferry Road**; and
- Turn **LEFT** onto **Grove Street**; end at **Parkview Regional Medical Center**.

See Map to Hospital – Appendix E.

First-Aid and Response Equipment Locations

First-Aid Kit: In Vehicles

Eyewash (Bottle): In Vehicles

Eyewash Station: Near ARCADIS truck for Task 2 through Task 5

The Project Manager will make the following notifications:

Name	Phone Numbers
Corporate Health & Safety Manager – Pat Vollertsen	720-344-3779 (O)
Regional Health & Safety Manager – Mike Ramer	720-344-3766
Area Health & Safety Representative – Madeline Rogers	225-292-1004
Project Physician or Local Physician (if required or requested by Client or project contract)	N/A
Subcontractor's Office – *(Company – Name)*	*To be determined.*
Phone Number at Project Site – *(Name)*	*To be determined*

The following authorities were contacted and briefed about our activities and the potential hazards:

Name: Mr. Jere "Trey" Hess

Agency: MDEQ, Mississippi Brownfields Program Coordinator

Date: *(Date)*

Name: _____

Agency: _____

Date: _____

Name: _____

Agency: _____

Date: _____

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7. Organization and Responsibilities

7.1 ARCADIS Personnel

The following personnel are designated to carry out health and safety (H&S) job functions on the site. Their responsibilities and the tasks they will be carrying out on the site are listed below. The same person may fill more than one role.

ARCADIS Project Team	Responsibility and Tasks
David Escudé	**Project Manager (PM)** • Initiates Health and Safety Plan (HASP) development, and reviews and signs the HASP. • Obtains site-specific H&S information. • Communicates with the SSO on site H&S issues. • Allocates resources for correction of identified unsafe work conditions. • Communicates with the Client on H&S issues. • Ensures ARCADIS site workers have all training necessary for the project. • Finalizes PM Checklist. • Reports all injuries, illnesses, and near-misses to the Corporate H&S Manager and Area H&S Representative, assists with incident investigations, and ensures that any recommendations made are implemented. • Communicates H&S Program and a copy of the ARCADIS HASP to all subcontractors and receives their acknowledgement of receipt of such information.
George Cook/ Kipper Montgomery	**Site Safety Officer (SSO)** • Reviews and works in accordance with the components of this HASP. • Ensures that the HASP is available to and reviewed by all site personnel and that subcontractors have appropriately communicated H&S information. • Ensures that necessary site-specific training is performed (both initial and *"tailgate" safety briefings* – Use the Site Activities Tailgate Safety Briefing Sign-In Log in Appendix C). • Ensures that site visitors have been informed of the hazards related to ARCADIS work and precautions to take and have signed the Site Visitor Acknowledgement and Acceptance of HASP log found in Appendix F. • Ensures that work is performed in a safe manner and has authority to stop work when necessary to protect workers and/or the public. • Coordinates activities during emergency situations.

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ARCADIS Project Team	Responsibility and Tasks
George Cook/ Kipper Montgomery	**Site Safety Officer (SSO) (Continued)** • Ensures that all necessary permits and safety information provided by the Client is disseminated to other site personnel and is maintained in an organized manner. • Communicates with the PHSM and the PM on H&S issues. • Report all injuries, illnesses, and near-misses to the PM and PHSM. • Maintains injury/illness reports and other H&S data as required by the Client or regulatory agency (e.g., Mine Safety and Health Administration [MSHA] Quarterly Report). • Ensures that necessary safety equipment is maintained and used at the site.
ARCADIS Site Representatives	**Site Workers** • Read and work in accordance with the components of this HASP. • Report all unsafe working conditions to the SSO. • Report all injuries, no matter how trivial, to the SSO. • Work in a safe manner. • Sign the Employee Acknowledgement log at the beginning of this HASP.
Madeline Rogers	**Project Health and Safety Manager (PHSM)** The designated PHSM is responsible for overseeing all aspects of the site safety program and preparing any site-specific H&S guidance documents or addenda to this HASP. The PHSM does not report to the PM and is separately accountable to the ARCADIS Project Team senior management for site H&S. The PHSM acts as the sole contact to regulatory agencies on matters of H&S. Other responsibilities include: • Overall authority for H&S compliance and HASP conformance for the project. • General H&S program administration. • Conducts project H&S audits as warranted. • Determines the level of personal protection required. • Updates equipment or procedures based on information obtained during site operations. • Establishes air-monitoring parameters based on expected contaminants. • Assists in injury, illness, and near-miss investigation and follow-up.

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8. General Site Safety

The following general requirements apply to all on-site activities.

8.1 Site Access and Control

The SSO will coordinate access and control security at the work site. The SSO will establish a work area perimeter. Only authorized personnel will be allowed beyond the perimeter. Other site workers and visitors to the site should be kept out of the work site. If visitors need access to the site, the SSO, or his/her designee, will escort the visitor at all times. All visitors will log in and out with the SSO. Visitor log sheets are included in Appendix F.

When Level C PPE or greater is required on site, the SSO will establish control boundaries for the Exclusion Zone, Contamination Reduction Zone, and the Support Zone. The zones will be designated by traffic cones, barricades, signs, caution tape, or other means effective in identifying the different areas. The zones will be identified by the SSO during tailgate meetings. Entrance and exit to the Exclusion Zone will only be through controlled access points established for each work area.

8.2 Hazard Communication (HazCom)

All project-required chemicals will be handled in accordance with Occupational Safety and Health Administration (OSHA) 29 CFR 1910.1200 and ARCADIS-required procedures. The SSO will act as the HazCom Program Coordinator for the site and will maintain the Master Inventory List of hazardous chemicals kept on the job site. The SSO will maintain MSDSs on site for all chemicals. MSDSs will be maintained in Appendix B of this HASP and within ARCADIS vehicles. The SSO will communicate the location of the MSDSs and the hazards associated with these chemicals to all project site ARCADIS employees and subcontractors during the safety orientation. This information will be reviewed during tailgate briefings, especially if new chemicals or materials are introduced on site.

The SSO will ensure that all containers of chemicals (including drums, bags, pails, tanks, vessels, etc.) are labeled appropriately with the contents of the container, the proper name of the chemical, associated hazards and appropriate hazard warnings, and the name and address of the manufacturer/importer. Chemicals that are not properly labeled will not be accepted or allowed on site. If transferred to a secondary container, the new container will be labeled as described.

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The SSO will ensure that the PPE necessary for work around the particular chemical is available and that project site employees have been trained in its use.

The PM will ensure that all project personnel have received HazCom training as required in OSHA 29 CFR 1910.1200(h).

8.3 Personal Hygiene

Field personnel should avoid contact with potentially contaminated substances, such as puddles, pools, mud, etc. Monitoring equipment should not be placed on a potentially contaminated surface, including the ground surface.

Smoking, eating, and drinking will not be permitted within any controlled work area at any time. Field crew members will wash their hands and face after leaving any controlled work area prior to eating or drinking. Consumption of alcoholic beverages is prohibited at the site.

8.4 Site Awareness

All field crew members should remain alert for any indications of potentially dangerous situations (e.g., strong, irritating, or nauseating odors; heavy equipment; conditions of an excavation).

Field crew members will be familiar with the physical characteristics and requirements of the work site, including:

- Accessibility to equipment and vehicles;
- Communication (i.e., methods, restrictions, or limitations);
- Hot zones (areas of known or suspected contamination);
- Site access;
- Emergency procedures and evacuation assembly points;
- Activities of other contractors and personnel on site that may affect or be affected by tasks being performed; *and*
- Location of protective and emergency equipment and relevant first-aid procedures.

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The number of personnel and equipment in controlled work areas should be minimized, consistent with site operations. The SSO will review this information during the site orientation and periodically during the tailgate meetings.

8.5 Buddy System

All on-site personnel will operate using the buddy system whenever possible.

8.6 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Additionally, project equipment and supplies will be kept in an orderly manner so as not to create a trip hazard.

8.7 Communication

Effective communication is essential to safe working conditions and the successful completion of field projects. During on-site activities, cellular phones will be used by ARCADIS site personnel to maximize communications with emergency response units. Active cellular telephone service will be confirmed from the site prior to the initiation of work activities. In the event of a catastrophic event, any notice to evacuate will be given verbally by the SSO and via cell phone. Communication details will be provided at the site safety orientation.

Personnel in the project work area will attempt to remain in communication or within sight of the ARCADIS SSO or designee. The ARCADIS SSO will indicate the need to evacuate the site by verbal command or through radio or telephone communication.

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Addendum Page

This form should be used to document any changes required to this HASP. These changes may be a result of changes to the scope of services, changes in field conditions, new hazards identified on the site, higher or lower hazards than anticipated, etc. Please complete this form prior to the next work day once the changes have been identified. Review the modifications with all site staff, including subcontractors, during the daily tailgate briefing, and complete the tailgate briefing form as required. Attach a copy of the addendum to all copies of the HASP including the site copy, and log in the Addendum Log.

Addendum Number: _____ Project Number: _____

Date of Changed Conditions: _____ Date of Addendum: _____

Description of Change that Results in Modifications to HASP:

_____

_____

Hazard Analysis for Change in Work:

HAZARD:		Level of Risk:	
Source of Hazard:			
Admin. & Eng. Controls:		PPE:	
HAZARD:		Level of Risk:	
Source of Hazard:			
Admin. & Eng. Controls:		PPE:	

Signed: _____ Signed: _____

Project Manager Site Safety Officer

Signed: _____ Signed: _____

H&S Plan Writer H&S Plan Reviewer

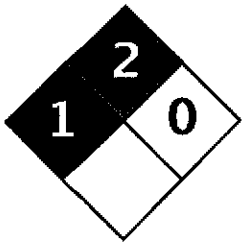
Make additional copies of this form as necessary.

ARCADIS

Appendix B

Material Safety Data Sheets

ScienceLab.com
Chemicals & Laboratory Equipment



Health	1
Fire	2
Reactivity	0
Personal Protection	J

Material Safety Data Sheet
Acetophenone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetophenone

Catalog Codes: SLA2425

CAS#: 98-86-2

RTECS: AM5250000

TSCA: TSCA 8(b) inventory: Acetophenone

CI#: *Not applicable.*

Synonym: Ketone methyl phenyl

Chemical Name: 1-Phenyl-ethanone

Chemical Formula: C6H5COCH4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acetophenone	98-86-2	100

Toxicological Data on Ingredients: Acetophenone: ORAL (LD50): Acute: 815 mg/kg [Rat.]. 740 mg/kg [Mouse]. DERMAL (LD50): Acute: 15900 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant). Hazardous in case of skin contact (irritant). Slightly hazardous in case of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
Very hazardous in case of eye contact (irritant).
Hazardous in case of skin contact (irritant).
Slightly hazardous in case of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate *medical attention.*

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Combustible.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: CLOSED CUP: 77°C (170.6°F). OPEN CUP: 82.2°C (180°F) (Cleveland).

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Store away from direct sunlight. When heated to decomposition it emits acrid smoke and fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal

container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Combustible material.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. If the product is in its solid form: Use a shovel to put the material into a convenient waste disposal container. If the product is in its liquid form: Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, alkalis.

Storage:
Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 120.16 g/mole

Color: Colorless to light yellow.

pH (1% soln/water): 7 [Neutral.]

Boiling Point: 201.7°C (395.1°F)

Melting Point: 19.7°C (67.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.03 (Water = 1)

Vapor Pressure: 0.1 kPa (@ 20°C)

Vapor Density: 4.1 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:
Soluble in methanol, diethyl ether.
Partially soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:
Acute oral toxicity (LD50): 740 mg/kg [Mouse].
Acute dermal toxicity (LD50): 15900 mg/kg [Rabbit].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant).
Slightly hazardous in case of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: 0900 Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans:
Material is irritating to mucous membranes and upper respiratory tract. Narcotic in high concentrations.
Hypnotic.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 3: Combustible liquid

Identification: : FLAMMABLE LIQUIDS, N.O.S. UNNA: UN1993 PG: Not available.

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Acetophenone
Massachusetts RTK: Acetophenone
TSCA 8(b) inventory: Acetophenone
SARA 313 toxic chemical notification and release reporting: Acetophenone
CERCLA: Hazardous substances.: Acetophenone

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R22- Harmful if swallowed.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 2

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

Other Special Considerations: Not available.

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AIR PRODUCTS

Material Safety Data Sheet

Version 1.14
Revision Date 11/22/2004

MSDS Number 300000005198
Print Date 11/27/2005

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Arsenic
Chemical formula	:	As
Synonyms	:	Metallic Arsenic, Arsenic Black
Product Use Description	:	Semiconductor Processing
Company	:	Air Products and Chemicals,Inc 7201 Hamilton Blvd. Allentown, PA 18195-1501
Telephone	:	1-800-345-3148 Chemicals 1-800-752-1597 Gases and Electronic Chemicals
Emergency telephone number	:	800-523-9374 USA 01-610-481-7711 International

2. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Concentration (Weight)
Arsenic	7440-38-2	100 %

Concentration is nominal. For the exact product composition, please refer to Air Products technical specifications. Contains no other components or impurities which will influence the classification of the product.

3. HAZARDS IDENTIFICATION

Emergency Overview

Components of the product may affect the nervous system.
Known human carcinogen.
Moderate skin irritant.
Irritating to eyes.
Toxic if swallowed.

Potential Health Effects

Inhalation	:	May cause central nervous system effects, such as headache, nausea, dizziness, confusion, breathing difficulties. Severe cases of overexposure can result in respiratory failure.
Eye contact	:	Contact with eyes may cause irritation. Inflammation of the eye and photophobia can develop.
Skin contact	:	If absorbed through the skin, may cause central nervous system effects, such as headache, nausea, dizziness, confusion, breathing difficulties. Causes skin irritation.

Ingestion	:	May cause central nervous system effects, such as headache, nausea, vomiting, abdominal pain, dizziness, confusion, breathing difficulties. Severe cases of overexposure can result in respiratory failure. May be fatal if swallowed. Toxic if swallowed. Garlic-like odor of breath and feces may be noted.
Chronic Health Hazard	:	This product contains listed carcinogen(s) according to IARC, ACGIH, NTP and/or OSHA in concentrations of 0.1 percent or greater. Muscular dysfunction. Chronic poisoning may result in weight loss, muscular weakness, tremors, fever, bronzing of the skin and horizontal white lines on fingernails and toenails. Known human carcinogen.

Exposure Guidelines

Target Organs	:	Skin. Eyes. Respiratory system. Kidney. Liver. Blood. Central nervous system. Lymphatic system. Mucous membranes. Peripheral nervous system.
Symptoms	:	Breathing difficulties. Headache. Nausea. Tingling. Cough. Fatality. Fever. Weakness. Diarrhea. Vomiting. Chest pain. Metallic taste in mouth. Skin abnormalities.

Aggravated Medical Condition

Blood chemistry changes (such as methemoglobinemia leading to cyanosis or loss of consciousness). Nervous system disorders (such as narcosis, behavioral changes or decrease in motor function). Liver disorders (such as jaundice or liver enlargement). Kidney disorders (such as edema, or proteinuria). Skin disorders and Allergies. Adverse skin effects (such as rash, irritation or corrosion). Adverse eye effects (such as conjunctivitis or corneal damage). Eye disease

4. FIRST AID MEASURES

General advice	:	Seek medical advice. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately.
Eye contact	:	Rinse immediately with plenty of water also under the eyelids for at least 20 minutes. Remove contact lenses.
Skin contact	:	Wash off immediately with plenty of water for at least 20 minutes. Immediately remove contaminated clothing, and any extraneous chemical, if possible to do so without delay.
Ingestion	:	Immediately give large quantities of water to drink. Induce vomiting if person is conscious. Prevent aspiration of vomit. Turn victim's head to the side.

Inhalation	:	Move to fresh air.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	Alcohol-resistant foam. Carbon dioxide (CO2). Dry chemical. Dry sand. Limestone powder.
Specific hazards	:	Burning produces obnoxious and toxic fumes. A moderate fire hazard exists if crystalline material is exposed to heat or strong oxidizers. A slight explosion hazard exists when dust is exposed to flame.
Special protective equipment for fire-fighters	:	Use personal protective equipment. Wear self contained breathing apparatus for fire fighting if necessary.
Further information	:	Do not allow run-off from fire fighting to enter drains or water courses.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Use self-contained breathing apparatus and chemically protective clothing. Evacuate personnel to safe areas.
Methods for cleaning up	:	Approach suspected leak areas with caution. Contact Air Products' Emergency Response Center for advice. Place in appropriate chemical waste container.
Additional advice	:	Place arsenic and all arsenic-contaminated material in an appropriate chemical waste container. If possible, stop flow of product.

7. HANDLING AND STORAGE

Handling

Do not breathe vapors/dust. Avoid contact with eyes. Use personal protective equipment. When using, do not eat, drink or smoke.

Storage

Keep containers tightly closed in a dry, cool and well-ventilated place.

Storage temperature	:	32 - 104 °F (0 - 40 °C)

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Provide readily accessible eye wash stations and safety showers.
Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.

Personal protective equipment

Respiratory protection	:	Use a NIOSH/MSHA-approved full-face respirator with a high efficiency particulate air (HEPA) filter when exposure is possible.
Hand protection	:	Impervious gloves. Latex gloves (ketone resistant) The breakthrough time of the selected glove(s) must be greater than the intended use period.
Eye protection	:	Chemical resistant goggles must be worn.
Skin and body protection	:	Long sleeve shirts and trousers without cuffs.

Exposure limit(s)

Arsenic	Time Weighted Average (TWA): ACGIH	-	0.01 mg/m3
Arsenic	Ceiling Limit Value and Time Period (if specified): NIOSH	-	0.002 mg/m3
Arsenic	Time Weighted Average (TWA): OSHA	-	0.01 mg/m3
Arsenic	OSHA Action level: OSHA	-	0.005 mg/m3
Arsenic	PEL: OSHA Z1	-	5 mg/m3
Arsenic	PEL: OSHA Z1	-	15 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

Form	:	Solid.
Color	:	Black.
Odor	:	Garlic-like.
Molecular Weight	:	74.92 g/mol
Relative density	:	5.7327 (water = 1)
Vapor pressure	:	1.33 hPa
Melting point/range	:	1.503 °F (817 °C)
Sublimation point	:	1.135 °F (613 °C)
Water solubility	:	Insoluble.

10. STABILITY AND REACTIVITY

Stability	:	Stable under normal conditions.
Conditions to avoid	:	Heat. Dusting.

Materials to avoid	: Oxidizing agents. Acids. Potassium. Peroxides. Hydrogen. Lithium. Alkali earth metal halogens. Alkaline earth metal halogens. Bromates. Chlorine Fluorine
Hazardous decomposition products	: Arsenic trioxide.

11. TOXICOLOGICAL INFORMATION

Acute Health Hazard

Ingestion	: LD50 : 145 mg/kg Species : Mouse. Acute arsenic ingestion usually produces symptoms within 30 minutes but may be delayed several hours if ingested with food. Dehydration, vomiting and diarrhea are common.
Inhalation	: No data is available on the product itself.
Skin.	: No data is available on the product itself.
Eye irritation/corrosion	: Eye irritation.
Acute dermal irritation/corrosion	: Skin irritation.
Sensitization	: May cause sensitization by skin contact.

Chronic Health Hazard

Arsenic is primarily absorbed through ingestion but may be absorbed through skin exposure or inhalation. Chronic Effects: Leukemia, reduced number of blood cells and platelets, aplastic anemia, bone marrow depression, intolerance to light, loss of appetite, fever, tremors and muscular weakness. Local keratosis precedes skin cancer. Special risk groups: Children and persons with diabetes or diseases of the skin, blood, liver, kidney, heart or CNS.

Carcinogenicity

Arsenic	IARC	: 1 - Human carcinogen.
	ACGIH	: Group A1 - Confirmed human carcinogen.
	NTP CARC	: Known carcinogen.
	OSHA	: Cancer hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity	:	No data is available on the product itself.
Toxicity to other organisms	:	No data available.

Persistence and degradability

Mobility	:	Atmospheric conditions are low, ranging from 0.0 to 0.1 mg/m3 in the rural U.S.
Bioaccumulation	:	No data is available on the product itself.

Further information

Arsenic as a free element (0. oxidation state) is rarely encountered in natural waters. Soluble inorganic arsenate (+5. oxidation state) is predominately found under normal conditions.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products	:	Possible fire hazards include arsenic dust and exposure to strong oxidants. Contact supplier if guidance is required.
Contaminated packaging	:	Dispose of container and unused contents in accordance with federal, state, and local requirements.

14. TRANSPORT INFORMATION

CFR

Proper shipping name	:	Arsenic
Class	:	6.1
UN/ID No.	:	UN1558
Packing group	:	II

IATA

Proper shipping name	:	Arsenic
Class	:	6.1
UN/ID No.	:	UN1558
Packing group	:	II

IMDG

Proper shipping name	:	ARSENIC
Class	:	6.1
UN/ID No.	:	UN1558
Packing group	:	II

CTC

Proper shipping name	:	ARSENIC
Class	:	6.1
UN/ID No.	:	UN1558
Packing group	:	II

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard (29 CFR 1910.1200) Hazard Class(es)
Toxic Irritant. Sensitizer. Carcinogen.

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on EINECS inventory or polymer substance, monomers included on EINECS inventory or no longer polymer.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Not on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification:
Acute Health Hazard Chronic Health Hazard

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)
WARNING! This product contains a chemical known in the State of California to cause cancer.
Arsenic

16. OTHER INFORMATION

NFPA Rating

Health : 3
Fire : 1
Instability : 1

HMIS Rating

Health : 4*
Flammability : 1
Physical hazard : 1

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

For additional information, please visit our Product Stewardship web site at
http//www.airproducts.com/productstewardship/

MATERIAL SAFETY DATA SHEET

MSDS Number
P-005N

AccuStandard
125 Market Street • New Haven, CT USA 06513
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number
203-786-5290
Mon. to Fri. 8am-5pm EDT

Product Number : P-005N

Product Name : Atrazine

Synonyms : Atred, Aatrex

Formula : C8H14ClN5 **Molecular Weight :** 215.72

Section 2 - Composition / Information on Ingredients

Component(s) (1)	CAS #	Appr. %	ACGIH TLV TWA mg/m3	ACGIH TLV SKIN	OSHA PEL TWA mg/m3	OSHA PEL SKIN
Atrazine	1912-24-9	100%	5		5	

Section 3 - Hazards Identification

Symptoms of Exposure:

May be harmful if inhaled, swallowed, or absorbed through the skin.

Causes severe eye irritation.

CAUSES SKIN IRRITATION.

Potential Health Effects:

No applicable information found.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

Proven animal carcinogenic substance. Possible Cancer Hazard.

Section 4 - First Aid Measures

First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

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Remove contaminated clothing and wash before reuse.

Section 5 - Fire Fighting Measures

Fire fighting measures for the Compound

Flammable Properties:

Flash Point (°F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A

Thermal decomposition produces toxic fumes.

Extinguishing Media:

Use water spray, dry chemical, CO2, or "alcohol" foam.

Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

Section 6 - Accidental Release Measures

Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

Section 7 - Handling and Storage

Keep container closed.
Store in a cool area away from ignition sources and oxidizers.
Do not breathe vapor.
Do not get in eyes, on skin, or on clothing.

Section 8 - Exposure Controls / Personal Protection

Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

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Protective gloves must be worn to prevent skin contact.

(Butyl Rubber, Viton or equivalent)

Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

Section 9 - Physical and Chemical Properties

Physical and chemical properties for the Compound

Appearance: White powder
Boiling Point: N/A
Melting Point: 175-177C
Specific Gravity (Water = 1): N/A
Vapor Pressure: N/A
Vapor Density (Air = 1): N/A
Percent Volatile (by volume): N/A
Evaporation Rate (Butyl acetate = 1): N/A
Flash Point: N/A
Explosion Limits (%): N/A to N/A
Solubility in water (%): Slightly

Section 10 - Stability and Reactivity

Stability and reactivity for the Compound

Stability: Stable
Materials to Avoid: Oxidizers

Hazardous Decomposition: Oxides of carbon and nitrogen. Hydrogen chloride
Hazardous Polymerization: Does not occur
Conditions to Avoid: None indicated

Section 11 - Toxicological Information

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See section 3 for specific toxicological information for the ingredients of this product.

Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

Section 14 - Transport Information

DOT Shipping Class: 6.1 Packing Group: III UN Number: UN2588

Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

None.

Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

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*** End of document ***

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Material Safety Data Sheet

1. MATERIAL AND COMPANY IDENTIFICATION

Material Name : **Benzene**
Uses : Raw material for use in the chemical industry.
Product Code : Q9121, Q9112, Q9169

Manufacturer/Supplier : **Shell Chemicals Americas Inc.**
PO Box 670 STN M
CALGARY AB T2P 2J3
Canada

Telephone : 1-888-791-4314
Fax : 1-403-691-3555

Emergency Telephone Number
CHEMTREC (24 hr) : 1-800-424-9300
Canutec (24 hr) : 1-613-996-6666

Material Formal Name : Benzene

2. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Benzol
Cyclohexatriene
CAS No. : 71-43-2

WHMIS Controlled Ingredients

Chemical Name	CAS No.	Conc. W/W
Benzene	71-43-2	100.00 %

Refer to Chapter 8 for Occupational Exposure Guidelines.

3. HAZARDS IDENTIFICATION

WHMIS Class/Description : Class B2 Flammable Liquid
Class D2A Other Toxic Effects - Carcinogen
Class D2B Other Toxic Effects - Mutagen/Chronic/Irritant (Skin and Eye)

Routes of Exposure : Inhalation is the primary route of exposure although exposure may occur through skin and eye contact, or following accidental ingestion.

Health Hazards : Slightly irritating to respiratory system. Vapours may cause drowsiness and dizziness. Irritating to skin. Irritating to eyes. Harmful: may cause lung damage if swallowed. Possibility of organ or organ system damage from prolonged exposure; see Chapter 11 for details. Target organ(s): Blood. Blood-forming

organs. Immune system. May cause cancer. May cause leukaemia (AML - acute myelogenous leukaemia). May cause heritable genetic damage.

Signs and Symptoms : Eye irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision. Skin irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blisters. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death. Damage to blood-forming organs may be evidenced by: a) fatigue and anaemia (RBC), b) decreased resistance to infection, and/or excessive bruising and bleeding (platelet effect).

Aggravated Medical Condition : Pre-existing medical conditions of the following organ(s) or organ system(s) may be aggravated by exposure to this material: Blood. Blood-forming organs. Cardiovascular system. Immune system. Eyes. Skin.

Safety Hazards : Highly flammable. In use, may form flammable/explosive vapour-air mixture. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire.

4. FIRST AID MEASURES

General Information : Keep victim calm. Obtain medical treatment immediately.

Inhalation : DO NOT DELAY. Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.

Skin Contact : Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.

Eye Contact : Immediately flush eyes with large amounts of water for at least 15 minutes while holding eyelids open. Transport to the nearest medical facility for additional treatment.

Ingestion : If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.

Advice to Physician : Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Potential for cardiac sensitisation, particularly in abuse situations. Hypoxia or negative inotropes may enhance these effects. Consider: oxygen therapy.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point	:	-11 °C / 12 °F (Abel)
Explosion / Flammability limits in air	:	1.4 - 7.1 %(V)
Auto ignition temperature	:	562 °C / 1,044 °F
Hazardous Combustion Products and Specific Hazards	:	The vapour is heavier than air, spreads along the ground and distant ignition is possible. Will float and can be reignited on surface water. Carbon monoxide may be evolved if incomplete combustion occurs.
Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use water in a jet.
Protective Equipment for Firefighters	:	Wear full protective clothing and self-contained breathing apparatus.
Additional Advice	:	Keep adjacent containers cool by spraying with water.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. Immediately remove all contaminated clothing. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. For guidance on disposal of spilled material see Chapter 13 of this Material Safety Data Sheet. Observe all relevant local and international regulations.

Protective Measures	:	Isolate hazard area and deny entry to unnecessary or unprotected personnel. Stay upwind and keep out of low areas. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment (of product and fire fighting water) to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all *equipment*. Ventilate contaminated area thoroughly.
Clean Up Methods	:	For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely.
Additional Advice	:	Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Vapour may form an explosive mixture with air.

7. HANDLING AND STORAGE

General Precautions : Avoid breathing of or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.

Handling : Avoid inhaling vapour and/or mists. Avoid contact with skin, eyes, and clothing. Avoid exposure. Obtain special instructions before use. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.

Storage : Vapours from tanks should not be released to atmosphere. Breathing losses during storage should be controlled by a suitable vapour treatment system. Bulk storage tanks should be diked (bunded). The vapour is heavier than air. Beware of accumulation in pits and confined spaces.

Product Transfer : Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.

Recommended Materials : For containers, or container linings use mild steel, stainless steel.

Unsuitable Materials : Natural, butyl, neoprene or nitrile rubbers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Benzene	ACGIH	TWA	0.5 ppm		
	ACGIH	STEL	2.5 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.

Consult local authorities for acceptable exposure limits within their jurisdiction.

Additional Information : Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.

Exposure Controls	:	The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate ventilation to control airborne concentrations below the exposure guidelines/limits. Adequate explosion-proof ventilation to control airborne concentrations. Firewater monitors and deluge systems are recommended. Eye washes and showers for emergency use.
Personal Protective Equipment	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers. The following information, while appropriate for the product is general in nature. The selection of Personal Protective Equipment will vary depending on the conditions of use.
Respiratory Protection	:	If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for organic gases and vapours [boiling point >65 °C (149 °F)] meeting EN141. Where respiratory protective equipment is required, use a full-face mask. Where air-filtering respirators are unsuitable (e.g., airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus.
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: Longer term protection: Viton. Incidental contact/Splash protection: Nitrile rubber. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced.
Eye Protection	:	Chemical splash goggles (chemical monogoggles).
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron. Where risk of splashing or in spillage clean up, use chemical resistant one-piece overall with integral hood.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Examples of sources of recommended air monitoring methods are given below or contact supplier. Further national methods may be available. National Institute of Occupational Safety and Health (NIOSH), USA: Manual of analytical Methods http://www.cdc.gov/niosh/nmam/nmammenu.html Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha-slc.gov/dts/sltc/methods/toc.html Health and Safety Executive (HSE), UK: Methods for the Determination of Hazardous

		Substances http://www.hsl.gov.uk/search.htm
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Colourless. Liquid.
Odour	:	Aromatic.
Odour threshold	:	2.7 ppm
pH	:	Not applicable.
Boiling point	:	80.1 °C / 176.2 °F
Freezing Point	:	5.6 °C / 42.1 °F
Vapour pressure	:	10 kPa at 20 °C / 68 °F
Specific gravity	:	0.8787 at 20 °C / 68 °F
Density	:	885 kg/m3 at 15 °C / 59 °F
Water solubility	:	0.1 g/l Negligible. 1.8 kg/m3 at 25 °C / 77 °F
n-octanol/water partition coefficient (log Pow)	:	1.95 - 2.13
Kinematic viscosity	:	0.65 mm2/s at 20 °C / 68 °F
Vapour density (air=1)	:	2.7 at 15 °C / 59 °F
Electrical conductivity	:	< 50 pS/m at 20 °C / 68 °F
Saturated Vapour concentration (in air)	:	99000 PPM_M at 20 °C / 68 °F
Evaporation rate (nBuAc=1)	:	2.8
Surface tension	:	0.03 N/m
Molecular weight	:	78 g/mol

10. STABILITY AND REACTIVITY

Stability	:	Stable under normal conditions of use. Reacts violently with strong oxidising agents.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources. Prevent vapour accumulation.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Hazardous Polymerisation	:	No
Sensitivity to Mechanical Impact	:	No
Sensitivity to Static Discharge	:	Yes

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on product testing.
Routes of Exposure	:	Inhalation is the primary route of exposure although exposure may occur through skin and eye contact, or following

accidental ingestion.

Routes of Exposure	Material	Values
Oral	Benzene	LD 50: 3,400 mg/kg, Rat
Dermal	Benzene	LD 50: > 8,260 mg/kg, Rabbit
Inhalation	Benzene	LC50: 70000 ppm / 1 hours, Rat

Acute Oral Toxicity : Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.

Acute Inhalation Toxicity : High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.

Skin Irritation : Irritating to skin.

Eye Irritation : Irritating to eyes.

Respiratory Irritation : Inhalation of vapours or mists may cause irritation to the respiratory system.

Sensitisation : Not expected to be a skin sensitiser.

Repeated Dose Toxicity : Blood-forming organs: repeated exposure affects the bone marrow.
Blood: may cause haemolysis of red blood cells and/or anaemia.
Immune System: animal studies on this material or its components have demonstrated immunotoxicity.

Mutagenicity : May cause heritable genetic damage.

Carcinogenicity : Known human carcinogen. May cause leukaemia (AML - acute myelogenous leukaemia).

Material	:	Carcinogenicity Classification
Benzene	:	ACGIH Group A1: Confirmed human carcinogen.
Benzene	:	IARC 1: Human carcinogen.

Reproductive and Developmental Toxicity : Causes foetotoxicity in animals at doses which are maternally toxic.
Does not impair fertility.

Additional Information : Myelodysplastic syndrome (MDS) was observed in individuals exposed to very high levels (50 ppm to 300 ppm range) of benzene over a long period of time in the workplace. The relevance of these results to lower levels of exposure is not known.
Exposure to very high concentrations of similar materials has been associated with irregular heart rhythms and cardiac arrest.

12. ECOLOGICAL INFORMATION

Acute Toxicity

Fish : Toxic: 1 < LC/EC/IC50 <= 10 mg/l

Aquatic Invertebrates : Harmful: 10 < LC/EC/IC50 <= 100 mg/l

Algae : Harmful: 10 < LC/EC/IC50 <= 100 mg/l

Microorganisms : Harmful: 10 < LC/EC/IC50 <= 100 mg/l

Mobility	:	Floats on water.
Persistence/degradability	:	Readily biodegradable meeting the 10 day window criterion.
Bioaccumulation	:	Does not bioaccumulate significantly.
Other Adverse Effects	:	In view of the high rate of loss from solution, the product is unlikely to pose a significant hazard to aquatic life.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations.
Local Legislation	:	Disposal should be in accordance with applicable regional, *national, and local laws and regulations.*

14. TRANSPORT INFORMATION

Canadian Road and Rail Shipping Classification

UN/NA Number	UN 1114
Proper shipping name	BENZENE
Class Division	3
Packing group	II
Shipping Description	BENZENE, Class 3, UN 1114, PG II
Emergency Response Guide No	130

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply *to this material.*

WHMIS Class/Description : Class B2 Flammable Liquid
Class D2A Other Toxic Effects - Carcinogen
Class D2B Other Toxic Effects - Mutagen/Chronic/Irritant (Skin and Eye)

Inventory Status

AICS	:	Listed.	
DSL	:	Listed.	
INV (CN)	:	Listed.	
ENCS (JP)	:	Listed.	(3)-1
TSCA	:	Listed.	
EINECS	:	Listed.	200-753-7
KECI (KR)	:	Listed.	97-1-99
KECI (KR)	:	Listed.	KE-02150
PICCS (PH)	:	Listed.	

16. OTHER INFORMATION

MSDS Version Number	:	3.
MSDS Effective Date	:	12-15-2005
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	The content and format of this (M)SDS is in accordance with the Controlled Product Regulations.
MSDS Prepared By	:	Product Stewardship; Shell Chemicals Americas Inc.; 1-888-791-4314
Uses and Restrictions	:	Raw material for use in the chemical industry.
MSDS Distribution	:	The information in this document should be made available to all who may handle the product
Disclaimer	:	*The information contained herein is based on our current* knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

MSDS Number: **E6500** * * * * * *Effective Date: 07/06/06* * * * * *Supercedes: 01/15/04*

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

DIOCTYLPHTHALATE

1. Product Identification

Synonyms: Di-(2-ethylhexyl)phthalate; DEHP; bis(2-ethylhexyl)phthalate; DOP; 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl)ester; Di-sec-octyl phthalate
CAS No.: 117-81-7
Molecular Weight: 390.56
Chemical Formula: C24H38O4
Product Codes: H187

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Di-sec-octyl Phthalate	117-81-7	100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL NERVOUS SYSTEM, LIVER, REPRODUCTIVE SYSTEM, AND GASTROINTESTINAL TRACT. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure. MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate (Cancer)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:
The low vapor pressure of this material essentially eliminates inhalation hazards unless the material is heated or misted. Inhalation of mists can cause nausea and is irritating to the respiratory tract.
Ingestion:
Ingestion causes nausea, abdominal cramps, diarrhea. CNS depression - lethargy, drowsiness, staggering and sleepiness - can result from absorbing large amounts.
Skin Contact:
Slight skin irritation may occur from prolonged skin contact. Low levels may be absorbed through the skin.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
Material is a suspected carcinogen and a suspected teratogen.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Do NOT induce vomiting. Give large amounts of water. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flash point: 215C (419F) OC
Autoignition temperature: 390C (734F)
Flammable limits in air % by volume:
lel: 0.3

Slight fire hazard.
Explosion:
Above the flash point, explosive vapor-air mixtures may be formed.
Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
5 mg/m3 (TWA).
- ACGIH Threshold Limit Value (TLV):
5 mg/m3 (TWA); A3 - animal carcinogen.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece particulate respirator (with NIOSH type P100 or R100 filters) may be worn for up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. Please note that N series filters are not recommended for this material. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient

atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear oily liquid.

Odor:
Slightly amine to odorless.

Solubility:
Insoluble in water.

Specific Gravity:
0.9861 @ 20C/20C

pH:
No information found.

% Volatiles by volume @ 21C (70F):
No information found.

Boiling Point:
230C (446F)

Melting Point:
-50C (-58F)

Vapor Density (Air=1):
16

Vapor Pressure (mm Hg):
1.32 @ 200C (392F)

Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Nitrates, strong oxidizers, acids and alkalis.

Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 30 g/kg; Skin rabbit LD50: 25 g/kg. Irritation Data (rabbit, std Draize, 500mg/24H): Skin, mild; Eye, mild. Investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Di-sec-octyl Phthalate (117-81-7)	No	Yes	3

12. Ecological Information

Environmental Fate:
When released into water, this material may biodegrade to a moderate extent. This material may bioaccumulate to some extent. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.
Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Di-sec-octyl Phthalate (117-81-7)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Di-sec-octyl Phthalate (117-81-7)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Di-sec-octyl Phthalate (117-81-7)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Di-sec-octyl Phthalate (117-81-7)	100	U028	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: None allocated.
Poison Schedule: *None allocated.*
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 1 Flammability: 1 Reactivity: 0
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL NERVOUS SYSTEM, LIVER, REPRODUCTIVE SYSTEM, AND GASTROINTESTINAL TRACT. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure. MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3.
Disclaimer:
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Scott Specialty Gases

Material Safety Data Sheets

MSDS No: 75-27-4
Date: 03/09/2001

SUPPLIER ADDRESS: 6141 Easton Road, Bldg. 1
PO Box 310
Plumsteadville, PA 18949-0310

EMERGENCY PHONE NUMBER: (215) 766-8861

1. CHEMICAL PRODUCT

PRODUCT NAME: BROMODICHLOROMETHANE

SYNONYMS: Methane-bromodichloro, BDCM, Monobromodicloromethane.

2. COMPOSITION, INFORMATION ON INGREDIENTS

				Exposure Limits (PPM)			
Ingredient Name	Formula	CAS #	Concentration	ACGIH TLV	OSHA PEL	MAC	Other STEL
BROMODICHLOROMETHANE	CHBRCL2	75-27-4	99+%	NE	NE	NE	NE

Note: NE = NONE ESTABLISHED S/A = SIMPLE ASPHYXIANT

3. HAZARD INDENTIFICATION

* * * EMERGENCY OVERVIEW * * *
Nonflammable liquid and vapor.
May cause irritation to eyes, skin, and mucous membranes.
May cause respiratory tract and central nervous system depression.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation , Skin

ACUTE EFFECTS: Inhalation can cause irritation to the eyes, mucous membranes, and respiratory tract. Can be absorbed through the skin. This material is narcotic in high concentrations. Prolonged exposure can cause nausea, dizziness and headaches. Acts as a central nervous system depressant.

CHRONIC EFFECTS: None known Suspected human carcinogen.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known

OTHER EFFECTS OF OVEREXPORSURE: None

CARCINOGENICITY (US ONLY):

NTP - Yes
IARC MONOGRAPHS - Yes
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration.

EYE CONTACT: Do not allow victim to rub or keep eyes tightly shut. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.

SKIN CONTACT: Immediately remove contaminated clothing. Rinse the affected area with flooding amounts of water and then wash it with soap and water.

INGESTION: Never give anything by mouth to an unconscious 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 to dilute.

IN EVENT OF EXPOSURE, CONSULT A PHYSICIAN

NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: Nonflammable

AUTOIGNITION TEMPERATURE: N/Ap

FLAMMABLE LIMITS: Nonflammable

LOWER:
UPPER:

EXTINGUISHING MEDIA: Use what is appropriate for surrounding fire.

SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray.

HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide, chlorine, phosgene, and bromine gases.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Emits toxic fumes under fire conditions.

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Absorb with sand or vermiculite and place in closed containers for disposal.

SPECIALIZED EQUIPMENT: None

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store in well ventilated areas. Keep valve protection cap on cylinders when not in use.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation.

EYE / FACE PROTECTION: Goggles. A safety shower and eyewash station should be readily available.

SKIN PROTECTION: Protective gloves. Wear suitable protective clothing.

RESPIRATORY PROTECTION: Use a self-contained breathing apparatus in case of emergency or non-routine use.

OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless

ODOR: Unknown.

PHYSICAL PRESSURE: Liquid

VAPOR PRESSURE: @20 deg. C: 50 mmHg

VAPOR DENSITY (AIR=1): N/Av

BOILING POINT (C): 90.6

SOLUBILITY IN WATER: 4,500 mg/L

SPECIFIC GRAVITY (H2O=1): @20 deg. C: 1.980

EVAPORATION RATE: N/Av

ODOR THRESHOLD: 1680 mg/m3

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.

CONDITIONS TO AVOID: Storage near a heat source.

MATERIALS TO AVOID: Bases. Oxidizing agents. Magnesium.

HAZARDOUS POLYMERIZATION: Will not occur.

HAZARDOUS DECOMPOSITION: Fumes of carbon monoxide, hydrogen chloride gas and hydrogen bromide gas.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): NONE ESTABLISHED

LETHAL DOSE 50 (LD50): N/Ap

TERATOGENICITY: N/Ap

REPRODUCTIVE EFFECTS: N/Ap

MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Return cylinders to supplier with any valve outlet plugs or caps secured and valve protection cap in place. Follow federal, state and local regulations. Non-returnable cylinders must not be refilled. Dispose of non-refillable cylinders in accordance with federal, state, and local regulations.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%

DOT DESCRIPTION (US ONLY):

PROPER SHIPPING NAME: Environmentally hazardous substances, liquid, n.o.s.
HAZARD CLASS: 9, Packing group III.
INDENTIFICATION NUMBER: UN3082
REPORTABLE QUANTITIES: None
LABELING: CLASS 9

ADR / RID (EU Only): N/Av

SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.

TSCA: Material is listed in TSCA inventory.

SARA: The threshold planning quantity for material is 10,000 lbs.

EU NUMBER: 200-856-7

NUMBER IN ANNEX 1 OF DIR 67/548: Not listed in annex 1.

EU CLASSIFICATION: N/Av

R: 45,46,20/21/22,36/37/38

S: 45,26,28,27,36/37/39

16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS: N/Ap - Not Applicable N/Av - Not Available SA - Simple Asphyxiant NE - None Established

DISCLAIMER: Information included in this document is given to the best of our knowledge, however, no warranty is made that the information is accurate or complete. We do not accept any responsibility for damages by the use of the document.

MATERIAL SAFETY DATA SHEET

ALDON CORPORATION
221 Rochester Street
Avon, New York 14414-9409
(585) 226-6177

MSDS No: BB0203
Effective Date: May 19, 2005

SECTION I NAME

24 HOUR EMERGENCY ASSISTANCE

Product	Bromoform
Chemical Synonyms	Tribromethane
Formula	$CHBr_3$
Unit Size	up to 20 Lt.
C.A.S. No.	75-25-2

CHEMTREC 800-424-9300
Day 585-226-6177

NFPA

Health	3
Fire	0
Reactivity	1

HMIS *

HAZARD RATING

MINIMAL	SLIGHT	MODERATE	SERIOUS	SEVERE
0	1	2	3	4

SECTION II INGREDIENTS OF MIXTURES

Principal Component(s)	%	TLV Units
Bromoform: (CAS No. 75-25-2)	96%	TWA: 0.5 ppm, 5 mg/m^3
Ethyl alcohol: (CAS No. 64-17-5)	4%	TWA: 1000 ppm, 1900mg/m^3
WARNING! LACHRYMATOR. TOXIC. HARMFUL IF		
SWALLOWED, INHALED OR ABSORBED THROUGH SKIN.		

SECTION III PHYSICAL DATA

Melting Point (°F)	8°C (46°F)	Specific Gravity (H_2O = 1)	2.889 @ 20°/4°C
Boiling Point (°F)	150°C (302°F)	Percent Volatile by Volume (%)	100%
Vapor Pressure (mm Hg)	4.4 mm Hg @ 20°C	Evaporation Rate (Ether =1)	N/A
Vapor Density (Air=1)	8.7		
Solubility in Water	0.1%		
Appearance & Odor	Colorless to yellow liquid; chloroform-like odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	Non-combustible.	Flammable Limits in Air % by Volume N/A	Lower	Upper
Extinguisher Media	Use dry chemical, carbon dioxide, water spray, fog, regular foam.			

SPECIAL FIREFIGHTING PROCEDURES

In fire conditions, wear a NIOSH/MSHA-approved, self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.

(1996 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.7, GUIDE PAGE NO. 159)

UNUSUAL FIRE AND EXPLOSION HAZARDS

When heated to decomposition may release irritating vapors. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated.

D.O.T. Bromoform, 6.1, UN2515, PG III

Approved by U.S. Department of Labor "essentially similar" to form OSHA-20

SECTION V HEALTH HAZARD DATA BB0203

Threshold Limited Value

ACGIH (2001): TWA 0.5 ppm, 5 mg/m^3

Effects of Overexposure

INGESTION/INHALATION: Prolonged exposure to high vapor concentrations or repeated exposures to low vapor concentrations causes CNS depression and may result in liver or kidney injury and possibly cardiac sensitization. May cause headache, nausea, vomiting, dizziness, drowsiness, irritation of respiratory tract, and loss of consciousness. EYES: Contact with eyes causes irritation, conjunctivitis and may be painful. SKIN: Prolonged or repeated contact causes defatting and cracking of the skin. Target organs: Kidneys, central nervous system, liver.

Emergency and First Aid Procedures

INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person. EYES: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention. SKIN: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention. INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

SECTION VI REACTIVITY DATA

Stability		Conditions to Avoid
Unstable		Open flame and excessive temperature.
Stable	X	

Incompatibility (Materials to Avoid) Oxidizers, bases, metals and acids.

Hazardous Decomposition Products Thermal decomposition may include toxic and corrosive fumes of bromides and oxides of carbon.

Hazardous Polymerization		Conditions to Avoid
May Occur	Will Not Occur	Not applicable.
	X	

SECTION VII SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled

Provide adequate ventilation. Wear suitable protective clothing, absorb spilled material on vermiculite, sand, ground. Place in a suitable chemical waste container. Wash spill area well with soap and water.

Waste Disposal Method

Discharge, treatment, or disposal may be subject to Federal, State or Local laws. These disposal guidelines are intended for the disposal of catalog-size quantities only.

Dispose of in accordance with Federal, state and local regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

Respiration Protection (Specify Type) Work in fume hood. If needed wear a NIOSH/MSHA-approved respirator.

Ventilation				
	Local Exhaust	Recommended.	Special	No.
	Mechanical (General)	Recommended.	Other	No.

Protective Gloves	Rubber.	Eye Protection	Chemical safety goggles.

Other Protective Equipment Faceshield, lab coat and apron, vented hood, proper gloves, eye wash station.

SECTION IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling & Storing

Keep container tightly closed when not in use.

Store in a cool place, protect from light. Do not store in metal containers. Wash thoroughly after handling.

Other Precautions

Read label on container before using. Do not wear contact lenses when working with chemicals. For laboratory use only. Not for drug, food or household use. Keep out of reach of children.

Avoid breathing vapor. Use with adequate ventilation. Avoid contact with eyes, skin, clothing. Remove and wash contaminated clothing.

Revision No. 4	Date 05/19/05	Approved Michael Raszeja	Chemical Safety Coordinator MR

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. * Hazardous Materials Industrial Standards. Printed on recycled paper.

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: CARBON TETRACHLORIDE

1. Product and Company Identification

BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101

PRODUCT NAME: CARBON TETRACHLORIDE
CHEMICAL NAME: Carbon Tetrachloride
COMMON NAMES/SYNONYMS: Carbon Chloride, Carbon Tet, Halon 1040, R 10
TDG (Canada) CLASSIFICATION: 6.1 (9.2)
WHMIS CLASSIFICATION: D1A, D2A, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 11/12/03

2. Composition, Information on Ingredients

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Carbon Tetrachloride FORMULA: CCl_4 CAS: 56-23-5 RTECS #: FG4900000	100.0	10 ppm TWA 25 ppm Ceiling 200 ppm (max. 5 min. peak above C in any 4 H)	5 ppm TWA 10 ppm STEL Skin	LD_{50}: 2350 mg/kg Ingestion/rat

[1] Refer to individual state or provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 2003 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW

Colorless nonflammable poison liquid with strong ethereal odor. Inhalation of high concentrations can have a narcotic effect. Toxic if inhaled, ingested, or absorbed through the skin. Carbon tetrachloride primarily affects the liver and kidneys, but toxic effects in the lungs, and other tissues have been reported. Overexposure can increase the risks of developing cancer. Nonflammable. Decomposes into highly toxic phosgene and hydrogen chloride under fire conditions.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	Yes	Yes	Yes	Yes

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization
Yes	Yes	No
Teratogen	**Reproductive Hazard**	**Mutagen**
Yes	Yes	Yes
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: Yes IARC: Yes OSHA: No*

*Although OSHA has not promulgated a specific standard for carbon tetrachloride, carbon tetrachloride should be treated as a probable carcinogen for Hazard Communication Purposes (29 CFR 1910.1200 Appendix A (1) (a, b).

EYE EFFECTS: Contact with product may cause mild irritation.

SKIN EFFECTS: Contact with product could cause mild irritation. Prolonged contact may cause defatting of the skin and dermatitis. Can be absorbed through the skin in toxic amounts.

INGESTION EFFECTS: Ingestion effects are similar to effects from inhalation.

INHALATION EFFECTS: High concentrations of carbon tetrachloride may act as a narcotic causing headache, dizziness, drowsiness, and unconsciousness. Moderate concentrations have caused liver and kidney failure. Damage to the kidneys, liver, and lungs may follow recovery from narcotic effects. Workers that have consumed alcoholic beverages may be more susceptible to effects.

Chronic exposures may cause liver and kidney damage. Long term exposures may also increase the risk of developing liver cancer and possibly other forms of cancer.

Acute and chronic exposure may cause a variety of symptoms including nausea, anorexia, vomiting, diarrhea, jaundice, enlarged liver, renal failure, blurred vision, bleeding, dizziness, convulsions, unconsciousness, coma and death.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: May aggravate pre-existing skin, liver, CNS, and kidney conditions.

POTENTIAL ENVIRONMENTAL EFFECTS: A 96-hour LC_{50} in the blugill has been reported as 27 mg/l/. The 96-hour LC50 in the fathead minnow (*Pimephales promelas)* was reported as 41.4 mg/L.

4. First Aid Measures

EYES: Flush eyes immediately with lukewarm water for at least 15 minutes. If irritation persists, seek medical attention.

SKIN: Remove contaminated clothing and flush affected areas with water. Seek medical attention.

INGESTION: CALL LOCAL POISON CONTROL CENTER. If conscious, induce vomiting and continue until vomit is clear. A physician should see the patient promptly.

INHALATION: PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area and given artificial resuscitation and supplemental oxygen. Medical assistance should be sought immediately. Further treatment should be symptomatic and supportive.

5. Fire Fighting Measures

Conditions of Flammability: Nonflammable		
Flash point: None	Method: Not Applicable	Autoignition Temperature: None
LEL(%): None	UEL(%): None	
Hazardous combustion products: hydrochloric acid, phosgene		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

FIRE AND EXPLOSION HAZARDS: Decomposes under fire conditions into phosgene and hydrogen chloride. Container may vent rapidly or rupture violently from pressure under fire conditions.

EXTINGUISHING MEDIA: None required. Use media appropriate for surrounding materials.

FIRE FIGHTING INSTRUCTIONS: Fire fighters should use self-contained breathing apparatus and full turnout gear with additional protective clothing for toxic decomposition products as necessary to prevent exposure. Use water spray to cool containers to prevent rupture. Continue to cool containers until well after flames are extinguished.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment (See Section 8). Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. Ventilate enclosed areas. Prevent spilled material from coming in contact with heat and open flames. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Store drums and cylinders upright in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits.

Use only in areas equipped with appropriate ventilation systems. Keep container tightly closed when not in use. Protect full and empty drums from physical damage and heat. Do not weld on or near full or empty containers. Do not re-use empty containers. Empty containers contain product residue, recycle and dispose of accordingly. Segregate full and empty drums. Use a "first in-first out" inventory system to prevent product from being stored for excessive periods of time. Do not drag, slide, or roll drums. Use a suitable hand truck, drum truck or other appropriate equipment. Avoid eye contact. Prevent skin contact.

Do not eat, drink, smoke, or apply cosmetics in areas where this product is used or stored. Do not store cigarettes, food or other personal items in storage and use areas. Wash hands and face thoroughly after handling and before meals and breaks. Change contaminated clothing promptly. Segregate contaminated clothing and launder appropriately. Shower at the end of the work shift.

Do not carry this product in an enclosed space such as a car trunk, van or station wagon. A leak can result in a toxic exposure.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS: Use enclosures and local exhaust ventilation as necessary to limit exposure below the acceptable exposure limits. Exhaust vapors should be vented to a vapor treatment system.

EYE/FACE PROTECTION: Safety goggles or glasses

SKIN PROTECTION: Appropriate protective and chemical-resistant gloves, clothing and splash protection, or fully encapsulating vapor protective clothing to prevent exposure. For materials of construction, consult protective clothing manufacture's specific data. (Polyvinyl-alcohol and Viton™ are generally effective for > 8 H exposures).

RESPIRATORY PROTECTION: For emergency release and conditions with exposures above the applicable exposure limits use a positive pressure NIOSH approved air-supplying respirator systems (SCBA or airline/escape bottle) using a full-face mask and at a minimum Grade D air.

OTHER/GENERAL PROTECTION: Safety shoes, safety shower, eyewash "fountain."

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Liquid	
Vapor pressure at at 70 °F	: 98	mmHg
Vapor density (Air = 1)	: 5.5	
Evaporation point	: Not Available	
Boiling point	: 170	°F
	: 76.5	°C
Freezing point	: -9.4	°F
	: -23	°C
PH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H_20)	: Insoluble (0.08%)	
Odor threshold	: Not Available	
Odor and appearance	: Colorless liquid with strong ethereal odor.	

10. Stability and Reactivity

STABILITY: Stable.

INCOMPATIBLE MATERIALS/CONDITIONS: Reacts explosively with alkali metals and chlorine. Incompatible with zinc and aluminum. Decomposes in open flame or at high temperatures.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen chloride, phosgene.

HAZARDOUS POLYMERIZATION: Will not occur.

11. Toxicological Information

INHALATION: A 4-6 hour LC_{50} of 7300 has been reported for rats and an 8 hour LC_{50} of 9526 ppm has been reported for mice. Toxic effects in the kidney, lung, CNS, reproductive organs, skin, liver, and developing fetus have been reported following acute exposure; however, the liver is most susceptible to damage from exposure to carbon tetrachloride.

SKIN AND EYE: Contact with the skin and eyes may cause irritation. The dermal LD_{50} for carbon tetrachloride is 15,000 mg/kg for guinea pigs.

OTHER: Carbon tetrachloride is listed as a possible human carcinogen (Group 2B) by IARC and by NTP as a substance "reasonably anticipated to be carcinogenic".

Carbon tetrachloride has induced embryotoxic and embryolethal effects at maternally toixc doses. It is not considered to be a teratogen and does not appear to be genotoxic.

Degenerative changes to liver following chronic inhalation exposure in multiple animal studies with mammalian species including rats, mice, rabbits, guinea pigs, dogs and monkeys. Toxic effects to the lungs, immune system and bladder have also been reported in animal studies with mammalian species.

12. Ecological Information

Carbon tetrachloride is a Class I (Group IV) ozone depleting substance. See Section 3 for ecotoxicity information. A measured BCF of 3.2-7.4 indicates the potential for bioconcentration in aquatic organisms is low. Carbon tetrachloride is a CERCLA hazardous substance with a reportable quantity (RQ) of 10 pounds.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Carbon Tetrachloride	Carbon Tetrachloride
HAZARD CLASS:	6.1	6.1 (9.2)
IDENTIFICATION NUMBER:	UN 1846	UN 1846
SHIPPING LABEL:	POISON	POISON

PG: II

Additional Marking Requirement: If net weight of product ≥ 10 pounds, the container must be also marked with the letters "RQ".

Additional Shipping Paper Description Requirement: If net weight of product ≥ 10 pounds, the shipping papers must be also marked with the letters "RQ".

15. Regulatory Information

SARA TITLE III NOTIFICATIONS AND INFORMATION
SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Chronic Health Hazard

SARA TITLE III - SECTION 313 SUPPLIER NOTIFICATION:
This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

CAS NUMBER	INGREDIENT NAME	PERCENT BY VOLUME
56-23-5	CARBON TETRACHLORIDE	100.0

This information must be included on all MSDSs that are copied and distributed for this material.

U.S. TSCA/Canadian DSL: All ingredients are listed on the U.S. Toxic Substances Control Act (TSCA) inventory or exempt from listing and on the Canadian Domestic Substance List (DSL).

California Proposition 65: This product contains ingredient(s) known to the State of California to cause cancer or reproductive toxicity.

Canadian Controlled Products Regulations (CPR): This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

16. Other Information

NFPA HAZARD CODES	HMIS HAZARD CODES	RATINGS SYSTEM
Health: 3	Health: 3	0 = No Hazard
Flammability: 0	Flammability: 0	1 = Slight Hazard
Instability: 0	Reactivity: 0	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

Note: The Reactivity Hazard Rating is based on the 2nd Edition of the National Paint and Coatings Association's (NPCA's) Hazardous Materials Identification System (HMIS®). Hazard ratings were based on the best available information at the time of the review. Ratings will be re-assigned in accordance with Compressed Gas Association (CGA) guidelines as published in the future edition of CGA Pamphlet P-19.

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

SIGMA-ALDRICH

MATERIAL SAFETY DATA SHEET

Date Printed: 08/14/2006
Date Updated: 05/19/2006
Version 1.15

Section 1 - Product and Company Information

Product Name	CHLOROFORM, >=99.9%, PRA GRADE
Product Number	324019
Brand	ALDRICH
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
CHLOROFORM	67-66-3	Yes

Formula	CHCl3
Synonyms	Chloroform (ACGIH:OSHA) * Chloroforme (French) * Cloroformio (Italian) * Formyl trichloride * Methane trichloride * Methane, trichloro- * Methenyl trichloride * Methyl trichloride * NCI-C02686 * R 20 (Refrigerant) * RCRA waste number U044 * Trichloormethaan (Dutch) * Trichlormethan (Czech) * Trichloroform * Trichloromethane (OSHA) * Triclorometano (Italian)
RTECS Number:	FS9100000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Harmful.

Harmful if swallowed. Irritating to eyes and skin. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.

Probable Carcinogen (US). Target organ(s): Liver. Cardiovascular system. Calif. Prop. 65 carcinogen.

HMIS RATING

HEALTH: 2*
FLAMMABILITY: 0
REACTIVITY: 1

NFPA RATING

HEALTH: 2
FLAMMABILITY: 0
REACTIVITY: 1

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

INFORMATION FOR PHYSICIAN
Contamination of the eyes should be treated by immediate and prolonged irrigation with copious amounts of water.

Section 5 - Fire Fighting Measures

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Noncombustible. Use extinguishing media appropriate to surrounding fire conditions.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves. Wear disposable coveralls and discard them after use.

METHODS FOR CLEANING UP
Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe vapor. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Use only in a chemical fume hood. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA	ACGIH	TWA	10 PPM
USA	MSHA Standard	Ceiling co	50 PPM (240 MG/M3)
USA	OSHA.	PEL	CL 50 PPM (240 MG/M3)
New Zealand	OEL		
Remarks: check ACGIH TLV			
USA	NIOSH	STEL	2 PPM/60M

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	8
Poland		NDSCh	-
Poland		NDSP	-

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Liquid Color: Colorless Form: Clear liquid

Property	Value	At Temperature or Pressure
Molecular Weight	119.38 AMU	
pH	N/A	
BP/BP Range	61 °C	
MP/MP Range	- 63.0 °C	
Freezing Point	N/A	
Vapor Pressure	160 mmHg	20 °C
Vapor Density	4.1 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	1.48 g/cm3	
Bulk Density	N/A	
Odor Threshold	205.0 - 307.0 ppm	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	

Viscosity	0.56 Pas	
Surface Tension	27.1 mN/m	20 °C
Partition Coefficient	Log Kow: 1.97	
Decomposition Temp.	N/A	
Explosion Limits	N/A	
Flammability	N/A	
Autoignition Temp	N/A	
Refractive Index	1.445	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	Other Solvents: SOLUBLE IN CARBON DISULFIDE BENZENE, CARBON TETRACHLORIDE MISCIBLE WITH ALCOHOL, ET	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable.
Conditions of Instability: May decompose on exposure to light.
Materials to Avoid: Strong oxidizing agents, Strong bases, Magnesium, Sodium, Lithium.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Phosgene gas, Chlorine.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: Causes skin irritation.
Skin Absorption: Skin absorption may occur. May be harmful if absorbed through the skin.
Eye Contact: Causes eye irritation.
Inhalation: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
Ingestion: Harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)

Liver. Blood. Central nervous system. Cardiovascular system. Kidneys.

SIGNS AND SYMPTOMS OF EXPOSURE

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated. Exposure can cause: Vomiting. Gastrointestinal disturbances. Exposure to and/or consumption of alcohol may increase toxic effects.

CONDITIONS AGGRAVATED BY EXPOSURE

May cause nervous system disturbances.

TOXICITY DATA

Oral
Man
2514 mg/kg
LDLO

Remarks: Behavioral:Muscle contraction or spasticity. Cardiac:Other changes. Kidney, Ureter, Bladder:Changes in tubules (including acute renal failure, acute tubular necrosis).

Inhalation
Human
25,000 ppm
LCLO

Oral
Rat
695 mg/kg
LD50
Remarks: Behavioral:Change in motor activity (specific assay). Behavioral:Ataxia. Lungs, Thorax, or Respiration:Respiratory stimulation.

Inhalation
Rat
47,702 mg/m3
LC50

Intraperitoneal
Rat
894 MG/KG
LD50

Oral
Mouse
36 mg/kg
LD50

Intraperitoneal
Mouse
623 MG/KG
LD50

Subcutaneous
Mouse
704 MG/KG
LD50

Intraperitoneal
Dog
1 GM/KG
LD50
Remarks: Liver:Liver function tests impaired.

Skin
Rabbit
> 20000 mg/kg
LD50

Oral
Guinea pig
820 mg/kg
LD50

IRRITATION DATA

Skin
Rabbit

10 mg
24H
Remarks: Open irritation test

Skin
Rabbit
500 mg
24H
Remarks: Mild irritation effect

Eyes
Rabbit
148 mg

Eyes
Rabbit
20 mg
24H
Remarks: Moderate irritation effect

CHRONIC EXPOSURE - CARCINOGEN
Result: The National Cancer Institute (NCI) has found clear evidence for carcinogenicity. This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Species: Rat
Route of Application: Oral
Dose: 13832 MG/KG
Exposure Time: 2Y
Frequency: C
Result: Tumorigenic:Carcinogenic by RTECS criteria.
Blood:Leukemia

Species: Mouse
Route of Application: Oral
Dose: 127 GM/KG
Exposure Time: 92W
Frequency: I
Result: Tumorigenic:Carcinogenic by RTECS criteria. Liver:Tumors.

Species: Rat
Route of Application: Oral
Dose: 98 GM/KG
Exposure Time: 78W
Frequency: I
Result: Endocrine:Thyroid tumors. Kidney, Ureter, Bladder:Kidney tumors. Tumorigenic:Neoplastic by RTECS criteria.

Species: Mouse
Route of Application: Oral
Dose: 18 GM/KG
Exposure Time: 17W
Frequency: I
Result: Tumorigenic:Neoplastic by RTECS criteria. Liver:Tumors.

Species: Rat
Route of Application: Oral
Dose: 7020 MG/KG
Exposure Time: 78W
Frequency: I
Result: Tumorigenic:Carcinogenic by RTECS criteria.

Liver:Tumors. Kidney, Ureter, Bladder:Kidney tumors.

Species: Rat
Route of Application: Oral
Dose: 70 GM/KG
Exposure Time: 78W
Frequency: I
Result: Endocrine:Thyroid tumors. Kidney, Ureter, Bladder:Kidney tumors. Tumorigenic:Neoplastic by RTECS criteria.

Species: Mouse
Route of Application: Oral
Dose: 24752 MG/KG
Exposure Time: 2Y
Frequency: C
Result: Liver:Tumors. Tumorigenic:Equivocal tumorigenic agent by RTECS criteria.

Species: Rat
Route of Application: Oral
Dose: 58968 MG/KG
Exposure Time: 2Y
Frequency: C
Result: Tumorigenic:Neoplastic by RTECS criteria. Endocrine:Thyroid tumors. Blood:Tumors.

Species: Mouse
Route of Application: Oral
Dose: 130 GM/KG
Exposure Time: 2Y
Frequency: I
Result: Tumorigenic:Neoplastic by RTECS criteria. Kidney, Ureter, Bladder:Tumors. Liver:Tumors.

IARC CARCINOGEN LIST

Rating: Group 2B

NTP CARCINOGEN LIST

Rating: Clear evidence.
Species: Mouse/rat
Route: Gavage

IRIS/EPA CARCINOGEN LIST
Rating: Group B2
Species: Rat, mouse
Route: Gavage

CHRONIC EXPOSURE - *TERATOGEN*

Species: Rat
Dose: 1260 MG/KG
Route of Application: Oral
Exposure Time: (6-15D PREG)
Result: Specific Developmental Abnormalities: Musculoskeletal system. Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Species: Rat
Dose: 4 GM/KG
Route of Application: Oral

Exposure Time: (6-15D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Species: Rat
Dose: 100 PPM/7H
Route of Application: Inhalation
Exposure Time: (6-15D PREG)
Result: Specific Developmental Abnormalities: Gastrointestinal system. Specific Developmental Abnormalities: Homeostasis

Species: Rat
Dose: 20100 UG/M3/1H
Route of Application: Inhalation
Exposure Time: (7-14D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Species: Mouse
Dose: 100 PPM/7H
Route of Application: Inhalation
Exposure Time: (8-15D PREG)
Result: Specific Developmental Abnormalities: Craniofacial (including nose and tongue).

Species: Rabbit
Dose: 260 MG/KG
Route of Application: Oral
Exposure Time: (6-18D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Musculoskeletal system.

CHRONIC EXPOSURE - MUTAGEN
Result: Laboratory experiments have shown mutagenic effects.

Species: Human
Dose: 19 MMOL/L
Cell Type: HeLa cell
Mutation test: DNA inhibition

Species: Human
Dose: 10 MMOL/L
Cell Type: lymphocyte
Mutation test: Sister chromatid exchange

Species: Rat
Route: Oral
Dose: 4 MMOL/KG
Mutation test: Micronucleus test

Species: Rat
Route: Oral
Dose: 1 GM/KG
Mutation test: Unscheduled DNA synthesis

Species: Rat
Route: Intraperitoneal
Dose: 1200 UG/KG
Mutation test: Cytogenetic analysis

Species: Rat

Route: Oral
Dose: 597 MG/KG
Exposure Time: 5D
Mutation test: Cytogenetic analysis

Species: Rat
Dose: 1 MMOL/L
Cell Type: leukocyte
Mutation test: Sister chromatid exchange

Species: Mouse
Dose: 12 MG/L (+S9)
Cell Type: lymphocyte
Mutation test: Mutation in microorganisms

Species: Mouse
Route: Intraperitoneal
Dose: 50 MG/KG
Mutation test: Unscheduled DNA synthesis

Species: Mouse
Route: Inhalation
Dose: 300 PPM
Exposure Time: 6H
Mutation test: Sister chromatid exchange

Species: Mouse
Route: Oral
Dose: 200 MG/KG
Exposure Time: 4D
Mutation test: Sister chromatid exchange

Species: Mouse
Route: Inhalation
Dose: 400 PPM
Exposure Time: 4H/5D
Mutation test: sperm

Species: Hamster
Dose: 4430 MG/L
Cell Type: kidney
Mutation test: Morphological transformation.

Species: Hamster
Dose: 1 PPH
Cell Type: fibroblast
Mutation test: Other mutation test systems

Species: Hamster
Dose: 100 UMOL/L
Cell Type: Embryo
Mutation test: Sister chromatid exchange

Species: Hamster
Dose: 60 MMOL/L
Cell Type: lung
Mutation test: SLN

Species: Hamster
Dose: 1 MG/L
Cell Type: lung
Mutation test: Mutation in mammalian somatic cells.

Species: Mammal
Dose: 1 MMOL/L
Cell Type: lymphocyte
Mutation test: DNA

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat
Dose: 30 PPM/7H
Route of Application: Inhalation
Exposure Time: (6-15D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Fertility: Other measures of fertility Specific Developmental Abnormalities: Musculoskeletal system.

Species: Rat
Dose: 300 PPM/7H
Route of Application: Inhalation
Exposure Time: (6-15D PREG)
Result: Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Species: Mouse
Dose: 2177 MG/KG
Route of Application: Oral
Exposure Time: (3W MALE/3W PRE-7D POST)
Result: Effects on Newborn: Growth statistics (e.g., reduced weight gain). Effects on Newborn: Biochemical and metabolic.

Species: Mouse
Dose: 2115 MG/KG
Route of Application: Oral
Exposure Time: (3W MALE/3W PRE-5D POST)
Result: Effects on Newborn: Other postnatal measures or effects.

Species: Mouse
Dose: 100 PPM/7H
Route of Application: Inhalation
Exposure Time: (1-7D PREG)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Algae
Time: 24 h
Value: 500 mg/l

Test Type: EC50 Daphnia
Species: Daphnia magna
Time: 24 h

Value: 79 mg/l

Test Type: LC50 Fish
Species: Leuciscus idus
Time: 48 h
Value: 162 mg/l

Test Type: LC100 Fish
Species: Leuciscus idus
Time: 48 h
Value: 220 mg/l

Test Type: LC50 Fish
Time: 4 days
Value: 97 mg/l

Test Type: LC50 Fish
Species: Brachydanio rerio
Time: 96 h
Value: 121 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Observe all federal, state, and local environmental regulations. (DN)Requires special label: "Contains a substance which is regulated by Dannish work environmental law due to the risk of carcinogenic properties."

Section 14 - Transport Information

DOT
Proper Shipping Name: Chloroform
UN#: 1888
Class: 6.1
Packing Group: Packing Group III
Hazard Label: Toxic Substance
PIH: Not PIH

IATA
Proper Shipping Name: Chloroform
IATA UN Number: 1888
Hazard Class: 6.1
Packing Group: III

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: Xn
Indication of Danger: Harmful.
R: 22-38-40-48/20/22
Risk Statements: Harmful if swallowed. Irritating to skin. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
S: 36/37
Safety Statements: Wear suitable protective clothing and gloves.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Harmful.
Risk Statements: Harmful if swallowed. Irritating to eyes and

skin. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
Safety Statements: Wear suitable protective clothing and gloves.
US Statements: Probable Carcinogen (US). Target organ(s): Liver. Cardiovascular system. Calif. Prop. 65 carcinogen.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
DEMINIMIS: 0.1 %
NOTES: This product is subject to SARA section 313 reporting requirements.
TSCA INVENTORY ITEM: Yes

UNITED STATES - STATE REGULATORY INFORMATION

CALIFORNIA PROP - 65
California Prop - 65: This product is or contains chemical(s) known to the state of California to cause cancer. This product is or contains chemical(s) known to the state of California to cause cancer.

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.
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MATERIAL SAFETY DATA SHEET

MSDS Number
P-175N

AccuStandard
125 Market Street • New Haven, CT USA 06513
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number
203-786-5290
Mon. to Fri. 8am-5pm EDT

Product Number : P-175N

Product Name : Cyanazine

Synonyms : 2-Methylpropionitril

Formula : C9H13ClN6 **Molecular Weight :** 240.73

Section 2 - Composition / Information on Ingredients

Component(s) (1)	CAS #	Appr. %	ACGIH TLV TWA mg/m3	ACGIH TLV SKIN	OSHA PEL TWA mg/m3	OSHA PEL SKIN
Cyanazine	21725-46-2	100%				

Section 3 - Hazards Identification

Symptoms of Exposure:

Harmful if inhaled, swallowed, or absorbed through the skin.

Potential Health Effects:

No applicable information found.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

Section 4 - First Aid Measures

First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Remove contaminated clothing and wash before reuse.

Section 5 - Fire Fighting Measures

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Flammable Properties:

Flash Point (°F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A

Thermal decomposition produces toxic fumes.

Extinguishing Media:

Use water spray, dry chemical, CO2, or "alcohol" foam.

Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

Section 6 - Accidental Release Measures

Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

Section 7 - Handling and Storage

Keep container closed.
Store in a cool area away from ignition sources and oxidizers.
Do not breathe vapor.
Do not get in eyes, on skin, or on clothing.

Section 8 - Exposure Controls / Personal Protection

Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact.

(Butyl Rubber, Viton or equivalent)

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Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

Section 9 - Physical and Chemical Properties

Physical and chemical properties for the Compound

Appearance: Colorless crystalline solid
Boiling Point: N/A
Melting Point: 167-169C
Specific Gravity (Water = 1): N/A
Vapor Pressure: N/A
Vapor Density (Air = 1): N/A
Percent Volatile (by volume): N/A
Evaporation Rate (Butyl acetate = 1): N/A
Flash Point: N/A
Explosion Limits (%): N/A to N/A
Solubility in water (%): 0.17g/L

Section 10 - Stability and Reactivity

Stability and reactivity for the Compound

Stability: Stable
Materials to Avoid: Oxidizers

Hazardous Decomposition: Oxides of carbon and nitrogen, Hydrogen chloride, CN-
Hazardous Polymerization: Does not occur
Conditions to Avoid: None indicated

Section 11 - Toxicological Information

See section 3 for specific toxicological information for the ingredients of this product.

Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

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Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

Section 14 - Transport Information

DOT	Shipping Class:	6.1	Packing Group:	III	UN Number:	UN2588

Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your *local regulatory authorities.*

The following regulations apply:

The CAS number of this product is NOT listed on the TSCA Inventory. For reasearch and development use only. Not for manufacturing or commercial purposes.

WARNING: This product contains a chemical(s) known to the state of California to cause birth defects or other reproductive harm.

Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

This statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necssary technical skill and at their own discretion and risk. Since conditions and manner of use are ouside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

* * * End of document * * *

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Scott Specialty Gases

Material Safety Data Sheets

MSDS No: 124-48-1
Date: 03/09/2001

SUPPLIER ADDRESS: 6141 Easton Road, Bldg. 1
PO Box 310
Plumsteadville, PA 18949-0310

EMERGENCY PHONE NUMBER: (215) 766-8861

1. CHEMICAL PRODUCT

PRODUCT NAME: CHLORODIBROMOMETHANE SYNONYMS: Dibromochloromethane

2. COMPOSITION, INFORMATION ON INGREDIENTS

				Exposure Limits (PPM)			
Ingredient Name	Formula	CAS #	Concentration	ACGIH TLV	OSHA PEL	MAC	Other STEL
CHLORODIBROMOMETHANE	CIBr2CH	124-48-1	99+%	NE	NE	NE	NE

Note NE = NONE ESTABLISHED S/A = SIMPLE ASPHYXIANT

3. HAZARD INDENTIFICATION

* * * EMERGENCY OVERVIEW * * *
Nonflammable liquid and vapor.
Can cause irritation to the upper respiratory tract.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation , Ingestion

ACUTE EFFECTS: Skin and eye irritation may occur. If inhaled, may be irritating to mucous membrane and upper respiratory tract. Prolonged exposure can cause nausea, dizziness and headaches. High concentrations may have a narcotic effect.

CHRONIC EFFECTS: None

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None

OTHER EFFECTS OF OVEREXPORSURE: None

CARCINOGENICITY (US ONLY):

NTP - No
IARC MONOGRAPHS - No
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.

EYE CONTACT: Immediately flush with copious amounts of water for at least 15 minutes.

SKIN CONTACT: Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing.

INGESTION: Never give anything by mouth to an unconscious person. Do not induce vomiting because of aspiration hazard.

IN EVENT OF EXPOSURE, CONSULT A PHYSICIAN

NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: Nonflammable

AUTOIGNITION TEMPERATURE: N/Ap

FLAMMABLE LIMITS: Nonflammable

LOWER:
UPPER:

EXTINGUISHING MEDIA: Use what is appropriate for surrounding fire. Use water spray to keep fire exposed cylinders cool.

SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray.

HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide, hydrogen chloride, and hydrogen bromide.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Cylinder rupture may occur under fire conditions.

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Remove leaking cylinder to exhaust hood or safe outdoor area. Shut off source if possible and remove source of heat.

SPECIALIZED EQUIPMENT: None

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store in well ventilated areas away from heat and source of ignition. Keep valve protection cap on cylinders when not in use.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation.

EYE / FACE PROTECTION: Safety glasses

SKIN PROTECTION: Protective gloves.

RESPIRATORY PROTECTION: In case of leakage, use self-contained breathing apparatus.

OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Pale yellow heavy liquid.

ODOR: N/Av

PHYSICAL PRESSURE: Liquid

VAPOR PRESSURE: N/Av

VAPOR DENSITY (AIR=1): N/Av

BOILING POINT (C): 120

SOLUBILITY IN WATER: N/Av

SPECIFIC GRAVITY (H2O=1): @20 deg. celsius: 2.451

EVAPORATION RATE: N/Av

ODOR THRESHOLD: N/Av

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.

CONDITIONS TO AVOID: Storage in poorly ventilated areas. Storage near a heat source.

MATERIALS TO AVOID: *Strong bases, strong oxidizing agents and magnesium.*

HAZARDOUS POLYMERIZATION: Will not occur.

HAZARDOUS DECOMPOSITION: Fumes of carbon monoxide, hydrogen chloride gas and hydrogen bromide gas.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): None established

LETHAL DOSE 50 (LD50): N/Ap

TERATOGENICITY: N/Ap

REPRODUCTIVE EFFECTS: N/Ap

MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Return cylinders to supplier with any valve outlet plugs or caps secured and valve protection cap in place. *Empty cylinders will contain hazardous residue.*

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%

DOT DESCRIPTION (US ONLY):

PROPER SHIPPING NAME: This material is not hazardous according to DOT definitions. No DOT label or shipping paper work is required.
HAZARD CLASS: N/Ap
INDENTIFICATION NUMBER: N/Ap
REPORTABLE QUANTITIES: None

LABELING: N/Ap

ADR / RID (EU Only): N/Av

SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.

TSCA: Material is listed in TSCA inventory.

SARA: The threshold planning quantity for material is 10,000 lbs.

EU NUMBER: N/Av

NUMBER IN ANNEX 1 OF DIR 67/548: Not listed in annex 1.

EU CLASSIFICATION: N/Av

R: N/Av

S: N/Av

16. OTHER INFORMATION

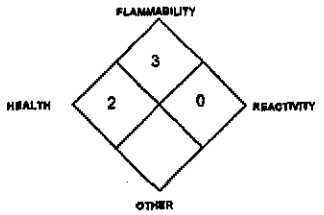
OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS: N/Ap - Not Applicable N/Av - Not Available SA - Simple Asphyxiant NE - None Established

DISCLAIMER: Information included in this document is given to the best of our knowledge, however, no warranty is made that the information is accurate or complete. We do not accept any responsibility for damages by the use of the document.

Airgas

NFPA RATING



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: **ETHYLENE DICHLORIDE - $C_2H_4Cl_2$**
Document Number: 001068

PRODUCT USE: For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME: AIRGAS INC.

ADDRESS: 259 N. Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283

BUSINESS PHONE: 1-610-687-5253

EMERGENCY PHONE: CHEMTREC: 1-800-424-9300
International: 703-527-3887 (Call Collect)

DATE OF PREPARATION: May 5, 1998

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	OTHER
Ethylene Dichloride	107-06-2	> 98.0	10, A4 (Not Classifiable as a Human Carcinogen)	NE	50	C = 100; 200 (5 minute peak in any 3 hours)	3800 (Based on LEL)	NIOSH REL: Carcinogen TWA = 1 ppm STEL = 2 ppm DFG MAK: Danger of Cutaneous Absorption. Carcinogen: EPA-B2; IARC-2B; MAK-A2; NTP-2B
Maximum Impurities		< 2.0	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established C = Ceiling Limit See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Ethylene Dichloride is a colorless, flammable, toxic liquid with a pleasant, sweetish odor (similar to chloroform). Inhalation of the vapors of Ethylene Dichloride can cause central nervous system depression and irritation of the tissues of the respiratory system. Severe inhalation exposures can be fatal. Skin and eye contact can be moderately to severely irritating. Ethylene Dichloride is possibly carcinogenic to humans. This liquid is flammable; vapors are heavier than air and may travel long distances to source of ignition and flashback. If involved in a fire Ethylene Dichloride will decompose to produce toxic gases (e.g., carbon monoxide, carbon dioxide, hydrogen chloride, and phosgene). Persons responding to fires or emergencies involving Ethylene Dichloride must have adequate fire protection and wear personal protective equipment to protect.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of overexposure for Ethylene Dichloride are by inhalation or skin and eye contact. The symptoms of overexposure to Ethylene Dichloride by route of exposure are as follows:

INHALATION: The main effect of inhalation of Ethylene Dichloride is central nervous system depression. Symptoms of such overexposure can include drowsiness, headache, dizziness, and loss of coordination. Exposure to extremely high concentrations can result in lung effects (e.g., pulmonary edema), liver and kidney damage, and death. The vapors can be moderately to severely irritating to the mucous membranes, causing lacrimation, coughing, and breathing difficulties.

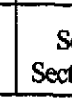
CONTACT WITH SKIN or EYES: Ethylene Dichloride is a moderate to severe skin and eye irritant. Eye contact with the liquid or vapors can cause pain, redness, watering, and may result in corneal clouding. Skin contract can result in redness, dryness, and itching. Repeated or prolonged contact can also cause dermatitis, resulting in dry, itchy, cracked skin.

SKIN ABSORPTION: Ethylene Dichloride exposure through skin contact has been reported. Symptoms of absorption may be similar to those described in "Inhalation".

INGESTION: Ingestion of Ethylene Dichloride may cause a burning sensation in the mouth and stomach, nausea, vomiting, excess salivation and vomiting of blood. Ethylene Dichloride is readily absorbed into the body following ingestion exposures, producing symptoms of central nervous system depression and other symptoms similar to those described in "Inhalation". If ingested, Ethylene Dichloride presents a potential aspiration hazard. Aspiration of even small amounts of Ethylene Dichloride into the lungs can result in the development of pulmonary edema (a potentially fatal accumulation of fluid in the lungs), chemical pneumonitis and hemorrhage of pulmonary tissue.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	2
FLAMMABILITY	(RED)	3
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		X

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For routine industrial applications

See Section 16 for Definition of Ratings

INJECTION: Injection is not anticipated to be a significant route of overexposure for Ethylene Dichloride. If Ethylene Dichloride is "injected" (as may occur through punctures by contaminated, sharp objects), symptoms described in "Inhalation" can occur.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to may cause the health effects described on the following page.

ACUTE: Acute inhalation overexposure to Ethylene Dichloride will initially act as a narcotic, possibly leading to coma in extreme cases. Following exposure to high concentrations, victims may be unconscious, and if exposure continues, death can follow from respiratory failure, circulatory collapse, or liver and kidney damage. Contact with the skin can cause moderate to severe irritation. Contact with the eyes is moderately to severely irritating, causing burning and watering of the eyes. Ingestion of Ethylene Dichloride will cause gastric distress and central nervous system effects. Aspiration of Ethylene Dichloride into the lungs, following ingestion, can result in severe damage to the lungs; death may result.

3. HAZARD IDENTIFICATION (Continued)

CHRONIC: Repeated inhalation exposure can result in bronchitis and other lung disorders. Repeated skin contact can cause dermatitis. *Chronic exposure by all routes may* result in liver and kidney damage. Ethylene Dichloride is a possible human carcinogen, based on results from clinical studies on test animals. See Section 11 (Toxicological Information) for further information

TARGET ORGANS: Respiratory system, central nervous system, liver, kidneys, skin, eyes.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO ETHYLENE DICHLORIDE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. If necessary, a Self-Contained Breathing Apparatus should be worn.

INHALATION: If vapors, mists, or sprays of Ethylene Dichloride are inhaled, remove victim to fresh air. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

SKIN EXPOSURE: If Ethylene Dichloride contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If Ethylene Dichloride or its vapors enter the eyes, open victim's eyes *while under gentle running water.* Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INGESTION: If Ethylene Dichloride is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Physicians should refer to "Recommendations to Physicians" in Section 11 (Toxicological Information). Take copy of label and MSDS to health professional with victim.

5. FIRE-FIGHTING MEASURES

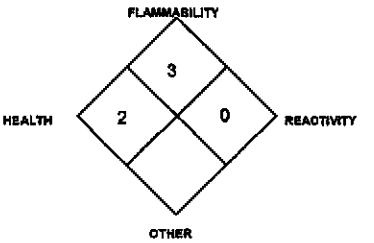
FLASH POINT: 13°C (56°F)
AUTOIGNITION TEMPERATURE: 413°C (775°F)
FLAMMABLE LIMITS (in air by volume, %):
Lower (LEL): 6.2%
Upper (UEL): 15.9%

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES (for cooling only)
Foam: YES
Halon: YES
Carbon Dioxide: YES
Dry Chemical: YES
Other: Any "B" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Ethylene Dichloride is a Class IB flammable liquid and presents a serious fire hazard to firefighters. Due to the low flash point, vapors can form explosive mixtures with air, at room temperature. When involved in a fire, this material ignites to produce toxic gases (e.g., carbon monoxide, carbon dioxide, hydrogen chloride, phosgene). The vapors of Ethylene Dichloride are heavier than air and may spread long distances; distant ignition and flash-back are possible. Containers of Ethylene Dichloride, when involved in fire, may rupture or burst in the heat of the fire.

NFPA RATING



See Section 16 for Definition of Ratings

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Ethylene Dichloride can accumulate static charge by flow or agitation; vapors can be ignited by static discharge.

5. FIRE-FIGHTING MEASURES (Continued)

SPECIAL FIRE-FIGHTING PROCEDURES: In the event of fire, cool containers of Ethylene Dichloride with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Water may not be effective in actually extinguishing a fire involving Ethylene Dichloride, due to its low flash point. Stop the leak or discharge, if possible. For small releases, if it is not possible to stop the leak, and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment, including chemical resistant clothing. Large fires should be fought from a distance with an unmanned hose holder or monitor nozzles. If Ethylene Dichloride is involved in a fire, fire runoff water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook (Guide #129) for additional guidance.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area and protect people. Minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemical resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus.** Monitor the surrounding area for combustible vapor levels. Combustible vapor levels must be below 10% of the LEL for Ethylene Dichloride (LEL = 6.2%) before personnel are permitted to enter the area. If necessary, ventilate area.

Monitoring should be done for the levels of Ethylene Dichloride and oxygen. Colorimetric tubes are available to detect the presence of Ethylene Dichloride. Levels of Ethylene Dichloride should be below levels listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

Eliminate all sources of ignition before clean-up operations begin. Use non-sparking tools. Absorb spilled liquid with activated carbon, polypads or other suitable absorbent materials. Prevent material from entering sewer or confined spaces. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. If necessary, decontaminate spill-response equipment with soap and water solution. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations, or the applicable standards of Canada and its Provinces (see Section 13, Disposal Considerations).

THIS IS A FLAMMABLE, TOXIC LIQUID: Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Ethylene Dichloride IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of effects of Ethylene Dichloride exposure indicated in Section 3 (Hazard Identification); exposures to fatal concentrations of Ethylene Dichloride could occur rapidly.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing vapors or mists generated by Ethylene Dichloride. Use in a well-ventilated location. Cylinders of Ethylene Dichloride must be properly labeled. If Ethylene Dichloride is used in other types of containers, only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids.

Store cylinders of Ethylene Dichloride in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Do not allow area where cylinders are stored to exceed 52°C (125°F). Material should be stored in secondary containers, or in a diked area, as appropriate. Store containers away from incompatible chemicals. Keep container tightly closed when not in use. Storage areas should be made of fire-resistant materials. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Refer to NFPA 30, Flammable and Combustible Liquids Code, for additional information on storage.

Empty containers may contain residual flammable liquid or vapors. Therefore, empty containers should be handled with care. Do not expose "empty" containers to welding touches, or any other source of ignition.

7. HANDLING and STORAGE (Continued)

SPECIAL PRECAUTIONS FOR HANDLING CYLINDERS: Protect cylinders of Ethylene Dichloride against physical damage. If appropriate, cylinders should be stored in an up-right position. Cylinders should be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: If appropriate, move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Ethylene Dichloride. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Bulletin SB-2 "*Oxygen Deficient Atmospheres*".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use Ethylene Dichloride in areas where adequate ventilation is provided. Decontaminate equipment using soapy water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Ethylene Dichloride dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the presence of potentially explosive air-gas mixtures and the level of oxygen.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Ethylene Dichloride. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards, or the applicable regulations of Canada and its Provinces. The following NIOSH respiratory protection recommendations are for Ethylene Dichloride for further information.

CONCENTRATION	RESPIRATORY EQUIPMENT
AT CONCENTRATIONS ABOVE THE NIOSH REL:	Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.
ESCAPE:	Gas mask with organic vapor canister; or escape-type SCBA.
NOTE:	The NIOSH Recommended Exposure Limit (REL) for Ethylene Dichloride is 1 ppm (4 mg/m3) time-weighted average concentration; 2 ppm (8 mg/m3) short-term exposure limit.

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and contact with liquid.

HAND PROTECTION: Wear mechanically-resistant, chemically compatible gloves when handling cylinders of Ethylene Dichloride. Viton or neoprene gloves are recommended for operations in which exposure to liquid may occur.

BODY PROTECTION: Use body protection appropriate for task. An apron or coveralls may be necessary if splashes of liquid may be anticipated. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from gas spraying, as well as fire-retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): 3.4
SPECIFIC GRAVITY(@ 68°F (20°C) (water = 1): 1.256
SOLUBILITY IN WATER @ 77°F (25°C): 0.8g/100 mL
EVAPORATION RATE (diethyl ether = 1): Not established.
ODOR THRESHOLD: 26 ppm(detection); 87 ppm (recognition)
LOG COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = 1.48
VAPOR PRESSURE @ 68°F (20°C): 66.1 mm Hg: 10 kPa

pH: Not applicable.
FREEZING/MELTING POINT: -35.5°C (-32°F)
BOILING POINT: 83.5°C (182.3°F)
SPECIFIC VOLUME: Not applicable.
EXPANSION RATIO Not applicable.

9. PHYSICAL and CHEMICAL PROPERTIES (Continued)

APPEARANCE AND COLOR: Colorless, flammable liquid, with a pleasant, sweetish odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of Ethylene Dichloride is not a good warning property as a the odor threshold is above the TLV.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in air, but will slowly decompose and darken in color. In the presence of steam, Ethylene Dichloride hydrolyzes slowly to form hydrochloric acid

DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, vinyl chloride, hydrogen chloride gas and phosgene gas.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Ethylene Dichloride reacts violently with strong caustics, liquid ammonia, alkali metals (e.g., potassium, sodium), and powdered metals (e.g., aluminum, zinc, magnesium). Ethylene Dichloride also posses an explosion or fire risk in the presence of strong oxidizers. Ethylene Dichloride can attack many plastics.

HAZARDOUS POLYMERIZATION: Not expected to occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for Ethylene Dichloride:

Open irritation test - skin - rabbit: 625 mg: Mild

Standard Draize test: skin - rabbit: 500 mg/: Mild

Standard Draize test - eye - rabbit: 63 mg: Severe

Standard Draize test - eye - rabbit: 500 mg/24 hours: Mild

TCLo - Inhalation - man: 4000 ppm/1 hour: Peripheral Nerve and Sensation - flaccid paralysis without anesthesia (usually neuromuscular blockage) Behavioral - coma Gastrointestinal - nausea or vomiting

LDLo - Oral - Human: 286 mg/kg: Gastrointestinal - ulceration or bleeding from stomach; Gastrointestinal - nausea or vomiting; Liver - fatty liver degeneration

TDLo - Oral -Human: 428 mg/kg: Behavioral - somnolence (general depressed activity) Lungs, Thorax, or Respiration - cough Gastrointestinal - nausea or vomiting

TDLo - Oral - man: 892 mg/kg: Gastrointestinal - hypermotility, diarrhea Gastrointestinal - nausea or vomiting Liver - jaundice, other or unclassified

LDLo - Oral - man: 714 mg/kg: Behavioral - somnolence (general depressed activity) Cardiac - change in rate Lungs, Thorax, or Respiration - cyanosis

LD_{50} - Oral - rat: 670 mg/kg:

LC_{50} - Inhalation - rat: 1000 ppm/7 hours: Behavioral - coma Lungs, Thorax, or Respiration - cyanosis Nutritional and Gross Metabolic - body temperature decrease

LD_{50} - Intraperitoneal - rat: 807 mg/kg:

LD_{50} - Subcutaneous - rat: 1 gm/kg: Sense Organs and Special Senses (Eye) - lacrimation Behavioral - general anesthetic Behavioral - ataxia:

LDLo - Intratracheal - rat: 120 mg/kg

LD_{50} - Oral - mouse: 413 mg/kg: Lungs, Thorax, or Respiration - other changes Liver - other changes

LCLo - Inhalation - mouse: 5 gm/m3/2 hours

LD_{50} - Intraperitoneal - mouse: 470 mg/kg:

LDLo - Subcutaneous - mouse: 380 mg/kg

LD_{50} - Oral - dog: 5700 mg/kg: Sense Organs (Eye) - lacrimation Behavioral - general anesthetic, ataxia

LDLo - Intravenous - dog: 175 mg/kg:

LC_{50} - Inhalation - monkey: 3000 ppm/7 hours

LC - Inhalation - cat: >3000 ppm/7 hours

LD_{50} - Oral - rabbit: 860 mg/kg

LCLo Inhalation - rabbit: 3000 ppm/7 hours: Behavioral - somnolence ; Lungs, Thorax, or Respiration - dyspnea Lungs, Thorax, or Respiration - other changes

LD_{50} - skin - rabbit: 2800 mg/kg: Sense Organs and Special Senses (Eye) - lacrimation Behavioral - general anesthetic Behavioral - ataxia

LDLo - Subcutaneous - rabbit: 1200 mg/kg

LCLo - Inhalation - pig: 3000 ppm/7 hours: Sense Organs and Special Senses (Eye) - lacrimation Behavioral - somnolence (general depressed activity) Lungs, Thorax, or Respiration - dyspnea

LCLo - Inhalation - guinea pig: 1500 ppm/7 hours: Sense Organs and Special Senses (Eye) - lacrimation Behavioral - somnolence ; Kidney, Ureter, Bladder - changes in tubules (including acute renal failure, acute tubular necrosis)

LDLo - Intraperitoneal - guinea pig: 600 mg/kg: Biochemical - Enzyme inhibition, induction, or change in blood or tissue levels - other transferases

LC - Inhalation: Mammal - species unspecified: >3000 ppm/7 hours:

TDLo - Oral - rat: 21840 mg/kg/13 weeks-Continuous: Liver - changes in liver weight Kidney, Ureter, Bladder - changes in bladder weight

TDLo - Oral - rat: 1 gm/kg/10 weeks - Intermittent: Blood - changes in serum composition (e.g. TP, bilirubin, cholesterol) Liver - changes in liver weight Reproductive - Tumorigenic effects - other reproductive system tumors

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

TCLo - Inhalation - rat: 200 ppm/7 hours/6 weeks - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

TCLo - Inhalation - rat: 1500 ppm/7 hours/5 days - Intermittent: Lungs, Thorax, or Respiration - respiratory depression Kidney, Ureter, Bladder - changes in tubules (including acute renal failure, acute tubular necrosis) Reproductive - Tumorigenic effects - other reproductive system tumors

TDLo - Oral-mouse: 43680 mg/kg/13 weeks - Continuous: Liver - changes in liver weight Kidney, Ureter, Bladder - changes in tubules (including acute renal failure, acute tubular necrosis) Kidney, Ureter, Bladder - changes in bladder weight

TCLo - Inhalation - mouse: 200 ppm/7H/9 days - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

TDLo - Oral - mouse: 685 mg/kg/14 days - Intermittent: Blood - changes in leukocyte (WBC) count Immunological Including Allergic - decrease in humoral immune

TCLo - Inhalation - dog: 1500 ppm/7 hours/5 days - Intermittent: Sense Organs and Special Senses (Eye) - corneal damage Reproductive - Tumorigenic effects - other reproductive system

TCLo - Inhalation - monkey: 1000 ppm/7 hours/9 weeks - Intermittent: Behavioral - coma Reproductive - Tumorigenic effects - other reproductive system tumors

TCLo - Inhalation - cat: 1000 ppm/7 hours/11 weeks - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

TCLo - Inhalation - rabbit: 400 ppm/7 hours/19 weeks - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

TCLo - Inhalation - guinea pig: 200 ppm/7 hours/25 weeks - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

T TCLo - Inhalation: Rodent - guinea pig: 1500 ppm/7 hours/5 days - Intermittent: Cardiac - other changes Kidney, Ureter, Bladder - changes in tubules (including acute renal failure, acute tubular necrosis) Reproductive - Tumorigenic effects - other reproductive system tumors

LDLo - Oral - rat: 5286 mg/kg/69 weeks - Intermittent: Tumorigenic; Gastrointestinal - tumors Skin and Appendages - tumors

TCLo - *Inhalation - rat: 5 ppm/7 hours/78* weeks - Intermittent: Tumorigenic - equivocal tumorigenic agent; Blood - leukemia Skin and Appendages - tumors

TDLo - Oral - mouse: 3536 mg/kg/78 weeks - Intermittent: Tumorigenic - Carcinogenic; Lungs, Thorax, or Respiration - tumors Skin and Appendages - tumors

TCLo - Inhalation - mouse: 5 ppm/7H/78 weeks - Intermittent: Tumorigenic - equivocal tumorigenic agent; Lungs, Thorax, or Respiration - tumors Skin and Appendages - tumors

TDLo - skin - mouse: 1120 gm/kg/74 weeks - Intermittent: Tumorigenic - neoplastic; Lungs, Thorax, or Respiration - tumors Skin and Appendages - tumors

TD - Oral - rat: 38 gm/kg/78 weeks - Intermittent: Tumorigenic; Vascular - tumors Gastrointestinal - tumors

TD - Oral - mouse: 76 gm/kg/78 weeks - Intermittent: Tumorigenic; Skin and Appendages - tumors Reproductive - Tumorigenic effects - uterine tumors:

TD - Oral - rat 18 gm/kg/78 weeks - Intermittent: Tumorigenic; Vascular - tumors Gastrointestinal - tumors

TD - Oral - mouse: 38 gm/kg/78 weeks - Intermittent: Tumorigenic; Skin and Appendages - tumors Reproductive - Tumorigenic effects - uterine tumors

TCLo - Inhalation - rat: 300 ppm/7 hours: female 6-15 day(s) after conception: Reproductive - Fertility - post-implantation mortality

TCLo - Inhalation - rat 208 mg/m3/6 hours: female 2 week(s) pre-mating female 1-21 day(s) after conception: Reproductive - Fertility - pre-implantation mortality

Mutation in microorganisms: Bacteria - Salmonella typhimurium: 10 umol/plate

Mutation in microorganisms: Bacteria - Salmonella typhimurium: 10 ug/plate

DNA damage: Bacteria - Salmonella typhimurium: 7060 umol/L

Mutation test systems -: Bacteria - Escherichia coli: 316 mmol/L

DNA repair: Bacteria - Escherichia coli; 10 mg/plate

Specific locus test Oral: Insect - Drosophila melanogaster: 1000 ppm

Specific locus test: Inhalation: Insect - Drosophila melanogaster: 250 mg/m3

Sex chromosome loss and nondisjunction: Oral: Insect - Drosophila melanogaster: 120 mmol/

Sex chromosome loss and nondisjunction : Inhalation : Insect - Drosophila melanogaster: 2 ppm/96 hours

Sex chromosome loss and nondisjunction: Mold - Aspergillus nidulans: 2000 ppm

DNA Inhibition: Human Lymphocyte: 5 mL/L

Mutation in mammalian somatic: Human Lymphocyte: 100 mg/L

DNA damage: Oral - rat: 150 mg/kg

DNA damage - Inhalation - rat: 150 ppm/6 hours

Unscheduled DNA synthesis - rat Liver: 130 umol/L

Specific locus test - Intraperitoneal - mouse 300 mg/kg

DNA damage - Intraperitoneal - mouse: 2 mmol/kg

DNA damage Oral - mouse: 100 mg/kg

DNA Inhibition - Intraperitoneal: Rodent - mouse: 29 mg/kg

Body fluid assay - mouse Bacteria - Salmonella typhimurium: 80 mg/kg

Mutation in microorganisms - hamster Ovary: 2 mmol/L

Morphological transformation - hamster Embryo: 200 uL/plate

Cytogenetic analysis - hamster Lung: 1 gm/L

Mutation in mammalian somatic cells - hamster Ovary 40 mmol/L

SUSPECTED CANCER AGENT: Ethylene Dichloride is listed as follows:

ACGIH-A4; Not Classifiable as a Human Carcinogen
EPA-B2; Probable Human Carcinogen/Sufficient Animal Evidence
IARC-2B; Possibly Carcinogenic to Humans
MAK-A2; Unmistakably Carcinogenic in Animal Experiments
NIOSH-X; Carcinogen
NTP-2B; Reasonably Anticipated to be a Carcinogen/Based on Animal Evidence.

IRRITANCY OF PRODUCT: Ethylene Dichloride is moderately to severely irritating to all skin tissue.

SENSITIZATION TO THE PRODUCT: Ethylene Dichloride is not reported to be a sensitizer after prolonged or repeated exposures.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Ethylene Dichloride on the human reproductive system.

Mutagenicity: No human mutagenicity effects have been described for Ethylene Dichloride. Mutagenic data are available for Ethylene Dichloride; these data were obtained during clinical studies on test animal tissue or micro-organisms exposed to this substance.

Embryotoxicity: No human embryotoxic effects have been described for Ethylene Dichloride.

Teratogenicity: No human teratogenicity effects have been described for Ethylene Dichloride.

Reproductive Toxicity: No human reproductive toxicity effects have been described for Ethylene Dichloride. Reproductive toxicity data are available for Ethylene Dichloride; these data were obtained during clinical studies on test animals exposed to this substance. The effects include uterine tumors and most-implantation mortality.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Conditions relating to the target organs may be aggravated by overexposures to Ethylene Dichloride. See Section 3 (Hazard Identification) for information on these conditions.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure. Be observant for pulmonary edema, and liver and kidney damage. Specific laboratory tests should include prothombine time, serum glucose, electrolytes, CBC, and tests for renal and liver function. Victims experiencing respiratory tract irritation should have arterial blood gases monitored and a chest X-ray is suggested. Pulmonary function test can be useful.

ACGIH BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Ethylene Dichloride.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Ethylene Dichloride will be degraded over time into other organic compounds. The following environmental data are available for Ethylene Dichloride:

Persistence: Biodegrades at moderate rate. Stable to water, acids, and some active chemicals. in presence of air, moisture, and light, becomes acidic, and darkens. 1,2-dichloroethane undergoes volatilization readily. The half-life is approximately 30-minutes at 25°C. Once volatilized, it undergoes oxidation by hydroxyl radicals to form chloracetyl chloride. The chloracetyl chloride is then hydrolyzed to hydrochloric acid and the carboxylic acid. The half-life for oxidation of 1,2-dichloroethane vapor ranges from 1.5 weeks to 4 months.

Biodegradation: Biodegradability tests with 1,2-dichloroethane resulted in little or no biodegradation in aerobic systems using sewage seed or activated sludge. The one river die-away test reported no degradation. The percent BOD produced in 5-10 days was 0-7% (2,3,4). Another investigator reported slow to moderate biodegradation activity. The extent of biodegradation is difficult to assess due to compound's susceptibility to volatilization. No degradation occurred in an acclimated anaerobic system after 4 months incubation.

Bioconcentration: 1,2-Dichloroethane is not expected to bioconcentrate in fish due to its low octanol/water partition function. The measured log BCF in bluegill sunfish is 0.30.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Ethylene Dichloride may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of Ethylene Dichloride are released). Refer to Section 11 (Toxicology Information).

EFFECT OF CHEMICAL ON AQUATIC LIFE: Ethylene Dichloride can be harmful or fatal to contaminated aquatic plant and animal life. The following aquatic toxicity data are available for Ethylene Dichloride.

LC_{50} (*Daphnia magna* water flea) 218,000 mg/L 48 hours (conditions of bioassay not specified)

LC_{50} (mysid shrimp) 113,000 mg/L/96 hours in salt water (conditions of bioassay not specified)

LC_{50} (*Gammarus fasciatus* scud) greater than 100 mg/L/96 hours at 21°C, age mature, static bioassay

LC_{50} (*Pteronarcys* stonefly) greater than 100 mg/L/96 hours at 15°C, second year class, static bioassay

LC_{50} (*Salmo gairdneri* rainbow trout) 225 mg/L/96 hours at 13°C, wt 1.8 g, static bioassay

LC_{50} (*Lepomis macrochirus* bluegill) 430 mg/L/96 hours (95% confidence limit 230-710 mg/L)

LC_{50} (*Lepomis macrochirus* bluegill) 600 mg/L/24 hours, static bioassay, temp 21-23°C, pH 7.9-6.5

LC_{50} (*Cyprinodon variegatus* sheepshead minnows) 130 ppm but ppm at 24 hours, 48 hours, 72 hours, and 96 hour

LC_{50} (*Pimephales promelas* fathead minnow) 136 mg/L/96 hours

LC_{50} (*Crangon crangon* brown shrimp) 75 mg/L/24 hours, 65 mg/L/48 hours, 65 mg/L/96 hours

LC_{50} (*Gobius minutus* gobi) 185 mg/L/60-minutes, 3 hours; and up to 96 hours in sea water at 15°C

LC_{50} (*Poecilia reticulata* guppy) 106 ppm/7 days

toxicity threshold (cell multiplication inhibition test): bacteria (*Pseudomonas putida*): 135 mg/L. Algae (*Microcystis aeruginosa*): 105 mg/L Green algae (*Scenedesmus quadricuda*): 719 mg/L. Protozoa (*Entosiphon sulcatum*): 1,127 mg/L.

NOEC (rainbow trout, bluegill): 24 hours = 5 mg/L

NOEC (*Limanda limanda* dab): 96 hours = 60 mg/L

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations or with regulations of Canada and its Provinces. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Ethylene dichloride
HAZARD CLASS NUMBER and DESCRIPTION:	3 (Flammable Liquid)
UN IDENTIFICATION NUMBER:	UN 1184
PACKING GROUP:	PG II
DOT LABEL(S) REQUIRED:	Primary Hazard: Flammable Liquid Subsidiary Hazard: Toxic Material

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 129

MARINE POLLUTANT: Ethylene Dichloride is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments. Also, there is an additional Hazard Class: 9.2 (Substance Hazardous to the Environment).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Ethylene Dichloride	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Ethylene Dichloride = 100 lb.

U.S. TSCA INVENTORY STATUS: Ethylene Dichloride is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Compliance with the OSHA Process Safety Standard (29 CFR 1910.119) may be applicable to operations involving the use of Ethylene Dichloride. Under this regulation Ethylene Dichloride is not listed in Appendix A; however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb. (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Ethylene Dichloride is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Ethylene Dichloride.
California - Permissible Exposure Limits for Chemical Contaminants: Ethylene Dichloride.
Florida - Substance List: *Ethylene* Dichloride.
Illinois - Toxic Substance List: Ethylene Dichloride.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Ethylene Dichloride.
Michigan Critical Materials Register: Ethylene Dichloride.
Minnesota - List of Hazardous Substances: Ethylene Dichloride.
Missouri - Employer Information/Toxic Substance List: Ethylene Dichloride.
New Jersey - Right to Know Hazardous Substance List: Ethylene Dichloride.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
Pennsylvania - Hazardous Substance List: No.
Rhode Island - Hazardous Substance List: Ethylene Dichloride.
Texas - Hazardous Substance List: Ethylene Dichloride.
***West Virginia* - Hazardous Substance List:** Ethylene Dichloride.
Wisconsin - Toxic and Hazardous Substances: Ethylene Dichloride.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Ethylene Dichloride is on the California Proposition 65 lists. WARNING: This product contains a chemical known to the State of California to cause cancer.

15. REGULATORY INFORMATION (Continued)

ANSI LABELING (per Z129.1): **WARNING!** FLAMMABLE LIQUID AND VAPOR. FLASH POINT = 13°C (56°F). HARMFUL IF INHALED. HARMFUL OR FATAL IF SWALLOWED. PROLONGED OR REPEATED SKIN CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. CHRONIC EXPOSURE MAY CAUSE ADVERSE EFFECTS ON THE RESPIRATORY SYSTEM, LIVER, KIDNEYS. CAN CAUSE DEATH IF TOO MUCH IS BREATHED. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. SUSPECTED CANCER HAZARD, BASED ON ANIMAL TESTS. Risk of cancer depends on concentration and duration of exposure. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Avoid contact with skin and clothing. Avoid exposure to vapor. Wash thoroughly after handling. FIRST-AID: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of fire, use water fog, foam, dry chemical, or CO_2. In case of spill: Absorb spill with inert materials (e.g. activated carbon, dry sand). Flush residual spill with water. Consult Material Safety Data Sheet for additional information.

ADDITIONAL CANADIAN REGULATIONS:

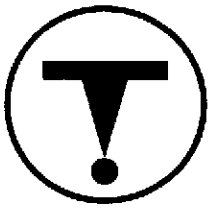
CANADIAN DSL/NDSL INVENTORY STATUS: Ethylene Dichloride is on the DSL Inventory.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Ethylene Dichloride is on the CEPA Priorities Substances Lists, as follows: First Priority Substances List; Toxic under CEPA Section 11 [25].

CANADIAN WHMIS SYMBOLS:

Class B2: Flammable Liquid
Class D2A/B: Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average **(TWA)**, the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level **(C)**. Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order. **IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration **(OSHA)**. NIOSH issues exposure guidelines called Recommended Exposure Levels **(RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association **(NFPA)**. Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo, LDLo**, and **LDo**, or **TC, TCo, LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information: BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **Ecological Information:** EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **U.S.: EPA** is the U.S. Environmental Protection Agency. **DOT** is the U.S. Department of Transportation. **SARA** is the Superfund Amendments and Reauthorization Act. **TSCA** is the U.S. Toxic Substance Control Act. **CERCLA (or Superfund)** refers to the Comprehensive Environmental Response, Compensation, and Liability Act. Labeling is per the American National Standards Institute **(ANSI Z129.1)**. **CANADA: CEPA** is the Canadian Environmental Protection Act. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **TC** is Transport Canada. **DSL/NDSL** are the Canadian Domestic/Non-Domestic Substances Lists.

MATERIAL SAFETY DATA SHEET

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Manufacturer: AccuStandard, Inc.
125 Market Street
New Haven, CT 06513

Date MSDS Printed: 1/12/2006
Preparation Date: 5/19/2004
Information Phone Number: 203-786-5290
Emergency Phone Number: 203-786-5290
Hours: Mon. to Fri. 8am-5pm EDT

MSDS Number: P-144S-10X
Product Name: Dinoseb
Synonyms: N/A
Formula: N/A

Molecular Weight: N/A

SECTION 2 - COMPOSITION / INFORMATION ON INGREDIENTS

Component(s) (2)	CAS #	Appr. %	ACGIH-TLV (mg/m3) TWA	ACGIH-TLV (mg/m3) STEL skin	OSHA-PEL (mg/m3) TWA	OSHA-PEL (mg/m3) STEL skin
Dinoseb	88-85-7	0.1%				
Methanol	67-56-1	99.9%	262	328 x	260	

SECTION 3 - HAZARDS IDENTIFICATION

Symptoms of Exposure:

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

Over exposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

May irritate skin on prolonged contact.

Potential Health Effects:

May cause eye, kidney, liver, and skin damage.

Toxic if inhaled, absorbed through skin, or swallowed.

May cause central nervous system, kidney, and liver damage.

Poison, May be fatal or cause blindness if swallowed.

Fetal development abnormalities and effects on embryo or fetus have been reported from prolonged exposure to methanol in laboratory tests involving pregnant rats.

Routes of Entry:

Inhalation, ingestion or skin contact.

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For full page MSDS please visit www.accustandard.com

Carcinogenicity:

This product is or contains a component that is not listed (ACGIH, IARC, NTP, OSHA) as a cancer causing agent.

SECTION 4 - FIRST AID MEASURES

Emergency First Aid:

Get medical assistance for all cases of overexposure.

Skin contact: Wash thoroughly with soap and water.

Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

Ingestion: Drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Remove contaminated clothing and wash before reuse.

SECTION 5 - FIRE FIGHTING MEASURES

Flammable Properties:

Flash Point: 52F (tcc)
Flammable Limits LEL (%): 6.7
Flammable Limits UEL (%): 36.5
Autoignition Temperature: N/A

Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

Extinguishing Media:

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

Fire Fighting Procedures:

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Spill Response:

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Keep container closed when not in use.

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For full page MSDS please visit www.accustandard.com

Store in a cool area away from ignition sources and oxidizers.

Do not breathe vapor or mist.

Do not get in eyes, on skin, or on clothing.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls and Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact.

(Butyl, viton or equivalent)

Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid
Odor: N/A
pH: N/A
Vapor Pressure: 97 20C
Vapor Density (Air = 1): 1.1
Boiling Point: 65
Melting Point: -98
Solubility in Water (%): Soluble
Specific Gravity (H_2O = 1): 0.791
Flash Point: 52F (tcc)
Explosion Limits (%): 6.7 to 36.5
Autoignition Temperature: N/A
Percent Volatile: 99.9+
Evaporation Rate (BuAc = 1): 5.9
Molecular Weight: N/A
Molecular Formula: N/A

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable
Conditions To Avoid: Heat, contact with ignition sources
Materials To Avoid: Acids
Oxidizers

Reactive metals
Hazardous Decomposition: CO>>x<<, Formaldehyde
Hazardous Polymerization: Does not occur

SECTION 11 - TOXICOLOGICAL INFORMATION

See section 3 for specific toxicological information for the ingredients of this product.

SECTION 12 - ECOLOGICAL INFORMATION

By complying with sections 6 and 7 there will be no release to the environment.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

DOT UN Number: UN1230 Shipping Class: 3 Packing Group: II CARCINOGENIC

SECTION 15 - REGULATORY INFORMATION

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:
WARNING: This product contains chemical(s) known to the state of California to cause cancer and to cause birth defects or other reproductive harm.

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make
NO WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

Legend : N/A = Not Available ND = Not Determined NR = Not regulated
* * * End of Document * * *

PRODUCT NAME: 13003-13023 COLOR COAT CLEAR AEROSOLS
PRODUCT CODE: CCCLRAEROMSDS **2 4 0 G**
Non Methylene Chloride formula

========== SECTION I - MANUFACTURER IDENTIFICATION ==========

MANUFACTURER'S NAME: SEM PRODUCTS, INC.
ADDRESS : 651 MICHAEL WYLIE DR.
CHARLOTTE, NC 28217

EMERGENCY PHONE : CHEMTRC 800-424-9300 DATE REVISED : 9/23/2002
INFORMATION PHONE : (800) 831-1122 NAME OF PREPARER : CG

========== SECTION II - HAZARDOUS INGREDIENTS/SARA III INFORMATION ==========

REPORTABLE COMPONENTS	CAS NUMBER	VAPOR PRESSURE mm Hg @ TEMP		WEIGHT PERCENT
ACETONE	67-64-1	186	68	40-45%
OSHA PEL: 1000 PPM, ACGIH TLV: 750 PPM, OTHER: N/A LD50: 9750MG/KG:RAT-ORL, LC50: N/A				
PROPANE (HYDROCARBON PROPELLANT)	74-98-6	108 PSIG	68	15-20%
OSHA PEL: 1000 PPM, ACGIH TLV: 1000 PPM, OTHER: N/A LD50: N/A, LC50: N/A				
* TOLUENE	108-88-3	22	68	5-10%
OSHA PEL: 100 PPM-8HR, STEL: 200 PPM, OTHER: 300 PPM CEILING LD50: 5000MG/KG:RAT-ORL, LC50: 5320PPM/8H:MUS-IHL				
ISOBUTYL ACETATE	110-19-0	12.8	68	5-10%
OSHA PEL: 150 PPM, ACGIH TLV: 150 PPM, OTHER: N/A LD50: 15GM/KG:RAT-ORL, LC50: N/A				
METHYL ISOBUTYL KETONE	108-10-1	16.00	68 F	5-10%
LD50: 2080MG/KG:RAT ORL LC50 23300MG/M3MUS-IHL OSHA PEL: 75PPM				
* METHYL ETHYL KETONE	78-93-3	70	68	1-5%
OSHA PEL: 200 PPM, ACGIH TLV: 200 PPM, OTHER: N/A LD50: 3400MG/KG:RAT-ORL, LC50: N/A				
1-METHOXY-2-PROPANOL ACETATE	108-65-6	3.7	68	1-5%
OSHA PEL: N/A, ACGIH TLV: N/A, OTHER: N/A LD50: N/A, LC50: N/A				
ETHYL 3- ETHOXYPROPIONATE (3-ETHOXYPROPIONATE)	763-69-9	1.11	77	1-5%
OSHA PEL: 50 PPM TWA, ACGIH TLV: 100 PPM, OTHER: N/A LD50: N/A, LC50: N/A				
ETHYLENE GLYCOL MONOPROPYL ETHER	2807-30-9	1.3	68	1-5%
OSHA PEL: N/A, ACGIH TLV: N/A, OTHER: N/A LD50: 4890MG/KG:RAT-ORL, LC50: 1530PPM/4H:MUS-IHL				

* Indicates toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.
WARNING: CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND/OR BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM. TSCA CERTIFICATION: All chemicals in this product are listed, or are exempt from listing on the TSCA inventory.

========== SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS ==========

BOILING RANGE: < 0 - 238 F **SPECIFIC GRAVITY (H2O=1): .75**
VAPOR DENSITY: HEAVIER THAN AIR **EVAPORATION RATE: FASTER THAN n-BUTYL ACETATE**

COATING V.O.C.: 5.25 lb/gl **MATERIAL V.O.C.: 3.23 lb/gl**

SOLUBILITY IN WATER: INSOLUBLE
APPEARANCE AND ODOR: CLEAR LIQUID - SOLVENT

========== SECTION IV - FIRE AND EXPLOSION HAZARD DATA ==========

FLASH POINT: PROPELLENT < 0 F METHOD USED: TCC
FLAMMABLE LIMITS IN AIR BY VOLUME- LOWER: 1.0 UPPER: 13.0

EXTINGUISHING MEDIA: FOAM, ALCOHOL FOAM, CO2, DRY CHEMICAL, WATER FOG

SPECIAL FIREFIGHTING PROCEDURES
WATER SPRAY MAY BE INEFFECTIVE, BUT MAY BE USED TO COOL CONTAINERS EXPOSED TO HEAT. WEAR SELF-CONTAINED BREATHING APPARATUS.

UNUSUAL FIRE AND EXPLOSION HAZARDS
VAPORS MAY IGNITE EXPLOSIVELY. EXPOSURE TO HEAT OR PROLONGED EXPOSURE TO SUN MAY CAUSE BURSTING. DO NOT EXPOSE TO HEAT OR STORE AT TEMPERATURES ABOVE 120 F DO NOT PUNCTURE OR INCINERATE (BURN) CONTAINER.

========== SECTION V - REACTIVITY DATA ==========

STABILITY: STABLE
CONDITIONS TO AVOID
EXCESSIVE HEAT, OPEN FLAMES, SPARK SOURCES

INCOMPATIBILITY (MATERIALS TO AVOID)
OXIDIZING AGENTS

HAZARDOUS DECOMPOSITION OR BYPRODUCTS
CARBON DIOXIDE, CARBON MONOXIDE, VARIOUS HYDROCARBONS, OXIDES OF NITROGEN

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

========== SECTION VI - HEALTH HAZARD DATA ==========

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
NASAL AND RESPIRATORY IRRITATION, DIZZINESS, HEADACHE, NAUSEA, POSSIBLE UNCONSCIOUSNESS, AND ASPHYXIATION.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE
MODERATE IRRITATION, REDNESS, ITCHING AND BLURRED VISION. EXCESSIVE SKIN EXPOSURE MAY CAUSE BURNING SENSATION.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
MODERATE IRRITATION, REDNESS, DERMATITIS.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
GASTROINTESTINAL IRRITATION, VOMITING, DIARRHEA.

HEALTH HAZARDS (ACUTE AND CHRONIC)
EYES: IRRITATION, BLURRED VISION. SKIN: MODERATE IRRITATION, DERMATITIS. INHALATION: NASAL AND RESPIRATORY IRRITATION, NAUSEA, POSSIBLE UNCONSCIOUSNESS, ASPHYXIATION. INGESTION: GASTROINTESTINAL IRRITATION, VOMITING, DIARRHEA. CNS: INTOXICATION CAUSING SLIGHT EUPHORIA, DIZZINESS AND HEADACHE. OTHER: OVEREXPOSURE TO ETHYLENE GLYCOL MONOPROPYL ETHER CAN AFFECT LIVER AND KIDNEYS

CARCINOGENICITY: NTP CARCINOGEN: No IARC MONOGRAPHS: No OSHA REGULATED: No

N/A

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
BRONCHITIS, CNS DISORDERS, ALLERGIES, NAUSEA.

EMERGENCY AND FIRST AID PROCEDURES
EYES: FLUSH WITH LARGE AMOUNTS OF WATER LIFTING UPPER AND LOWER LIDS. GET MEDICAL ATTENTION. SKIN: THOROUGHLY WASH EXPOSED AREA WITH SOAP AND WATER. INHALATION: REMOVE TO FRESH AIR, GIVE ARTIFICIAL RESPIRATION IF NECESSARY. INGESTION KEEP PERSON WARM AND QUIET. SEEK IMMEDIATE MEDICAL ADVICE REGARDING INDUCTION OF VOMITING.

========== SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE ==========

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
REMOVE ALL SOURCES OF IGNITION. ALLOW VOLATILE PORTION TO EVAPORATE COMPLETELY. AVOID BREATHING VAPORS AND REMOVE WITH INERT ABORBENT.

WASTE DISPOSAL METHOD
DO NOT INCINERATE. DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATION. DO NOT CONTAMINATE LAKES, STREAMS OR OTHER WATER SUPPLY.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
DO NOT STORE OR USE NEAR HEAT, SPARKS OR FLAME. STORE IN WELL VENTILATED AREA. KEEP CLOSURE TIGHT AND CONTAINER UPRIGHT TO PREVENT LEAKAGE. DO NOT PUNCTURE OR INCINERATE. DO NOT SPRAY NEAR FIRE OR OPEN FLAMES.

OTHER PRECAUTIONS
REPORTS HAVE ASSOCIATED REPEATED AND PROLONGED OCCUPATIONAL OVER-EXPOSURE TO SOLVENTS WITH PERMANENT BRAIN AND NERVOUS SYSTEM DAMAGE. INTENTIONAL MISUSE BY DELIBERATELY CONCENTRATING AND INHALING THE CONTENTS MAY BE HARMFUL OR FATAL. AVOID SPONTANEOUS COMBUSTION OF CONTAMINATED RAGS OR OTHER IGNITABLE MATERIAL BY IMMEDIATE IMMERSION IN WATER. KEEP OUT OF THE REACH OF CHILDREN.

========== SECTION VIII - CONTROL MEASURES ==========

RESPIRATORY PROTECTION
USE OF A NIOSH APPROVED CHEMICAL/MECHANICAL FILTER, DESIGNED TO REMOVE A COMBINATION OF PARTICLES AND VAPOR.

VENTILATION
PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW TLV(S).

PROTECTIVE GLOVES
NEOPRENE OR BUTYL RUBBER GLOVES.

EYE PROTECTION
GOGGLES OR SIDE-SHIELD SAFETY GLASSES.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT
TO PREVENT REPEATED OR PROLONGED SKIN CONTACT, WEAR IMPERVIOUS CLOTHING AND BOOTS. WASH CONTAMINATED CLOTHING BEFORE RE-USE.

WORK/HYGIENIC PRACTICES
WASH HANDS BEFORE EATING, SMOKING OR USING THE WASHROOM.

========== SECTION IX - DISCLAIMER ==========

THE INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE AND RELIABLE AS OF THE DATE INDICATED ABOVE, HOWEVER SEM PRODUCTS, INC., MAKES NO REPRESENTATION, WARRANTY OR GUARANTEE NOR ASSUMES ANY LEGAL RESPONSIBILITY AS TO ITS ACCURACY, RELIABILITY OR COMPLETENESS. ULTIMATE DETERMINATION OF SUITABILITY FOR INTENDED USE IS THE RESPONSIBILITY OF THE USER.

The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

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p-Nitrophenol
1066CR Revised 27-JUN-1989

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

Corporate MSDS Number	: DU000305
CAS Number	: 100-02-7
Formula	: NO2C6H4-OH
Molecular Weight	: 139.11
CAS Name	: PHENOL, 4-NITRO-
Grade	: TECHNICAL

Tradenames and Synonyms

PNP
4-Hydroxynitrobenzene

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS

Product Information	: 1-800-441-7515 (outside the U.S. 302-774-1000)
Transport Emergency	: CHEMTREC 1-800-424-9300(outside U.S. 703-527-3887)
Medical Emergency	: 1-800-441-3637 (outside the U.S. 302-774-1000)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
*P-NITROPHENOL	100-02-7	99

* Disclosure as a toxic chemical is required under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

HAZARDS IDENTIFICATION

Potential Health Effects

Harmful if inhaled, swallowed or absorbed through skin; reduces blood's oxygen carrying capacity. Symptoms may be delayed. Causes eye and skin irritation.

HUMAN HEALTH EFFECTS

Overexposure may initially include: skin irritation with discomfort or rash; nonspecific discomfort such as nausea, headache, or weakness; reduction of the blood's oxygen carrying capacity with cyanosis (bluish discoloration), weakness, or shortness of breath by formation of methemoglobin; abnormal blood forming system function with anemia, or red blood cell destruction. There are no reports of human sensitization.

Individuals with preexisting diseases of the cardiovascular system or bone marrow may have increased susceptibility to the toxicity of excessive exposures.

In its "Notice of Intent to Establish", ACGIH gives a BEI for methemoglobin inducers of 1.5% methemoglobin in blood.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

If inhaled: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

If swallowed: Induce vomiting immediately by giving two glasses of water and sticking finger down throat. Call a physician. Never give anything by mouth to an unconscious person.

In case of contact: Immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse and destroy contaminated shoes.

Note to Physician:

Absorption of this product into the body leads to the formation of methemoglobin which, in sufficient

(FIRST AID MEASURES - Continued)

concentration causes cyanosis. In case of skin absorption, symptoms may be delayed. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of body including scalp and nails is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, 1 mg/kg of body weight, may be of value. Cyanocobalamin (Vitamin B-12), 1 mg intramuscularly, will speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposures.

FIRE FIGHTING MEASURES

Flammable Properties

Autoignition : 283 C (541 F)

Fire and Explosion Hazards:

PNP will burn and may release hazardous oxides of nitrogen.

Extinguishing Media

Small fires: Water, carbon dioxide (CO2)
Large fires: Water, water spray

Fire Fighting Instructions

Isolate hazard and evacuate area. Stay upwind and avoid smoke and fumes. Use water spray to cool containers. p-Nitrophenol provides its own oxygen for combustion; flood fire with water. If smoke and fumes cannot be avoided wear chemical proof suit with hood and breathing air supply. Fight fire from maximum distance. Use caution in approaching large or advanced fire; product may decompose violently. Run-off from fire may cause pollution.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

(ACCIDENTAL RELEASE MEASURES - Continued)

Accidental Release Measures

Sweep up spillage; transfer to covered metal containers for disposal. Flush spill area with detergent and water. Comply with Federal, State, and Local regulations on reporting releases.

HANDLING AND STORAGE

Handling (Personnel)

Avoid breathing vapor or dust. Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling.

Storage

Store inside a cool place away from heat, sparks, and flame. Keep containers dry and tightly closed. Do not store with flammable or oxidizing materials. Handle in a manner to prevent human contact. Do not roll drums on side.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Good general ventilation should be provided to minimize contact with vapors of dust.

Personal Protective Equipment

Have available and wear as appropriate: hard hat with brim; safety spectacles (side shields preferred); chemical splash goggles; full length face shield; Butyl Rubber gauntlet gloves, apron, and safety shoes, or Butyl Rubber boots over leather shoes. If there is a possibility of direct contact with dust or vapor, wear a Butyl Rubber suit with hood and breathing air supply.

Exposure Guidelines

Exposure Limits
p-Nitrophenol

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Boiling Point	: Decomposes
Vapor Pressure	: 0.6 mm Hg @ 120 C (248 F) 6.9 mm Hg @ 165 C (329 F)
Melting Point	: 114 C (237 F)
Evaporation Rate	: <1 (Butyl Acetate = 1)
Solubility in Water	: 3.3 WT% @ 40 C (104 F) 4.3% wt @ 50 deg C (122 deg F)
pH	: 4.1 (Water extract)
Odor	: Phenolic
Form	: Solid, flakes
Color	: Buff
Specific Gravity	: 1.48 at 20 C (68 F) 1.27 at 120 C (248 F)

STABILITY AND REACTIVITY

Chemical Stability

Stable at normal temperatures and storage conditions.

Decomposes if overheated.

Incompatibility with Other Materials

Incompatible with oxidizing agents.

Decomposition

May release hazardous smoke, fumes, and nitrogen oxide gases if overheated.

Polymerization

Polymerization will not occur.

TOXICOLOGICAL INFORMATION

Animal Data

Skin Absorption ALD: 1,500-2,000 mg/kg in rabbits
Oral LD50: 350 mg/kg in rats

The compound is a skin and eye irritant. Tests for mutagenic activity in bacterial or mammalian cell cultures have been inconclusive, with positive results in some studies, and negative results in others.

ECOLOGICAL INFORMATION

Ecotoxicological Information

Aquatic Toxicity

PNP is slightly toxic (96 hour LC50 - 50-500 mg/L)
96 hour LC50, fathead minnows: 61 mg/L

DISPOSAL CONSIDERATIONS

Waste Disposal

Comply with Federal, State, and Local regulations. If approved, may be incinerated or transferred to a disposal contractor. Very dilute solutions are biodegradeable by specially acclimated bacteria.

TRANSPORTATION INFORMATION

Shipping Information

DOT
Proper Shipping Name : RQ, HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class : ORM-E
I.D. No. (UN/NA) : NA 9188

DOT/IMO
Proper Shipping Name : NITROPHENOLS
Hazard Class : POISON B, 6.1
UN No. : UN 1663

Shipping Containers

Fiber drums
Reportable Quantity : 100 lbs./45.4 kg.

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Reported/Included.

Superfund reportable discharge = 100 lb.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : Yes
Chronic : Yes
Fire : No
Reactivity : No
Pressure : No

(REGULATORY INFORMATION - Continued)

Lists:

Extremely Hazardous Substance	-	No
CERCLA Hazardous Substance	-	Yes
Toxic Chemical	-	Yes

OTHER INFORMATION

NFPA, NPCA-HMIS

NFPA Rating	
Health	: 3
Flammability	: 1
Reactivity	: 0
NPCA-HMIS Rating	
Health	: 2
Flammability	: 1
Reactivity	: 1

Personal Protection rating to be supplied by user depending on use conditions.

Additional Information

For further information, see DuPont "p-Nitrophenol, Technical" Data Sheet.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : J. C. Watts
Address : DuPont Company, C & P Dept.
P. O. Box 80709, Chestnut Run
Wilmington, De 19880-0709
Telephone : 302-999-4946

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

Valid 11/1999 - 01/2000

Sigma Chemical Co.
P.O. Box 14508
St. Louis, MO 63178 USA
Tel: 314-771-5765

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -

CATALOG #: P1045

NAME: PENTACHLOROPHENOL

SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -

CAS #: 87-86-5

MF: C6HCL5O

EC NO: 201-778-6

SYNONYMS

AD 73 * CHEM-PENTA * CHEM-TOL * CHLON * CHLOROPHEN * CM 613 * CP 1309 * DOWICIDE 7 * DOWICIDE EC-7 * DOW PENTACHLOROPHENOL DP-2 ANTIMICROBIAL * DUROTOX * EP 30 * FUNGIFEN * GRUNDIER ARBEZOL * 1-HYDROXYPENTACHLOROBENZENE * LAUXTOL * LAUXTOL A * LIROPREM * MB 333 * NCI-C54933 * NCI-C55378 * NCI-C56655 * PCP (PESTICIDE) * PENCHLOROL * PENTA * PENTACHLOORFENOL (DUTCH) * PENTACHLOROFENOL * PENTACLOROFENOLO (ITALIAN) * PENTACHLOROPHENOL * 2,3,4,5,6-PENTACHLOROPHENOL * PENTACHLOROPHENOL (ACGIH:OSHA) * PENTACHLOROPHENOL, DP-2 * PENTACHLORPHENOL (GERMAN) * PENTACON * PENTA-KIL * PENTA READY * PENTA WR * PENWAR * PERATOX * PERMACIDE * PERMAGARD * PERMASAN * PERMATOX DP-2 * PERMATOX PENTA * PERMITE * POLE TOPPER FLUID * POL NU * PREVENTOL P * RCRA WASTE NUMBER U242 * SANTOPHEN 20 * THOMPSON'S WOOD FIX * WEEDONE * WITOPHEN P * WOODTREAT A *

SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -

LABEL PRECAUTIONARY STATEMENTS

HIGHLY TOXIC (USA)

TOXIC (EU)

TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.

POSSIBLE RISK OF HARM TO THE UNBORN CHILD.

POSSIBLE RISK OF IRREVERSIBLE EFFECTS.

IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.

CALIF. PROP. 65 CARCINOGEN.

POSSIBLE MUTAGEN.

READILY ABSORBED THROUGH SKIN.

TARGET ORGAN(S):

LIVER

KIDNEYS

AVOID EXPOSURE - OBTAIN SPECIAL INSTRUCTIONS BEFORE USE.

IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).

WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.

DO NOT BREATHE DUST.

SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL

RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

SECTION 5. - - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -

EXTINGUISHING MEDIA

WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

SPECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS

EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

SECTION 6. - - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -

EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH DRY LIME OR SODA ASH, PICK UP, KEEP IN A CLOSED CONTAINER AND HOLD FOR WASTE DISPOSAL.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - -

REFER TO SECTION 8.

ADDITIONAL INFORMATION

MAY BE CONTAMINATED WITH A MIXTURE OF POLYCHLOROBENZODIOXINS.

SECTION 8. - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
SAFETY SHOWER AND EYE BATH.
USE ONLY IN A CHEMICAL FUME HOOD.
DO NOT BREATHE DUST.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THOROUGHLY AFTER HANDLING.
KEEP TIGHTLY CLOSED.
STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -

APPEARANCE AND ODOR

OFF-WHITE POWDER

PHYSICAL PROPERTIES

BOILING POINT: 310 C
MELTING POINT: 188 C TO 191 C
VAPOR PRESSURE: 40MM 211.2 C
SOLUBILITY:

WATER -INSOLUBLE	ETHANOL -SOLUBLE
ETHER -SOLUBLE	ACETONE -SOLUBLE
BENZENE -SOLUBLE	PINE OIL: SOLUBLE

CARBON TETRACHLORIDE: SLIGHTLY

SPECIFIC GRAVITY: 1.978
VAPOR DENSITY: 9.2

SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -

INCOMPATIBILITIES

STRONG OXIDIZING AGENTS
STRONG BASES
ACID CHLORIDES
ACID ANHYDRIDES

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE
HYDROGEN CHLORIDE GAS

HAZARDOUS POLYMERIZATION

WILL NOT OCCUR.

SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - - -

ACUTE EFFECTS

MAY BE FATAL IF INHALED, SWALLOWED, OR ABSORBED THROUGH SKIN.
CAUSES EYE AND SKIN IRRITATION.
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
EXPOSURE CAN CAUSE:
CONVULSIONS
DERMATITIS
READILY ABSORBED THROUGH SKIN.

CHRONIC EFFECTS

THE EVIDENCE FOR CARCINOGENICITY OF PENTACHLOROPHENOL (PCP) IS BASED ON ASSAYS THAT UTILIZED LESS THAN PURE PCP. CONTAMINANTS OF PCP INCLUDE: TRI- OR TETRA- CHLOROPHENOL, HEXACHLOROBENZENE, POLYCHLORINATED DIBENZO-P-DIOXINS OR POLYCHLORINATED DIBENZOFURANS. INDICATIONS ARE THAT POSITIVE EVIDENCE FOR CARCINOGENICITY IS FROM THE CONTAMINANT(S) AND NOT THE PCP.
LABORATORY EXPERIMENTS HAVE SHOWN MUTAGENIC EFFECTS.
OVEREXPOSURE MAY CAUSE REPRODUCTIVE DISORDER(S) BASED ON TESTS WITH LABORATORY ANIMALS.
TARGET ORGAN(S):
LIVER
KIDNEYS
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.

RTECS #: SM6300000
PHENOL, PENTACHLORO-

IRRITATION DATA

SKN-RBT 10 MG/24H OPEN MLD	AIHAAP 23,95,1962
EYE-RBT 100 UL/24 MLD	NTIS** OTS0546023

TOXICITY DATA

ORL-MAN LDLO:401 MG/KG	EESADV 1,343,1977
ORL-RAT LD50:27 MG/KG	JPETAB 76,104,1942
IHL-RAT LC50:355 MG/M3	GTPZAB 13(9),58,1969
SKN-RAT LD50:96 MG/KG	GTPZAB 13(9),58,1969
IPR-RAT LD50:56 MG/KG	BJPCAL 13,20,1958
ORL-MUS LD50:36 MG/KG	ARTODN 40,63,1978
IHL-MUS LC50:225 MG/M3	GTPZAB 13(9),58,1969
IPR-MUS LD50:32 MG/KG	ARTODN 40,63,1978
UNR-DOG LD50:70 MG/KG	PHPHA6 1,3,1953
UNR-GPG LD50:100 MG/KG	PHPHA6 1,3,1953
ORL-HAM LD50:168 MG/KG	TXAPA9 48,A192,1979
ORL-GRB LD50:294 MG/KG	ARTODN 40,63,1978
ORL-DCK LD50:380 MG/KG	DOEAAH 35,25,1979
UNR-FRG LD50:36 MG/KG	PHPHA6 1,3,1953

TARGET ORGAN DATA

BEHAVIORAL (CONVULSIONS OR EFFECT ON SEIZURE THRESHOLD)
BEHAVIORAL (EXCITEMENT)
BEHAVIORAL (CHANGE IN MOTOR ACTIVITY)
BEHAVIORAL (MUSCLE WEAKNESS)
BEHAVIORAL (MUSCLE CONTRACTION OR SPASTICITY)
VASCULAR (BP ELEVATION NOT CHARACTERIZED IN AUTONOMIC SECTION)
LUNGS, THORAX OR RESPIRATION (DYSPNAE)
LUNGS, THORAX OR RESPIRATION (TUMORS)
LIVER (TUMORS)
KIDNEY, URETER, BLADDER (URINE VOLUME INCREASED)
ENDOCRINE (HYPERGLYCEMIA)
SKIN AND APPENDAGES (SWEATING)
EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)
EFFECTS ON EMBRYO OR FETUS (FETAL DEATH)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (HOMEOSTASIS)
EFFECTS ON NEWBORN (DELAYED EFFECTS)
NUTRITIONAL AND GROSS METABOLIC (BODY TEMPERATURE INCREASE)
TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA)

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - -

DATA NOT YET AVAILABLE.

SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - - -

DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - - -

CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - -

EUROPEAN INFORMATION

EC INDEX NO: 604-002-00-8

TOXIC

R 24/25

TOXIC IN CONTACT WITH SKIN AND IF SWALLOWED.

R 26

VERY TOXIC BY INHALATION.

R 36/37/38

IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.

R 40

POSSIBLE RISK OF IRREVERSIBLE EFFECTS.

R 50/53

VERY TOXIC TO AQUATIC ORGANISMS, MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT.

S 22

DO NOT BREATHE DUST.

S 36/37

WEAR SUITABLE PROTECTIVE CLOTHING AND GLOVES.

S 45

IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).

S 52

NOT RECOMMENDED FOR INTERIOR USE ON LARGE SURFACE AREAS.

S 60

THIS MATERIAL AND ITS CONTAINER MUST BE DISPOSED OF AS HAZARDOUS WASTE.

S 61

AVOID RELEASE TO THE ENVIRONMENT. REFER TO SPECIAL INSTRUCTIONS/ SAFETY DATA SHEETS.

REVIEWS, STANDARDS, AND REGULATIONS

OEL=MAK

ACGIH TLV-ANIMAL CARCINOGEN	DTLVS* TLV/BEI,1997
ACGIH TLV-TWA 0.5 MG/M3 (SKIN)	DTLVS* TLV/BEI,1997
IARC CANCER REVIEW:HUMAN LIMITED EVIDENCE	IMEMDT 41,319,1986
IARC CANCER REVIEW:ANIMAL SUFFICIENT EVIDENCE	IMEMDT 53,371,1991
IARC CANCER REVIEW:ANIMAL INADEQUATE EVIDENCE	IMEMDT 20,303,1979
IARC CANCER REVIEW:HUMAN INADEQUATE EVIDENCE	IMEMDT 53,371,1991
IARC CANCER REVIEW:GROUP 2B	IMEMDT 53,371,1991

EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION
FEREAC 54,7740,1989

MSHA STANDARD-AIR:TWA 0.5 MG/M3 (SKIN)
DTLVS* 3,198,1971

OSHA PEL (GEN INDU):8H TWA 0.5 MG/M3 (SKIN)
CFRGBR 29,1910.1000,1994

OSHA PEL (CONSTRUC):8H TWA 0.5 MG/M3 (SKIN)
CFRGBR 29,1926.55,1994

OSHA PEL (SHIPYARD):8H TWA 0.5 MG/M3 (SKIN)
CFRGBR 29,1915.1000,1993

OSHA PEL (FED CONT):8H TWA 0.5 MG/M3 (SKIN)
CFRGBR 41,50-204.50,1994

OEL-AUSTRALIA:TWA 0.5 MG/M3;SKIN JAN 1993

OEL-AUSTRIA: SKIN, CARCINOGEN, JAN1999
OEL-BELGIUM:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-DENMARK: TWA 0.005 PPM (0.05 MG/M3), SKIN, JAN1999
OEL-FINLAND:TWA 0.5 MG/M3;STEL 1.5 MG/M3;SKIN JAN 1993
OEL-GERMANY:TWA 0.005 PPM (0.05 MG/M3);SKIN JAN 1993
OEL-JAPAN: OEL 0.5 MG/M3, SKIN, JAN1999
OEL-HUNGARY:TWA 0.2 MG/M3;STEL 0.4 MG/M3;SKIN JAN 1993
OEL-JAPAN:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-THE NETHERLANDS:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-POLAND: MAC(TWA) 0.5 MG/M3, MAC(STEL) 1.5 MG/M3, JAN1999
OEL-THE PHILIPPINES:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-RUSSIA:STEL 0.1 MG/M3;SKIN JAN 1993
OEL-SWEDEN:TWA 0.5 MG/M3;STEL 1.5 MG/M3;SKIN JAN 1993
OEL-SWITZERLAND:TWA 0.05 PPM (0.5 MG/M3);STEL 0.1 PPM;SKIN JAN 1993
OEL-TURKEY:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-UNITED KINGDOM:TWA 0.5 MG/M3;STEL 1.5 MG/M3;SKIN JAN 1993
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV
NIOSH REL TO PENTACHLOROPHENOL-AIR:10H TWA 0.5 MG/M3 (SK)
NIOSH* DHHS #92-100,1992
NOHS 1974: HZD 54160; NIS 47; TNF 3548; NOS 42; TNE 29154
NOES 1983: HZD 54160; NIS 29; TNF 2248; NOS 38; TNE 26806; TFE 4191
ATSDR TOXICOLOGY PROFILE (NTIS** PB/90/182163/AS)
EPA GENETOX PROGRAM 1988, POSITIVE: CELL TRANSFORM.-SA7/SHE; S CEREVISIAE GENE CONVERSION
EPA GENETOX PROGRAM 1988, POSITIVE: S CEREVISIAE-FORWARD MUTATION
EPA GENETOX PROGRAM 1988, NEGATIVE: HOST-MEDIATED ASSAY; MOUSE SPOT TEST
EPA GENETOX PROGRAM 1988, NEGATIVE: HISTIDINE REVERSION-AMES TEST; S CEREVISIAE-HOMOZYGOSIS
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JUNE 1999
NIOSH ANALYTICAL METHOD, 1994: PENTACHLOROPHENOL, 5512; IN BLOOD, 8001; IN URINE, 8303
NTP CARCINOGENESIS STUDIES (FEED);CLEAR EVIDENCE;MOUSE
NTPTR* NTP-TR-349,1989
OSHA ANALYTICAL METHOD #39

U.S. INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS - CHLOROPHENOLS.
CALIFORNIA PROPOSITION 65:
THIS PRODUCT IS OR CONTAINS CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

SECTION 16. - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - - -

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

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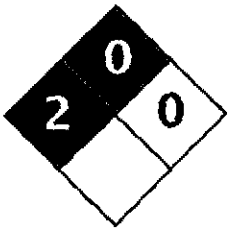

Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP.
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States]
TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States]
TWA: 170 (mg/m3) from OSHA (PEL) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane.
It dissolves in most of the fixed and volatile oils.
Solubility in water: 0.015 g/100 ml @ 25 deg. C
It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents.
Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium.
Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 2629 mg/kg [Rat].
Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract,

skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation.
Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc:
LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg
LDL [Dog] - Route: Oral; Dose: 4000 mg/kg
LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic).
May affect genetic material (mutagenic).
May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts.
Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain.
Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema
Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation.
Chronic Potential Health Effects:
Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation.
Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene
Connecticut hazardous material survey.: Tetrachloroethylene
Illinois toxic substances disclosure to employee act: Tetrachloroethylene
Illinois chemical safety act: Tetrachloroethylene
New York release reporting list: Tetrachloroethylene
Rhode Island RTK hazardous substances: Tetrachloroethylene
Pennsylvania RTK: Tetrachloroethylene
Minnesota: Tetrachloroethylene
Michigan critical material: Tetrachloroethylene
Massachusetts RTK: Tetrachloroethylene
Massachusetts spill list: Tetrachloroethylene
New Jersey: Tetrachloroethylene
New Jersey spill list: Tetrachloroethylene
Louisiana spill reporting: Tetrachloroethylene
California Director's List of Hazardous Substances: Tetrachloroethylene
TSCA 8(b) inventory: Tetrachloroethylene
TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97
SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene
CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects.
R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S23- Do not breathe gas/fumes/vapour/spray
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S37- Wear suitable gloves.
S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:29 PM

Last Updated: 10/10/2005 08:29 PM

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SIGMA-ALDRICH

MATERIAL SAFETY DATA SHEET

Date Printed: 08/10/2006
Date Updated: 01/31/2006
Version 1.5

Section 1 - Product and Company Information

Product Name	1,1,1,2-TETRACHLOROETHANE
Product Number	46254
Brand	RIEDEL
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
1,1,1,2-TETRACHLOROETHANE	630-20-6	Yes

Formula	C2H2Cl4
Synonyms	NCI-C52459 * RCRA waste number U208 * 1,1,1,2-Tetrachloroethane
RTECS Number:	KI8450000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Harmful.
Harmful if swallowed. Limited evidence of a carcinogenic effect.
Risk of serious damage to eyes.
Possible Carcinogen (US). Target organ(s): Liver. Kidneys.

HMIS RATING

HEALTH: 2*
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING

HEALTH: 2
FLAMMABILITY: 0
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE

If inhaled, remove to fresh air. If breathing becomes difficult,

call a physician.

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.
Store at 2-8°C

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Safety shower and eye bath. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose

combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash thoroughly after handling.

Section 9 - Physical/Chemical Properties

Appearance	Color: Colorless Form: Clear liquid	
Property	Value	At Temperature or Pressure
Molecular Weight	167.85 AMU	
pH	N/A	
BP/BP Range	138 °C	
MP/MP Range	- 70.2 °C	
Freezing Point	N/A	
Vapor Pressure	14 mmHg	25 °C
Vapor Density	N/A	
Saturated Vapor Conc.	N/A	
SG/Density	1.553 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	Log Kow: 2.66	
Decomposition Temp.	N/A	
Explosion Limits	N/A	
Flammability	N/A	
Autoignition Temp	N/A	
Refractive Index	1.483	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	Solubility in Water:Slightly. Other Solvents: ALCOHOL, ETHER, ACETONE	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Strong oxidizing agents, Strong bases.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Hydrogen chloride gas.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: May cause skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: Causes severe eye irritation.
Inhalation: Material may be irritating to mucous membranes and upper respiratory tract. May be harmful if inhaled.
Ingestion: Harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)
Nerves. Kidneys. Liver.

SIGNS AND SYMPTOMS OF EXPOSURE
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA

Oral
Rat
670 mg/kg
LD50

Inhalation
Rat
2,100 ppm
LC50
Remarks: Gastrointestinal:Hypermotility, diarrhea.

Oral
Mouse
1500 mg/kg
LD50

Intraperitoneal
Mouse
1275 MG/KG
LD50

Inhalation
Rabbit
2,800 ppm
LC50
Remarks: Gastrointestinal:Hypermotility, diarrhea.

Skin
Rabbit
20000 mg/kg
LD50

IRRITATION DATA

Skin
Rabbit
500 mg
24H

Eyes
Rabbit
100 mg
Remarks: Severe irritation effect

CHRONIC EXPOSURE - CARCINOGEN

Result: This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

IARC CARCINOGEN LIST

Rating: Group 3

CHRONIC EXPOSURE - MUTAGEN

Species: Mouse
Dose: 200 MG/L (+S9)
Cell Type: lymphocyte
Mutation test: Mutation in microorganisms

Species: Mouse
Route: Oral
Dose: 1 GM/KG
Mutation test: Other mutation test systems

Species: Mouse
Dose: 200 MG/L
Cell Type: lymphocyte
Mutation test: Mutation in mammalian somatic cells.

Species: Hamster
Dose: 158 MG/L
Cell Type: ovary
Mutation test: Sister chromatid exchange

Species: Human
Dose: 100 MG/L
Cell Type: lung
Mutation test: SLN

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Daphnia
Species: Daphnia magna
Time: 48 h
Value: 17.0 - 30.0 mg/l

Test Type: LC50 Fish
Species: Lepomis macrochirus (Bluegill)
Time: 96 h
Value: 16.0 - 24.0 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Toxic, liquids, organic, n.o.s.

UN#: 2810
Class: 6.1
Packing Group: Packing Group III
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: Toxic liquid, organic, n.o.s.
IATA UN Number: 2810
Hazard Class: 6.1
Packing Group: III

Section 15 - Regulatory Information

EU ADDITIONAL CLASSIFICATION
Symbol of Danger: Xn
Indication of Danger: Harmful.
R: 22-40-41
Risk Statements: Harmful if swallowed. Limited evidence of a carcinogenic effect. Risk of serious damage to eyes.
S: 26-36
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Harmful.
Risk Statements: Harmful if swallowed. Risk of serious damage to eyes. Limited evidence of a carcinogenic effect.
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing.
US Statements: Possible Carcinogen (US). Target organ(s): Liver. Kidneys.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
DEMINIMIS: 1 %
NOTES: This product is subject to SARA section 313 reporting requirements.
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or

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Cerilliant
Science. Down to a science.

MATERIAL SAFETY DATA SHEET

IDENTITY: **Toxaphene**

SECTION I

Manufacturer: Cerilliant Corporation
811 Paloma, Suite A
Round Rock, TX 78664

Emergency Telephone Number: (512) 238-9974
Date Prepared: March 2, 2006

SECTION II - HAZARDOUS COMPONENTS/IDENTITY INFORMATION

Hazardous Components	Synonyms	CAS Number	%
Toxaphene	M 5055; Agricide; agricide maggot killer (f); alltex; Alltox; attac 4-2; attac 4-4; attac 6; attac 6-3; attac 8; camphechlor; Campheclor; Camphene, chlorinated; camphochlor; camphoclor; camphofene huileux; chem-phene; Chlorocamphene; Chlorinated Camphene; Chlorinated Camphenes; CHLORINATED CAMPHENE (TOXAPHENE) (CAMPHECHOR); chlorinated champhene; clor chem t-590; compound 3956; Coopertox; crestoxo; cristoxo; cristoxo 90; estonox; fasco-terpene; Geniphene; gy-phene; Hercules 3956; hercules toxaphene; kamfochlor; melipax; Motox; octachlorocamphene; Penphene; phenacide; Phenatox; polychlorocamphene; Polychlorinated camphenes; Polychorinated camphenes; Strobane-T; strobane t-90; toxadust; toxakil; toxaphene; Toxaphene ; toxon 63; toxyphen; vertac toxaphene 90	8001-35-2	100

SECTION III – Hazard Identification

Toxic. Dangerous for the environment. Harmful in contact with skin. Toxic if swallowed. Irritating to respiratory system and skin. Limited evidence of a carcinogenic effect. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

SECTION IV – First Aid Measures

Eye Contact: Flush eyes with copious amounts of water for a minimum of 15 minutes and transport to a medical facility.
Ingestion: Do not induce vomiting. Give victim large quantities of liquid and transport to a medical facility.
Skin Contact: Wash affected areas with copious amounts of water and transport to a medical facility.
Inhalation: Remove to fresh air. If breathing is disturbed, give artificial respiration while transporting to a medical facility.

SECTION V- Fire Fighting Measures

Flash Point: N/A
Method Used: N/A

Flammable Limits
LEL: N/A **UEL:** N/A

Extinguishing Media: Dry chemical, carbon dioxide or Halon extinguisher
Special Fire Fighting Procedures: Wear SCBA and protective clothing to prevent contact with skin and eyes.
Unusual Fire and Explosion Hazards: N/A

SECTION VI- Accidental Release Measures

Evacuate area. Remove all sources of ignition. Use inert absorbent to pick up all spilled material. Transfer to a suitable waste container with non-sparking tools. Wash spill site with appropriate cleaning agent to removal residual traces of spilled material.

SECTION VII- Handling and Storage

Handling: Do not breathe vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged repeated exposure. Wash thoroughly after handling.

Storage: Room temperature. Protect from light. Keep container closed. Keep away from ignition sources.

Cerilliant
Science. Down to a science.

SECTION VIII-Exposure Controls/Personal Protection

As appropriate to quantity handled.
Ventilation - Local Exhaust: Use with forced ventilation.
General Mechanical: Normal laboratory air exchange.
Special: N/A
Respiratory Protection: NIOSH approved cartridge type respirator with organic vapor cartridges with HEPA pre-filter recommended.
Eye Protection: Safety glasses with side shields or chemical safety goggles.
Protective Gloves: Compatible chemical resistant gloves.
Other Protective Clothing or Equipment: Lab Coat
Work/Hygienic Practices: Only experienced personnel should be allowed to handle this material.

	Exposure Limits			
	OSHA PEL	**ACGIH TLV**	**DFG MAK**	**Other Limits**
Toxaphene	TWA 0.5 mg/m^3; STEL 1 mg/m^3 (skin)	TWA 0.5 mg/m^3; STEL 1 mg/m^3 (skin)	Animal Carcinogen, Suspected Human Carcinogen	N/A

SECTION IX-Physical/Chemical Properties

Boiling Point (degrees C): N/A
Melting Point (degrees C): 65-90
Specific Gravity (Water=1): N/A
Vapor Pressure (mmHg):N/A
Vapor Density (Air=1): N/A
Evaporation Rate (Butyl Acetate=1): N/A
Solubility in Water: Insoluble
Appearance and Odor: white solid

SECTION X-Stability and Reactivity

Stability: Stable
Conditions to Avoid: Heat, sparks or other sources of ignition.
Incompatible Materials: N/A
Hazardous Dcmp Pdts: Toxic fumes of carbon monoxide and carbon dioxide.
Hazardous Polymerization: Will not occur.
Conditions to Avoid: N/A

SECTION XI-Toxicological Information

Routes of Entry: **Inhalation?** Yes **Skin?** Yes **Ingestion?** Yes

Carcinogenicity:
NTP? Anticipated carcinogen
IARC? Probable Human Carcinogen
OSHA? N/A

Symptoms of Exposure: NA

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Toxicity Data:

skin-mam 500 mg MOD	intraperitoneal-rat LDLo:70 mg/kg
mmo-sat 100 µg/plate	oral-mouse LD50:112 mg/kg
mma-sat 500 µg/plate	ihl-mouse LCLo:2000 mg/m3/2H
sce-human:lym 10 µmol/L	intraperitoneal-mouse LD50:47 mg/kg
otr-mouse:emb 12,400 µg/L	unreported-mouse LD50:45 mg/kg
oral-human LDLo:28 mg/kg:CNS	oral-dog LD50:15 mg/kg
oral-man LDLo:29 mg/kg	oral-rabbit LD50:75 mg/kg
skin-human TDLo:657 mg/kg:SKIN	skin-rabbit LD50:1025 mg/kg
unreported-man LDLo:44 mg/kg	oral-guniea pig LD50:250 mg/kg
oral-rat LD50:50 mg/kg	oral-ham LD50:200 mg/kg
skin-rat LD50:600 mg/kg	oral-duck LD50:31 mg/kg

The toxicological properties of Toxaphene have not been fully investigated. It should be assumed to have toxic effects and, therefore, procedures appropriate for the safe handling of hazardous chemicals should be followed.

SECTION XII-Ecological Information

Data not available

SECTION XIII-Disposal Considerations

Waste materials should be disposed of under conditions that meet Federal, State, and Local environmental control regulations. Contact a licensed waste disposal specialist to dispose of this material.

SECTION XIX- Transportation Information

DOT	IATA
Proper Shipping Name: Organochlorine pesticide, solid, toxic	Proper Shipping Name: Organochlorine pesticide, solid, toxic
UN #: 2761	UN #: 2761
Class: 6.1	Class: 6.1
Packing Group: II	Packing Group: II
Small quantities exempted	Small quantities exempted

SECTION XV-Regulatory Information

EU Directives Classification
Symbol of Danger: T N
Indication of Danger: Toxic. Dangerous for the environment.
R: 21 25 37/38 40 50/53
Risk Statements:
Harmful in contact with skin. Toxic if swallowed. Irritating to respiratory system and skin. Limited evidence of a carcinogenic effect. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 36/37 45 60
Safety Statements: Wear suitable protective clothing and gloves. In case of accident or if you feel unwell seek medical advice immediately (show the label where possible). This material and its container must be disposed of as hazardous waste

SECTION XVI-Other Information

The information contained herein is believed to be accurate and is supplied in good faith. Cerilliant Corporation makes no warranty with respect to and assumes no legal responsibility for use of or reliance upon this information. Individuals receiving this data must exercise their own judgement in determining its suitability for a particular purpose.

SECTION I PRODUCT INFORMATION

PRODUCT IDENTIFIER : TRICHLOROETHYLENE TECH
CHEMICAL NAME AND SYNONYMS : *Trichloroethylene, trichloroethene.*
IDENTIFICATION NUMBER : UN 1710
PRODUCT USE : Industrial solvent, cleaner, degreaser.

SUPPLIER : Amplex Chemical Products Ltd.
ADDRESS : 600 Delmar Avenue
Pointe-Claire, QC
H9R 4A8
TELEPHONE : (514) 630-3309

EMERGENCY : Newalta Industrial Services Inc
1-800-567-7455 (24h/24)

SECTION II HAZARDOUS INGREDIENTS

INGREDIENT	CONC.	CAS NUMBER	LD50(oral)	LC50(ihl)
Trichloroethylene	99 - 100%	79-01-6	5650 mg/kg Rat 2402 mg/kg Mouse	8450 ppm (4h) Mouse

SECTION III WHMIS CLASSIFICATION

CLASS D1B

CLASS D1A - CLASS D2B

SECTION IV PHYSICAL DATA

PHYSICAL STATE	Liquid	pH (WATER=7)	Not applicable
ODOUR AND APPEARANCE	Ether odour, clear, colourless liquid	SPECIFIC GRAVITY	1,46
ODOUR THRESHOLD	82 ppm	VAPOUR DENSITY	4,54 (air=1)
BOILING POINT	≈ 87 •C	VAPOUR PRESSURE	57,8 mmHg @ 20 •C
FREEZING POINT	≈ - 86 •C	EVAPORATION RATE	3.1 (ether=1)
COEFFICIENT OF WATER/OIL DISTRIBUTION	0.00513		

SECTION V FIRE OR EXPLOSION

CONDITION OF FLAMMABILITY: Non flammable. Vapours concentrated in a confined or poorly ventilated area can be ignited upon contact with a spark, flame or high intensity source of heat.

MEANS OF EXTINCTION: Water fog, dry chemicals, foam, CO_2. Fire fighters should use pressure-demand self contained breathing apparatus due to possible exposure to hydrogen chloride and phosgene gas. Use water spray to disperse vapours and cool fire-exposed containers or structures.

FLASH POINT	None (TCC method)	AUTO-IGNITION TEMPERATURE	410 •C
UPPER FLAMMABLE LIMIT	10.5 % at 25 °C	MECHANICAL IMPACT SENSITIVITY	Not Available
LOWER FLAMMABLE LIMIT	8.0 % at 25 °C	STATIC DISCHARGE SENSITIVITY	Not Available

HAZARDOUS COMBUSTION PRODUCTS: Thermal decomposition products are toxic and may include chlorine, hydrogen chloride, phosgene and oxides of carbon.

SECTION VI REACTIVITY DATA

CHEMICAL INSTABILITY CONDITIONS: Stable under normal conditions.

INCOMPATIBLE SUBSTANCES AND CONDITIONS OF REACTIVITY: Avoid oxygen-enriched atmosphere, open flames, hot glowing surfaces, electric arcs or other hot surfaces which can cause thermal decomposition. Avoid strong oxidizing and reducing agents. Lewis or mineral acids. Strong bases. Caustics. May react violently with metals such as: sodium, potassium, barium, magnesium and titanium, particularly if they are finely divided. May decompose with strong alkalis to give spontaneously flammable and highly toxic chloroacetylenes. May be corrosive to aluminium. Aluminum and its alloys should not be used in equipment for storage, handling or transportation.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition products are toxic and may include chlorine, hydrogen chloride, phosgene and oxides of carbon.

SECTION VII TOXICOLOGICAL PROPERTIES

SKIN CONTACT/ABSORPTION: Can irritate skin due to defatting action, drying and cracking of the skin. Burns can occur if material is not promptly removed. Repeated on prolonged contact may lead to dermatitis. Can be absorbed through intact skin.

EYE CONTACT: Liquid can cause transient pain, lacrimation. May cause severe irritation, corneal burns, and conjunctivitis, possible corneal damage. Vapors may cause the same effects.

INHALATION: Vapours are irritating to nose, throat, and respiratory tract. Exposure to high concentrations can cause nausea, headache, and dizziness. Overexposure may lead to coma and death from cardiac or respiratory failure. TCE may sensitize myocardium and cause cardiac arrhythmia. May cause convulsions, CNS depression, visual disturbances, systemic poisoning, kidney damage, and peripheral nervous system effects.

INGESTION: May cause irritation and burning of the mouth, throat, respiratory tract, and esophagus. Can cause convulsions, CNS depression (headache, dizziness, drowsiness, nausea, vomiting, abdominal pain, liver damage, myocardial damage, kidney failure, and incoordination), cardiac arrhythmia, visual disturbances, and systemic poisoning. Severe exposure may cause death.

ACUTE EXPOSURE EFFECTS: Severe overexposures may lead to coma and possible death due to respiratory failure. Mild blurring of vision to complete blindness may occur, including changes in colour perception and conjunctivitis.

CHRONIC EXPOSURE EFFECTS: Chronic exposure to trichloroethylene has caused toxic effect in the liver, lymphatic (one species), kidneys, and cardiovascular system of animals. Humans exposed to trichloroethylene can become intolerant to ethyl alcohol, with small quantities causing inebriation and skin blotching. Exposure to 40 - 270 ppm can cause fatigue, headache, irritability, vomiting, intolerance to alcohol, and electrocardiographic changes. Prolonged and repeated exposure may lead to dermatitis. See also acute exposure effects.

EXPOSURE LIMIT	50 ppm	SHORT TERM EXPOSURE LIMIT	200 ppm
CARCINOGENICITY	Yes	SENSITIZATION TO PRODUCT	None known
TERATOGENICITY	Not available	MUTAGENICITY	Yes
SYNERGISTIC PRODUCTS	Alcohols	REPRODUCTIVE TOXICITY	Not available
IRRITANCY OF PRODUCT	Yes		

SECTION VIII PREVENTIVE MEASURES

PROTECTIVE GLOVES: Protective gloves made from viton, neoprene.

EYE PROTECTION: Chemical goggles and/or face shield where splashing is possible. Do not wear contact lenses.

RESPIRATORY PROTECTION: A NIOSH/MSHA approved full facepiece self-contained breathing apparatus required for any concentrations above permissible exposure limits.

OTHER PROTECTIVE EQUIPMENT: Impervious apron (or viton clothing) and boots. Safety shower and eye bath located close to chemical exposure area.

ENGINEERING CONTROLS: Local ventilation required to maintain below 50 ppm (Exposure limit).

PROCEDURES TO BE FOLLOWED IN CASE OF SPILL OR LEAK: Immediately evacuate the area and provide maximum ventilation. Turn off heating and/or air-conditioning systems to prevent vapours from contaminating entire building. Only properly equipped personnel should be permitted in area. Dike area to contain spill. Take precautions as necessary to prevent contamination of ground and surface waters. Recover or absorb spilled material on vermiculite and sweep into closed containers for disposal. After all visible traces have been removed, thoroughly wet vacuum the area. Do not flush into sewer. If area of spill is porous, remove as much contaminated earth and gravel, etc., as necessary and place in closed containers for disposal.

WASTE DISPOSAL: Contaminated vermiculite or porous surfaces must be disposed of in a licence hazardous waste management facility. Care must be taken when using or disposing of chemical materials and/or their containers to prevent environmental contamination. In accordance with federal, provincial and municipal regulations.

HANDLING AND STORAGE PROCEDURES: Ground and bond equipment and containers to prevent a static charge buildup. Use spark-resistant tools and avoids "splash-filling" of containers. Store in a cool place. Solvents should not be stored in low areas because of the risk of accumulation of heavy solvent vapours. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276. Store in labelled, sealed containers in a cool, dry, well-ventilated area. Prevent water or moist air from entering storage tanks or containers. Do not cut or weld on empty or full drums. Aluminum equipment should not be used for storage and/or transfer. Contact with aluminum parts in a pressurizable fluid system may cause violent reactions.

SPECIAL SHIPPING INFORMATION:

Shipping Name:	Trichloroethylene
Class/Division :	UN 1710, Class 6.1, Packing group III

SECTION IX FIRST AID MEASURES

SKIN: Flush with soap and water then continue flushing with running water for a minimum of 15 minutes. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing. Obtain medical attention immediately.

EYES: Immediately flush eyes with running water for a minimum of 15 minutes. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention immediately.

INHALATION: Move victim to fresh air. Give artificial respiration if breathing has stopped. Give cardio pulmonary resuscitation if there is no breathing and no pulse. Obtain medical attention immediately.

INGESTION: If victim is alert and not convulsing, give ½ to 1 glass of water to dilute material. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus. Rinse mouth and administer more water. Immediately contact a Poison Control Center. Do not induce vomiting. Obtain medical attention immediately.

NOTE TO PHYSICIAN: This product contains materials that may cause severe pneumonitis if aspired. If ingestion has occurred less than 2 hours earlier, carry out careful gastric lavage; use endotracheal cuff if available, to prevent aspiration. Observe patient for respiratory difficulty from aspiration pneumonitis. Give artificial resuscitation and appropriate chemotherapy is depressed. Never administer adrenaline following trichloroethylene overexposure. Delayed effects can occur a few hours after exposure. Keep patient under observation for 48 hours.

SECTION X PREPARATION INFORMATION

PREPARED BY	:	Amplex Chemical Products Ltd.
TELEPHONE	:	(514) 630-3309
DATE	:	June 19, 2006

IMPORTANT: The information presented herein is believed to be accurate and is offered only as a guide. Users should make their own tests to determine the suitability of these products for their own particular purposes. Users assume all risk of use, storage and handling of the product. No warranty, express or implied, is made including, but not limited to, implied warranties of merchantability and fitness for a particular purpose. Nothing contained herein shall be construed as a license to operate under, or recommendation to infringe any patents.

SIGMA-ALDRICH

MATERIAL SAFETY DATA SHEET

Date Printed: 08/10/2006
Date Updated: 03/24/2006
Version 1.5

Section 1 - Product and Company Information

Product Name	1,2,4-TRIMETHYLBENZENE, 98%
Product Number	T73601
Brand	ALDRICH
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
1,2,4-TRIMETHYLBENZENE	95-63-6	Yes

Formula: C9H12
Synonyms: Asymmetrical trimethylbenzene * Benzene, 1,2,5-trimethyl- * psi-Cumene * Pseudocumene * Pseudocumol * as-Trimethylbenzene
RTECS Number: DC3325000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Combustible (USA) Flammable (EU). Harmful. Dangerous for the environment.
Harmful by inhalation. Flammable. Irritating to eyes, respiratory system and skin. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Target organ(s): Central nervous system.

HMIS RATING

HEALTH: 2*
FLAMMABILITY: 2
REACTIVITY: 0

NFPA RATING

HEALTH: 2
FLAMMABILITY: 2
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE
In case of contact, immediately flush eyes with copious amounts of water for at least 15 minutes.

Section 5 - Fire Fighting Measures

FLAMMABLE HAZARDS
Flammable Hazards: Yes

EXPLOSION HAZARDS
Vapor may travel considerable distance to source of ignition and flash back. Container explosion may occur under fire conditions.

FLASH POINT
118.4 °F 48 °C Method: closed cup

EXPLOSION LIMITS
Lower: 0.9 % Upper: 6.4 %

AUTOIGNITION TEMP
515 °C

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Flammable liquid. Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area. Shut off all sources of ignition.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Cover with dry-lime, sand, or soda ash. Place in covered containers using non-sparking tools and transport outdoors. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Avoid breathing vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep container closed. Keep away from heat, sparks, and open flame.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Safety shower and eye bath. Use nonsparking tools. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash thoroughly after handling. Wash contaminated clothing before reuse.

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	100 mg/m3
Poland		NDSCh	170 mg/m3
Poland		NDSP	

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Clear liquid Color: Colorless	
Property	Value	At Temperature or Pressure
Molecular Weight	120.2 AMU	
pH	N/A	
BP/BP Range	168.0 - 169.0 °C	
MP/MP Range	- 43.7 °C	
Freezing Point	- 44.0 °C	
Vapor Pressure	7 mmHg	44.4 °C
Vapor Density	4.2 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	0.876 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	

Surface Tension	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Flash Point	118.4 °F 48 °C	Method: closed cup
Explosion Limits	Lower: 0.9 %	
	Upper: 6.4 %	
Flammability	N/A	
Autoignition Temp	515 °C	
Refractive Index	1.505	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	Solubility in Water:Insoluble.	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: Causes skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: Causes eye irritation.
Inhalation: May be harmful if inhaled. Material is irritating to mucous membranes and upper respiratory tract.
Ingestion: May be harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)
Central nervous system.

SIGNS AND SYMPTOMS OF EXPOSURE
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated. Headache, nausea, drowsiness, and fatigue. Bronchitis. Narcotic effect. Prolonged exposure can cause:

TOXICITY DATA

Oral
Rat
5000 mg/kg
LD50

Inhalation
Rat
18,000 mg/m3
LC50

CHRONIC EXPOSURE - MUTAGEN

Species: Mouse
Route: Intraperitoneal

Dose: 900 MG/KG
Mutation test: Sister chromatid exchange

Section 12 - Ecological Information

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Hydrocarbons, liquid, n.o.s.
UN#: 3295
Class: 3
Packing Group: Packing Group III
Hazard Label: Flammable liquid
PIH: Not PIH

IATA
Proper Shipping Name: Hydrocarbons, liquid, n.o.s.
IATA UN Number: 3295
Hazard Class: 3
Packing Group: III

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: Xn-N
Indication of Danger: Harmful. Dangerous for the environment.
R: 10-20-36/37/38-51/53
Risk Statements: Flammable. Harmful by inhalation. Irritating to eyes, respiratory system and skin. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 26-61
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Avoid release to the environment. Refer to special instructions/safety data sheets.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Combustible (USA) Flammable (EU). Harmful. Dangerous for the environment.
Risk Statements: Harmful by inhalation. Flammable. Irritating to eyes, respiratory system and skin. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Avoid release to the environment. Refer to special instructions/safety data sheets.
US Statements: Target organ(s): Central nervous system.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
DEMINIMIS: 1 %
NOTES: This product is subject to SARA section 313 reporting

requirements.
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.
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MSDS Number: **M1664** * * * * * *Effective Date: 07/06/06* * * * * * *Supercedes: 08/10/04*

MSDS **Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker®

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300
National Response in Canada
CANUTEC: 613-996-6666
Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance

MESITYLENE

1. Product Identification

Synonyms: Benzene, 1,3,5-trimethyl; mesitylene 99+%; trimethylbenzol
CAS No.: 108-67-8
Molecular Weight: 120.20
Chemical Formula: C9H12
Product Codes: P649

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Benzene, 1,3,5-trimethyl-	108-67-8	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! HARMFUL OR FATAL IF SWALLOWED. FLAMMABLE LIQUID AND VAPOR. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE BLOOD AND CENTRAL NERVOUS SYSTEM.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate

Flammability Rating: 2 - Moderate
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER.
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. May cause sore throat, coughing, headache and nausea. Affects central nervous system.
Ingestion:
Not expected to be very acutely toxic. Care should be taken due to potential irritant effects. May cause risk of chemical pneumonia from droplets entering lungs. Affects central nervous system.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain.
Eye Contact:
Liquid and vapor causes irritation, redness, and pain.
Chronic Exposure:
Repeated inhalation may cause chronic bronchitis of the asthmatic type. High concentrations of vapors causes blood effects.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flash point: 50C (122F)
Autoignition temperature: 559C (1038F)
Flammable liquid and vapor.
Contact with strong oxidizers may cause fire.
Explosion:
Above the flash point, explosive vapor-air mixtures may be formed. Sensitive to static discharge.

Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide. Water may be ineffective.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Vapors can flow along surfaces to distant ignition source and flash back. Water spray may be used to keep fire exposed containers cool.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Control ignition sources. Employ grounding, bonding, venting and explosion relief provisions in accord with accepted engineering practices in any process capable of generating an explosion due to static discharge. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- ACGIH Threshold Limit Value (TLV): 25 ppm, 123 mg/m3 (TWA)
- NIOSH (REL): 25 ppm; 125 mg/m3 (TWA)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area. Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Characteristic odor.
Solubility:
Negligible; 0.002% in water.
Specific Gravity:
0.864 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
99
Boiling Point:
165C (329F)
Melting Point:
-45C (-49F)
Vapor Density (Air=1):
1.006 @ 20C
Vapor Pressure (mm Hg):
1.86 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Nitric Acid, strong oxidizers.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Inhalation rat LC50: 24 mg/m3/4H

Irritation: rabbit skin (std Draize), 20 mg/24 H, moderate

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Benzene, 1,3,5-trimethyl- (108-67-8)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: 1,3,5-TRIMETHYLBENZENE
Hazard Class: 3
UN/NA: UN2325
Packing Group: III
Information reported for product/size: 500ML

International (Water, I.M.O.)

Proper Shipping Name: 1,3,5-TRIMETHYLBENZENE
Hazard Class: 3
UN/NA: UN2325
Packing Group: III
Information reported for product/size: 500ML

International (Air, I.C.A.O.)

Proper Shipping Name: 1,3,5-TRIMETHYLBENZENE
Hazard Class: 3
UN/NA: UN2325
Packing Group: III
Information reported for product/size: 500ML

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Benzene, 1,3,5-trimethyl- (108-67-8)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Benzene, 1,3,5-trimethyl- (108-67-8)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Benzene, 1,3,5-trimethyl- (108-67-8)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Benzene, 1,3,5-trimethyl- (108-67-8)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 3[Y]
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **2** Reactivity: **0**
Label Hazard Warning:
DANGER! HARMFUL OR FATAL IF SWALLOWED. FLAMMABLE LIQUID AND VAPOR. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE BLOOD AND CENTRAL NERVOUS SYSTEM.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Avoid contact with eyes, skin and clothing.
Avoid breathing vapor or mist.
Wash thoroughly after handling.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. Call a physician. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth

to an unconscious person.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

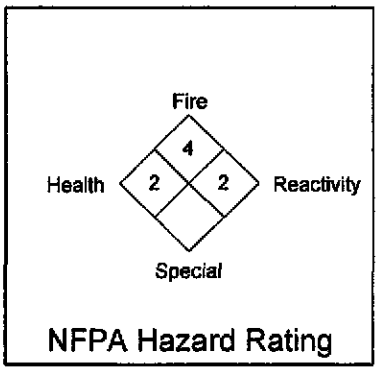
Georgia Gulf

Chemicals and Vinyls, LLC

Material Safety Data Sheet: Vinyl Chloride Monomer

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product name	**Vinyl Chloride Monomer**
Effective date	April 15, 2004
Synonyms	Chloroethene, chloroethylene, ethylene monochloride, monochloroethylene, VCM
Chemical formula	CH_2CHCL
CAS name & no.	Ethene, chloro-, 75-01-4
Manufacturer's name and address	Georgia Gulf Chemicals and Vinyls, LLC P.O. Box 629 Plaquemine, LA 70765-0629
Emergency telephone number	For transportation emergencies: CHEMTREC (800) 424-9300 For all other emergencies: (225) 685-2500
MSDS contact	Corporate Health & Safety Department P.O. Box 629 Plaquemine, LA 70765-0629 Phone Number (225) 685-2500



2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	Wt. %.
Vinyl Chloride Monomer (VCM)	75-01-4	>99.99

3. HAZARDS IDENTIFICATION

PRECAUTIONARY INFORMATION

Extremely flammable liquified gas. Possible cancer hazard. Eye and skin burns on contact. Liver and kidney toxin. Inhalation may cause central nervous system effects and narcosis. Heavier than air flammable gas.

POTENTIAL HEALTH EFFECTS

Primary Routes of Entry

Inhalation, skin, and eye contact.

Acute Effects

Acute toxicity is most often due to depression of the central nervous system, but these effects rarely occur at low concentrations. Symptoms include depression, fatigue, headache, vertigo, ataxia, euphoria, visual disturbances, dizziness, numbness and tingling in the extremities, narcosis, and loss of consciousness. Death may result from respiratory depression. Gastrointestinal symptoms include nausea, vomiting, epigastric pain, anorexia, and diarrhea. Skin problems associated with vinyl chloride exposure include allergic dermatitis and scleroderma (hardening or thickening of the skin). Contact with escaping, compressed gas or the liquid can result in frostbite.

Chronic Effects

A number of different toxic effects have been noted following chronic exposure to VCM, including coughing, sneezing, and lung inflammation. Gastrointestinal symptoms include abdominal pain, gastrointestinal bleeding, nausea, vomiting, indigestion, diarrhea, jaundice, weight loss, and anorexia. Increase in liver and spleen size has been noted. Other symptoms include fatigue, blood clotting disorders, and a cold, tingling sensation in the hands and feet. A condition in which the small bones of the hand weaken has also been noted. Occupational exposure is associated with an increased incidence of angiosarcoma of the liver (see below, Carcinogen Status).

Potential Adverse Chemical Interactions

VCM is known to be toxic to the lungs and liver. Persons chronically exposed to VCM should have liver enzyme studies, blood counts, electrocardiograms, chest x-rays, and urinalysis conducted on a periodic basis (refer to 29 CFR 1910.1017). Smoking activity, alcohol consumption, and previous episodes of hepatitis could increase the toxicity associated with VCM exposure. Ethanol exposure may increase the carcinogenic activity of VCM (IARC, Vol. 19, 1979).

HAZARD CLASSIFICATION

Carcinogen Status

IARC has determined that there is sufficient evidence of the carcinogenicity of VCM in both animals and man. This chemical has been rated as a carcinogen IARC (Group I), EPA (Group A), ACGIH (A1), NIOSH, OSHA and NTP.

4. FIRST AID MEASURES

Inhalation

Move the person to fresh air at once. Get emergency medical attention as soon as possible. Monitor for respiratory distress. If breathing has stopped, give artificial respiration and provide supplemental 100% humidified oxygen. Keep the person quiet and maintain normal body temperature. If cough or respiratory distress develops, evaluate for respiratory tract irritation, bronchitis, and pneumonitis. Transfer to a medical facility. Get medical attention as soon as possible.

Skin Contact

Remove any contaminated clothing and immediately wash the exposed area thoroughly with water for at least 15 minutes. Get medical attention.

Eye Contact

If the chemical contacts the eye, eyes should be irrigated with copious amounts of room temperature water for at least 15 minutes, occasionally lifting both the upper and lower lids. Have the individual examined by an ophthalmologist. Contact lenses should not be worn when working with this chemical.

Ingestion: Not Applicable

5. FIRE FIGHTING MEASURES

Flash Point	-77.8° C (Cleveland open cup)
Flammable Limits (% By Vol.)	
Lower Explosive Limit (LEL)	3.6%
Upper Explosive Limit (UEL)	33%
Autoignition Temperature	472° C

Fire Fighting Procedures/Fire Extinguishing Media

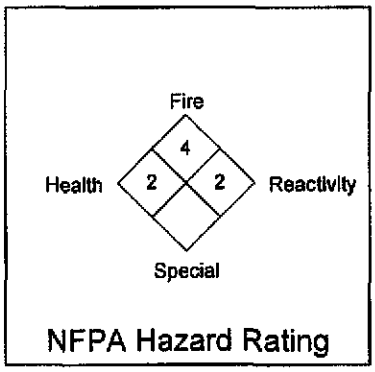
Keep unnecessary people away; isolate hazard area and deny entry. Avoid breathing vapors, stay upwind. Wear NIOSH approved self-contained respirator in the positive pressure mode and do not enter area without structural firefighters' protective equipment. Fight fire from protected location or maximum distance possible. Use flooding quantities of water as fog, carbon dioxide extinguishers, or alcohol foam for fires. Use water spray to cool containers exposed to fire. Large VCM fires are very difficult to extinguish. Stay away from ends of tanks. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. Isolate for 1/2 mile in all directions if tank car or truck is involved in fire.

Unusual Fire and Explosion Hazards

Dangerous fire and explosion hazard when exposed to heat or flame. VCM is extremely flammable and forms explosive mixtures with air. Vapors are heavier than air and may travel to the source of ignition and flash back. Containers may explode in heat of fire.

5. FIRE FIGHTING MEASURES CONTINUED

National Fire Protection Association Hazard Rating



4 = Extreme
3 = High
2 = Moderate
1 = Slight
0 = Insignificant

Note: NFPA Health Hazard Rating is a 2, and the rating does not consider carcinogenicity. Vinyl Chloride Monomer is classified by several organizations as a carcinogen. Please see Section 3, Carcinogen Status.

6. ACCIDENTAL RELEASE MEASURES

Shut off all sources of ignition. No smoking or flares allowed in the spill area. Immediately evacuate area and move unprotected personnel upwind of the area. Keep out of low areas. Allow only trained personnel wearing NIOSH approved self-contained respirator operated in the positive pressure mode with full protective clothing in the spill area. Do not touch spilled material; stop leak if you can without risk. Prevent VCM from entering water bodies, drains, or any sewage collection systems. Use water spray to disperse vapors and protect personnel. Control runoff and isolate discharge for disposal. Dispose all spill material in accordance with federal, state, and local regulations. VCM spills over the reportable quantity (1 lb.) should be reported to the National Response Center (800-424-8802).

7. HANDLING AND STORAGE

Possible cancer hazard. Store in a well ventilated place away from sources of ignition and oxidizing materials in accordance with 29 CFR 1910.106 and 1910.1017. Ground and/or bond storage containers. Use spark resistant equipment (tools) in the vinyl chloride monomer area. Containers of this material may be hazardous when emptied due to emptied containers retaining product residues. Assume emptied containers to have the same hazards as full containers. Follow all federal, state, and local regulations as well as all insurance codes when storing and handling VCM.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection

Use appropriate NIOSH approved respirator in accordance with 29 CFR 1910.132, 1910.134 and 1910.1017, to prevent overexposure. Respirators must be selected based on the airborne levels found in the workplace and must not exceed the working limits of the respirator.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION (continued)

Eye Protection
Use splash proof chemical safety goggles or appropriate full-face respirator. Follow the eye and face protection guidelines of 29 CFR 1910.132 and 1910.133. Where there is any possibility that individuals' eyes may be exposed to VCM, an eye wash fountain (in accordance with 29 CFR 1910.151) should be within the immediate work area for emergency use. Contact lenses should not be worn when working with this chemical.

Protective Gloves
Use gloves in accordance with 29 CFR 1910.132 and 29 CFR 1910.138.

Ventilation
Provide local ventilation to maintain exposure levels below recommended exposure limits, and to prevent accumulation of vinyl chloride in explosive levels. Use explosion proof ventilation equipment. Local exhaust ventilation should comply with OSHA regulations and the American Conference of Governmental Industrial Hygienists, Industrial Ventilation - A Manual of Recommended Practice.

Exposure Controls
The OSHA-PEL is 1 ppm (8-hr TWA) and the ACGIH-TLV is 1 ppm (8-hr TWA). The OSHA Ceiling/STEL value is 5ppm (Average, not exceeding any 15-min period of time).

Other
All personal protective equipment and procedures must follow the requirements of 29 CFR 1910.132, 1910.133, and 1910.1017. Where there is a possibility of exposure of an individual's body to vinyl chloride monomer, facilities for quick drenching of the body should be provided (in accordance with 29 CFR 1910.151) within the immediate work area for emergency use. Such individuals should be provided with and required to use impervious clothing in accordance with 29 CFR 1910.132 and 1910.1017.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colorless gas
Odor	Mild, sweet
Molecular Weight	62.5
Boiling Point	-14°C
Melting Point	-154°C
Solubility	Slightly soluble in water (0.11%), soluble in hydrocarbons, oil, alcohol, chlorinated solvents, and most common organic liquids
Specific Gravity (Water = 1.0)	0.91 at 20° C
Vapor Density (Air = 1.0)	2.15
Vapor Pressure	2,524 mm Hg at 20° C
pH	7.0 - 8.5

10. STABILITY AND REACTIVITY

Stability
Stable under normal conditions.

Polymerization
Hazardous polymerization of vinyl chloride monomer may occur with oxidizing materials, peroxides, and at elevated temperatures.

Hazardous Decomposition Products
VCM burns to form toxic and corrosive gases such as hydrogen chloride, phosgene, and carbon monoxide.

Incompatible Materials
Copper, aluminum, aluminum alloys, and peroxides.

11. TOXICOLOGICAL INFORMATION

Animal Toxicity

Oral:	Rat LD_{50}	500 mg/kg
Inhalation:	Rat LC_{50}	18 pph/15 min
	Guinea Pig LC_{50}	44,183 ppm (2hr)

LC_{50} = Air concentration that is lethal to 50% of a given species in a given period.
LD_{50} = Dose that is lethal to 50% of a given species by a given route of exposure.

12. ECOLOGICAL INFORMATION

Environmental Fate: The following information on vinyl chloride is extracted from the TOXNET database maintained by the National Library of Medicine.

Atmosphere: If released to air, a vapor pressure of 2,980 mm Hg at 25 deg C indicates vinyl chloride will exist solely as a gas in the ambient atmosphere. Gas-phase vinyl chloride will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 55 hours. Direct photolysis is not expected to be an important environmental fate process since this compound only absorbs light weakly in the environmental UV spectrum.

Terrestrial: If released to soil, vinyl chloride is expected to have high mobility based upon an estimated Koc value of 57. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 0.0278 atm-cu m/mole. Vinyl chloride may volatilize from dry soil surfaces based upon its vapor pressure. The volatilization half-life of vinyl chloride was estimated as 0.2 days when incorporated in a soil at a depth of 1 cm and 0.5 days at a depth of 10 cm. Biodegradation is expected to occur slowly in the environment under both aerobic and anaerobic conditions.

Aquatic: If released into water, vinyl chloride is not expected to adsorb to suspended solids and sediment in water based upon the estimated Koc. The biodegradation half-life of vinyl chloride in aerobic and anaerobic waters was reported as 28 and 110 days, respectively. Volatilization from water surfaces is expected to be an important fate process based upon this compound's Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 1 hour and 3 days, respectively. A measured BCF value of less than 10 in fish suggest bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process based on a hydrolysis half-life of 9.91 years at pH 7 and 25 deg C.

12. ECOLOGICAL INFORMATION CONTINUED

Biodegradation: (Aerobic) Limited existing data indicate that vinyl chloride is resistant to biodegradation in aerobic systems. Vinyl chloride was approximately 50% and 100% degraded in 4 and 11 weeks, respectively, in the presence of sand by methanogenic microorganisms under anaerobic conditions in laboratory scale experiments. In the absence of sand 20% and 55% degradation occurred in 4 and 11 weeks, respectively.

(Anaerobic) Studies have shown that anaerobic bacteria can reduce tetrachloroethylene and trichloroethylene to vinyl chloride via reductive dechlorination. The resultant vinyl chloride is further reduced to ethene, but the dechlorination of vinyl chloride to ethene is very slow and as a result an accumulation of vinyl chloride is noticed. The biodegradation half-life of vinyl chloride in aerobic and anaerobic waters was reported as 28 and 110 days, respectively. The first-order anaerobic biodegradation rate constant of vinyl chloride was reported to range from 0.0062-0.00096 day-1. These rate constants correspond to half-lives in the range of 112 to 722 days.

Ecotoxicity: Some data indicated that vinyl chloride is too readily volatilized to undergo bioaccumulation, except perhaps in the most extreme exposure conditions. Studies on five bacterial, three fungal, and two single organism cultures from natural aquatic systems did not show bioaccumulation to be an appreciable process. The BCF value of vinyl chloride in golden ide fish was reported as less than 10. The BCF value of vinyl chloride in green algae was reported as 40. According to a classification scheme, the BCF data suggest that bioconcentration in aquatic organisms is low.

13. DISPOSAL CONSIDERATIONS

Waste Management Information: Do not dump into any sewers, on the ground, or into any body of water. Any disposal practice must be in compliance with local, state and federal laws and regulations (contact local or state environmental agency for specific rules). Waste characterization and compliance with applicable laws are the responsibility of the waste generator.

14. TRANSPORTATION INFORMATION

Proper Shipping Name	Vinyl Chloride, stabilized
DOT Hazard class	2.1, (Flammable gas)
DOT Shipping I.D. No.	UN 1086
PG	N/A
DOT Labeling	Flammable gas
DOT Placard	Flammable gas

15. REGULATORY INFORMATION

SARA Title III

Section 302 and 304 of the Act; Extremely Hazardous Substances (40 CFR 355)

COMPONENT	CAS No.	TPQ (lbs)	RQ (lbs)
None	Not Applicable	Not Applicable	Not Applicable

Note: TPQ - Threshold Planning Quantity RQ - Reportable Quantity

Section 311 Hazard Categorization (40 CFR 370)

ACUTE	CHRONIC	FIRE	PRESSURE	REACTIVE
X	X	X	X	X

Section 313 Toxic Chemicals (40 CFR 372.65)

COMPONENT	CAS No.	WT.%
VCM	75-01-4	>99.99

CERCLA

Section 102(a) Hazardous Substances (40 CFR 302.4)

COMPONENT	CAS No.	WT.%	RQ (lbs)
VCM	75-01-4	>99.99	1

RCRA

40 CFR 261.33 Hazardous waste number:

VCM waste is regulated as hazardous waste material under the hazardous waste number U043. Material contaminated with 0.2 mg/L of VCM using the hazardous waste toxicity test would be regulated as hazardous waste material under the hazardous waste number D043.

TSCA

Vinyl chloride is listed on the TSCA inventory.

CA Proposition 65

This product contains substances known to the State of California to cause cancer and/or reproductive toxicity.

Canadian Environmental Protection Act (CEPA)

All substances in this product are listed on the Canadian Domestic Substances (DSL) list or are not required to be listed.

15. REGULATORY INFORMATION (continued)

Canada Regulations (WHMIS)

This product has been classified according to the hazard criteria of the Canadian Controlled Products Regulations, Section 33 and the MSDS contains all information required by this regulation.

Class A – Compressed Gas, Class B1 – Flammable Gas, Class D (2A) – Possible, probable or known human carcinogen according to classifications by IARC or ACGIH

OSHA 29 CFR 1910.1017:

(1) Entrances to regulated areas shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

(2) Areas containing hazardous operations or where an emergency currently exists shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT IN THIS AREA
PROTECTIVE EQUIPMENT REQUIRED
AUTHORIZED PERSONNEL ONLY

(3) Containers of VCM shall be legibly labeled either (I):

VINYL CHLORIDE
EXTREMELY FLAMMABLE GAS UNDER PRESSURE
CANCER-SUSPECT AGENT

or (ii) In accordance with 49 CFR 170-189, with additional legend:

CANCER-SUSPECT AGENT

applied near the label or placard.

16. OTHER INFORMATION

IMPORTANT: The information and data herein are believed to be accurate and have been compiled from sources believed to be reliable. It is offered for your consideration, investigation and verification. Buyer assumes all risk of use, storage and handling of the product in compliance with applicable federal, state and local laws and regulations. **GEORGIA GULF CHEMICALS AND VINYLS, LLC MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY OR COMPLETENESS OF THE INFORMATION AND DATA HEREIN.** Georgia Gulf will not be liable for claims relating to any party's use of or reliance on information and data contained herein regardless of whether it is claimed that the information and data are inaccurate, incomplete or otherwise misleading. This information relates to the material designated and may not be valid for such material used in combination with any other materials nor in any process.

MSDS Status: Revision Date: 4/15/04 Supersedes: 7/24/00

ARCADIS

Appendix C

Site Activities Tailgate Safety Briefing
Sign-in Log

ARCADIS

Site Activities Tailgate Safety Briefing Sign-In Log

Project Number: LA002656.0001.00001	**Project Name:** Mississippi Bluffs
Date:	**Time:**

Briefing Conducted by:	**Signature:**	**Company:**

This Sign-In Log documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

TOPICS COVERED (check all those covered):

- ☐ General PPE Usage
- ☐ Hearing Conservation
- ☐ Respiratory Protection
- ☐ Personal Hygiene
- ☐ Exposure Guidelines
- ☐ Decon Procedures
- ☐ Emergency Procedures (include route to hospital)
- ☐ Confined Space
- ☐ Slips, Trips, Falls
- ☐ Heat Stress
- ☐ Thermal Stresses
- ☐ Site Control
- ☐ Work Zones
- ☐ Lockout/Tagout
- ☐ Excavation Safety
- ☐ Confined Space
- ☐ Traffic Safety
- ☐ Changes to the HASP
- ☐ Initial Review of Hazard Evaluation
- ☐ Other (specify):
- ☐ Other (specify):

Printed Name	Signature	Company Name

A. Biological Hazards

Biological hazards are any virus, bacteria, fungus, parasite, or any living organism that can cause disease in human beings. Diseases can be transmitted from animals and insects to humans and from exposure to contaminated water and people. The biological hazards present at the site are common for all work tasks and may include the following:

A.1 Poisonous Plants

Perhaps the most common biological hazard is contact with poisonous plants including poison ivy, poison oak, and poison sumac. These plants can cause mild to severe skin irritation upon contact depending upon the individual, and in extreme cases may require medical evaluation.

- Poison ivy may be found as a low-growing plant, shrub, or vine that grows in sunny and shaded areas. It has three shining green leaflets usually with coarse teeth. During the fall months, leaves turn a bright red, then yellow.

- Poison oak is a close relative to poison ivy and has three, five, or seven lobed leaflets that are hairy underneath. Poison oak is not shade tolerant.

- Poison sumac is a tall shrub or small tree with 6 to 12 leaflets arranged in pairs. It is most likely found in peat bogs in the north and some southern swamps. Unlike other varieties of sumac, poison sumac has leaflets that are smooth and grow in a V-shape from the midrib.

To avoid contact:

- Learn to recognize these plants;

- Wear long pants;

- Wear long sleeves whenever possible;

- Wear a hat; and

- Wear gloves if cutting or handling vegetation.

If contact is made with these plants, the individual should wash exposed skin immediately with cold water and as soon as possible with soap and water. Clothing should be washed as soon as possible and all gear and equipment should be washed in hot, soapy water.

A.2 Insects

Care will be taken by all site workers to avoid stinging or biting insects such as ticks, spiders, bees, wasps, hornets, and yellow jackets. Workers allergic to any particular insect sting or bite should seek medical attention if stung or bitten and may need to carry emergency medicine prescribed by their doctor.

Care should always be taken to avoid these insects and increased vigilance is necessary:

- During high infestation seasons;
- When opening protective casings of monitor wells; and
- When walking through areas of heavy vegetation or areas known to be infested.

To minimize the chance of bites/stings:

- Wear appropriate personal protective equipment (PPE):
- Wear light-colored clothing so you can see insects;
  - Long pants and boots with pants tucked into boots;
  - Long sleeves when possible;
  - A hat; and
  - Gloves if you are cutting brush or need to handle or move vegetation.
- Check your body and clothing for insects, shower after work, and wash/dry clothes at as high temperature as possible;
- Do not swat at insects and don't eat in areas where there are insects;
- Avoid sweet-smelling personal hygiene products; and
- Unless contraindicated by the work being performed (e.g., sampling, data collection), wear U.S. Environmental Protection Agency (USEPA)-approved repellants such as those containing DEET.

Spider bites generally cause only localized reactions such as swelling, pain, and redness. However, bites from a Black Widow or Brown Recluse or if you are allergic to spiders can cause symptoms that are more serious. If nausea, vomiting, or difficulty breathing or swallowing occurs, medical attention should be sought immediately. Otherwise, clean the bite area with soap and water or alcohol and place a cold pack over the bite area.

Ticks are common, especially in the warmer weather months, and may carry diseases such as Rocky Mountain Spotted Fever and Lyme Disease. If a tick is found on the body:

- Using a fine-tipped tweezers, grasp tick firmly as close to skin as possible, and pull the body away from skin. Avoid crushing the body and don't twist;
- If tick mouth parts remain in skin, don't be alarmed because the mouth will dislodge as skin sloughs off;

- Wash the area with soap and water and apply antiseptic or antibiotic ointment to prevent infection; and

- If unexplained symptoms develop such as severe headaches, fever, or rash within 10 days of the bite, seek medical attention.

Mosquitoes are common, especially in areas with standing water and in damp, humid environments in the warmer months, and generally appear between dusk and dawn.

A.3 Snakes

The snakes of most concern in the project area are water moccasins, copperheads, coral snakes, and rattlesnakes. Leave snakes alone – many people are bitten because they try to kill a snake or get a closer look at it. If you see a snake, even if you know it's not poisonous, walk away quietly giving it a wide berth (at least 6 feet).

- Be especially cautious when opening monitor well casings and other enclosed field objects;

- The use of a heavy high-top work boot, denim work pants, etc., will help reduce the severity if bitten; and

- Whenever possible:

  - Stay out of tall grass;

  - Remain on paths as much as possible;

  - Keep hands and feet out of areas you can't see; and

  - Do not pick up rocks, timber, or other vegetation.

If bitten by a poisonous snake, the following is recommended:

- Seek medical attention immediately;

- Wash area with soap and water;

- Stay calm and remain as motionless as possible;

- Keep the bite area below the heart, if possible;

- Do not use cold packs or ice on the bite area; and

- Do not make incisions or try to suck the venom out.

B. Heat Stress

Heat stress can be a significant hazard, especially for workers wearing protective clothing. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim, and the prevention of heat stress incidents. Workers will be encouraged to immediately report any heat-related problems that they experience or observe in fellow workers.

During breaks, workers should be encouraged to drink plenty of water or other liquids to replace lost fluids and to help cool off.

Any worker exhibiting signs of heat stress and exhaustion should be made to rest in a cool location and drink plenty of water. Emergency help by a medical professional is required immediately for anyone exhibiting symptoms of heat stroke, such as red, dry skin, confusion, delirium, or unconsciousness. Heat stroke is a life-threatening condition that must be treated by competent medical authority.

B.1 Prevention

Whenever possible or within the control of ARCADIS, engineering controls should be utilized to protect workers from heat-related hazards. For example, isolation from the heat source, ventilation such as open windows, fans, or other methods of creating air flow, and heat shielding such as awnings or umbrellas.

Appropriate work practices can also lessen the chances of heat-related hazards. Some of these include:

- Water intake should be about equal to the amount of sweat produced (i.e., drinking 5 to 7 ounces of water every 15 to 20 minutes);
  - Electrolyte fluids may also be necessary.
- Whenever possible, gradual exposure to heat is preferred;
- Whenever possible, adjust the work schedule. For example, postpone nonessential or heavier work to another day or a cooler part of the day;
- Whenever possible, rotate personnel; and
- Increase the number and/or duration of rest breaks, but do not increase individual work periods when longer and/or more rest breaks periods are given.
  - Whenever possible, rest break areas should be in a cool area and as close to the work area as is feasible.

PPE is available, such as thermally conditioned clothing including self-contained air conditioning in a backpack and plastic jackets/vests with pockets that can be filled with dry ice or ice. However, the type of work being done, other required PPE, and the location in which the work is being done may prohibit or make the use of this PPE impossible or impractical.

B.2 Heat-Related Illnesses

The following guidance can be used in the identification and treatment of heat-related illness.

Heat Stress

This is the mildest heat-related illness, but prompt action may prevent a more severe heat-related illness. Symptoms include irritability, lethargy, significant sweating, headache, or nausea.

First-Aid

- Take the victim to a protected (e.g., shaded) area, remove any excess protective clothing, and provide cool fluids;
- If an air-conditioned spot is available, this is an ideal break location; and
- Once the victim shows improvement, he/she may resume working. However, the work pace and practices (e.g., does fluid intake need to be increased) should be moderated to prevent recurrence of the symptoms.

Heat Exhaustion

Heat exhaustion usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Symptoms include pale, clammy skin, profuse sweating and vomiting, and the bowels may move involuntarily. The pulse is weak and fast, breathing is shallow. Fainting can occur.

First-Aid

- Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling – you do not want the victim to shiver);
- Call a physician or emergency service, or transport the victim to medical care;
- Remove all protective outerwear; and
- If the victim is conscious, it may be helpful to give him/her sips of water.

Heat Stroke

Heat stroke is a severe medical condition requiring first-aid and emergency treatment by a medical professional, because death can occur without appropriate care. Heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperatures often rise to between 105 to 110 degrees Fahrenheit (°F). As the victim progresses toward heat stroke, symptoms include hot and usually dry, red, and spotted skin, headache, dizziness, nausea, mental confusion, delirium, possible convulsions, and loss of consciousness.

First-Aid

- Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling - you do not want the victim to shiver);
- Summon emergency medical help to provide on-site treatment and transportation to a medical facility;
- Remove all protective outerwear and loosen personal clothing;
- Give no stimulants or hot drinks; and
- Apply cool wet towels, ice bags, etc., to the head, armpits, and thighs. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place the victim in a tub of cool water.
  - The main objective is to cool without chilling the victim or causing him/her to shiver.

B.3 Skin Hazards

Sunburn and prickly heat are both symptoms of skin irritation/damage produced through exposure to sunlight and operating in hot work environments.

- Protect exposed skin with an appropriate sunscreen. A sunscreen with a sun protection factor (SPF) of 15 or greater is required for work in the sun with reapplication at breaks and lunch; and
- Heat rash, also known as prickly heat, can be prevented by the application of a hydrophobic, water-repellent barrier cream such as Kerodex 71.

C. Cold Stress

The four environmental conditions that cause cold-related stress are low temperatures, high/cool winds (wind chill), dampness, or cold water. One, all, or a combination of these factors can cause cold-related hazards. Cold stress, including frostbite and hypothermia, can result in severe health effects. Exposed skin is highly susceptible to wind chill and low temperatures.

Engineering controls should be utilized whenever possible to protect workers from cold-related hazards (for example, on-site heat sources, heated shelter, work areas shielded from drafty or windy conditions, and the use of thermal insulating material on equipment handles).

Effects arising from cold exposure will be minimized by the following control measures:

- Personnel will be trained to recognize cold stress symptoms.
- Field activities will be curtailed or halted if the equivalent chill temperature is below 20°F.
  - As much as possible, work that exposes personnel to the cold will be done during the warmest hours of the day.
  - Inactivity in cold conditions will be kept to a minimum.

- Frequent short breaks in warm, dry shelters will be taken.

- Vehicles will be equipped with supplies in case the vehicle becomes inoperable (e.g., blanket, dry clothing, water, food, a shovel).

The following PPE will be provided during work in cold environments:

- Workers will be provided with insulated dry clothing when the equivalent chill temperature is less than 30°F.

- Feet, hands, face, and head should be protected (40 percent of the body's heat can be lost when the head is exposed).

  – Foot and hand wear may also need to be waterproof.

- Clothing should be layered so that adjustments can be made to changing environmental temperatures and conditions. For example, an outer layer to break the wind, a middle layer that will absorb sweat and retain insulation when wet, and an inner layer that allows ventilation.

C.1 Cold-Related Illnesses

Hypothermia

Hypothermia occurs when the body temperature falls to a level where normal muscular and cerebral functions are impaired. Although it usually occurs in freezing air and water temperatures, it can occur in any climate if a person's temperature falls below normal. Symptoms should not be ignored and a supervisor, or whoever is available, should be notified as soon as hypothermia is suspected.

Initially, symptoms may include shivering, an inability to do complex motor functions, sluggishness, and mild confusion as the body temperature drops to around 95°F. As the body temperature falls, speech may become slurred, behavior may be irrational, simple motor functions may be difficult to do, and a state of "dazed consciousness" may exist. In severe states (below 90°F), heart rate, blood flow, and breathing will slow. Unconsciousness and full heart failure can occur.

First Aid

On Land

- Call for emergency help and move the victim (unless other injuries prohibit their being moved) to a warm, dry area and replace wet clothing with warm, dry clothing or a blanket. Move the person carefully because movement can increase the irritability of the heart.

- If the person is conscious and lucid, warm liquids can be provided, but **not** alcohol or caffeinated drinks. If possible, have them move their arms and legs to create muscle heat.

- If the person is unconscious or unable to assist, place warm bottles/packs in the person's armpits, groin, neck, and head areas.

- **Do not** rub the person's body or place them in warm water.

In Water (the body loses heat up to 25 times faster than on land)

- Call for emergency help and get the victim out of the water. Move the person carefully because movement can increase the irritability of the heart.

- **Do not** remove clothing - button, buckle, zip, and tighten collars, cuffs, shoes, and hoods because the water trapped next to the body provides a layer of insulation that may slow the loss of heat.

- If it is you in the water, **do not** swim unless a floating object or person can be reached quickly because swimming uses the body's heat and reduces survival time by about 50 percent.

  - If you are in the water and it is not possible to get out, conserve body heat by folding arms across the chest, keeping thighs together, bending knees, and crossing ankles. If another person is in the water with you, huddle together.

Frostbite

Frostbite occurs when the skin actually freezes, and deep frostbite can affect deeper tissues such as tendons and muscles. Frostbite usually occurs when temperatures drop below 30°F, but wind chill effects can cause frostbite at above-freezing temperatures. The ears, fingers, toes, cheeks, and nose are the most commonly affected body parts.

Initially, symptoms include an uncomfortable sensation of coldness. Tingling, stinging, or an aching feeling of the exposed area is followed by numbness. Frostbitten areas appear white and cold to the touch, and with deeper frostbite, the area becomes numb, painless, and hard and can turn black.

First Aid

- Seek medical attention as soon as possible and treat any existing hypothermia first.

- Warm liquids can be provided, but **not** alcohol or caffeinated drinks such as tea and coffee.

- **Do not** rub the affected areas, but cover them with dry, sterile gauze or soft, clean bandages.

- **Do not try re-warming the affected area if you have not been specifically trained to do so** and/or if there is a chance the affected area will get cold again.

Trench Foot

Trench foot is caused by a continuous exposure to a wet, cold environment. Symptoms include tingling and/or itching sensation, burning pain and swelling, and, in more extreme cases, blisters.

First Aid

- Seek medical attention as soon as possible and move the victim to a warm, dry area.

- Affected tissue can be treated with careful washing and drying and slight elevation. **Do not try re-warming the affected area if you have not been specifically trained to do so.**

C.2 Cold Stress Monitoring

Monitoring for cold stress is difficult and will be completed by the Site Safety Officer (SSO) by monitoring for symptoms and monitoring the weather conditions on a daily basis. The following table may be used as a guideline for establishing a work/rest regimen.

THRESHOLD LIMIT VALUES WORK/WARM-UP SCHEDULE FOR FOUR-HOUR SHIFT

Air Temperature-Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	Normal	1	Normal	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	Normal	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

D. Noise Exposure

The Occupational Safety and Health Administration (OSHA) generally considers any environmental condition where a person must shout to be heard from a distance of 3 feet a hazardous noise environment. Under these conditions, personnel must be protected through the use of appropriate hearing protective devices.

Hearing protection shall be worn:

- In any situation where normal conversation cannot be heard at a distance of 3 feet regardless of the source of the noise or where noise levels as measured with approved noise monitoring equipment is above 85 A-weighted decibels (dBA);

- When operating gasoline- or electric-powered machinery; and

- When working within 25 feet of operating heavy equipment (earth working equipment, etc.) because working around this type of equipment can result in exposure to hazardous levels of noise (levels greater than 90 dBA).

  - Earplugs or earmuffs will be worn.

The Project Health and Safety Manager (PHSM) may also choose to monitor employee exposure to potentially hazardous noise levels.

E. Severe Weather

During threatening weather, the SSO will monitor radio weather forecasts and heed any warnings. In addition, in the event of lightning in the vicinity of the site, the SSO will stop all activities and have site personnel take cover. Other severe weather such as high winds, hail, or heavy rain will be evaluated by the SSO, PHSM, and the Remediation Task Manager to determine how site activities should proceed.

F. Walking/Working Surfaces (Slips, Trips, Falls, and Protruding Objects)

Hazards from floor and wall openings and from careless movements, protruding objects, debris, spills, and placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. If any such hazards are identified, correct them immediately. If that is not possible, report the hazard to your SSO or Project Manager (PM) as soon as possible.

Slip, Trip, and Fall Hazards

Personnel should stay alert at all times and if tired or distracted, take this into account when working at the site. To minimize the possibility of injury:

- 8-inch sturdy work boots with good tread are required and steel-toed boots are recommended;
- Do not run;
- Slide feet when walking on slick/wet surfaces;
- Do not walk up or down steep embankments/hills if possible:
  - If not possible, walk at an angle when going up/down embankments/hills;
- Do not carry items that block your vision;
- Use handrails/grips when available and maintain 3-point contact whenever possible;
- Do not jump down from equipment and look down before you step down;
- Use appropriate fall protection when working at elevation;
- Report to the SSO or PM any floor openings that are not clearly marked and/or guarded;

- Do not use ladders/scaffolds during high winds or when ice or snow is on the rungs/work surface;
- Do not use ladder substitutes like a box or truck fender, and do not use ladders/scaffolding that are not in good condition;
- Keep paths and work areas clear of tools, equipment, boxes, cords, etc.
  - Tape or secure cords, wires, etc., to minimize a trip/fall hazard;
- If a protruding object cannot be moved, ensure that the object can be easily seen or guard/pad the object if possible; and
- Use ancillary lighting such as flashlights and headband lights when necessary.

G. Use of Drums and Containers

OSHA defines "anything that holds hazardous chemicals except pipes and piping systems" as a container (48 Federal Register [FR] 228 p. 53335). OSHA does not concern itself with non-hazardous materials; however, that does not mean that drums or containers containing non-hazardous materials cannot cause injury to workers. Examples of non-hazardous materials stored in drums and containers would include a drum of molasses rolling or falling and striking a worker.

G.1 Training

Prior to any movement of drums or containers containing hazardous materials or otherwise posing a threat to the safety of employees, all employees are required to be informed of the potential hazards associated the contents of the drums or containers.

As applicable, additional activities requiring appropriate training of employees include:

- Sampling procedures;
- Communication methods;
- Methods for relieving pressure from drums and containers or for shielding when pressure cannot be relieved from a remote location;
- Emergency response to accidents on site;
- Characterization of wastes to be bulked; and
- Use of monitoring equipment.

G.2 Labeling of Drums and Containers

Drums and containers shall be identified and classified prior to packaging for shipment.

G.3 Procedures for Handling Drums and Containers

Handling Drums and Containers

Where containers of a capacity greater than 5 gallons are used for containerizing chemical products or waste materials, handling of the containers will be accomplished in accordance with the following:

- When not in use, drums/containers will be covered with tight-fitting lids;
- At the conclusion of each work shift, all drums/containers will be placed in a designated storage area. This area will be properly marked and secured; and
- Mechanical or powered drum-handling equipment will be used to move "filled" drums/containers. Manual handling of the drums leads to musculo-skeletal injuries and will be avoided to the maximum extent possible.

Opening Drums and Containers

Only a couple of pounds of "built up" pressure can cause a loosened fitting to fly into the air like a rocket. This projectile can cause injury to site workers and can puncture adjacent containers or drums, causing rupture and leakage. If the drum or container is filled to or near the level of the opening, material can spew from the opening causing injury to site personnel, formation of hazardous/flammable atmospheres at the work site, and/or environmental damage. The procedure for opening of drums and containers needs to incorporate the minimum safeguards listed below:

- Employees not actually involved in the opening of the drum or container must be kept a safe distance from the drum or container during the process of opening it;
- Where there is the reasonable probability of a flammable atmosphere being present or developing on site, all equipment and tools must be of a type to prevent sources of ignition (non-sparking, explosion-proof, intrinsically safe) and grounding/bonding of containers needs to be considered;
- If the pressure within a drum or container cannot be relieved from a remote location, the employee opening the drum or container needs to be protected by an appropriate shield to reduce the risk of injury;
- Drums and containers are not stepladders. Employees are not allowed to stand on or work off of drums or containers;
- Material handling equipment used to move drums and containers needs to selected, positioned, and operated in a manner that minimizes the potential for the equipment to act as a source of ignition in the event that a drum or container should rupture;
- When a drum or container exhibits signs of over-pressurization such as swelling or bulging, the drum or container is not to be moved until the cause of the over-pressurization has been determined and proper containment procedures have been implemented;

- It is necessary to limit the number of areas where drums and containers are staged in order to identify and classify them; and

- Areas where drums and containers are staged need to be provided with adequate routes for access and egress from the staging area.

G.4 Use of Approved Drums or Containers

Drums and containers are required to meet the appropriate Department of Transportation (DOT), OSHA, and USEPA regulations for the materials that they contain. Large containers or drums shall carry either a DOT approval or a nationally recognized testing laboratory approval or both. The use of approved drums and containers provides some assurance that the drum or container will not fail due to incompatibility with the stored material and that the drum or container is structurally suitable for designated duty.

Drum Condition

The following apply to the assessment of drum condition:

- When practical, drums and containers must be inspected and their integrity ensured prior to being moved. Drums and containers that cannot be inspected prior to being moved due to storage conditions (i.e., buried, in a pile, stacked several tiers high) must be moved to an accessible location and inspected prior to further handling;

- Drums and containers that cannot be moved without risk of rupture, leakage, or spillage must be emptied into a sound container using a device classified (i.e., intrinsically safe or explosion-proof for the class of flammable material) for use around the material being transferred;

- Drums and containers are to be opened in a manner that safely relieves excess internal pressure; and

- If crystalline material is noted on any container, the contents of the container are to be handled as a shock-sensitive waste until positive identification of the contents determines otherwise.

G.5 Other Considerations

Unlabeled drums and containers must be considered to contain hazardous substances and are to be handled accordingly until positive identification of the contents has been made.

Polyethylene drums and containers are not equipped with a means for electrical grounding. When transferring flammable materials, the polyethylene container (or any other container for that matter) needs to be equipped with a mechanism that allows for grounding. A grounded suction pump (approved only) or a grounded metallic self-closing faucet can be used to accomplish safe transfer of flammable materials from these containers.

Where leaking drums or containers may be present, or ruptures or spills may occur, DOT-specified salvage drums or containers must be available on site along with suitable quantities of an appropriate absorbent material.

H. Heavy Machinery and Certification Requirements

H.1 Purpose

The purpose of this procedure is to present the minimum safety performance requirements for the operation of heavy equipment on ARCADIS project sites. Project managers are responsible for ensuring all equipment used on an ARCADIS site is certified and that equipment owners have submitted the attached Initial Equipment Inspection Checklist.

H.2 General Requirements

All equipment shall comply with all applicable requirements for motor vehicles and material handling heavy equipment contained in 29 Code of Federal Regulations (CFR) 1926 Subpart O. Heavy equipment includes, but is not limited to, drill rigs, front-end loaders, backhoes, track hoes, bulldozers, forklifts, cranes, derricks, and similar equipment used for the implementation of the project Statement of Work.

H.3 Equipment Safety Inspections

The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.

- All machinery and mechanized equipment will be certified to be in safe operating condition by a competent individual (using the attached Initial Equipment Inspection Checklist), within 7 days of initial on-site operation.
- Certification is valid for 1 year.
- Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.
- Inspections shall include, but are not limited to, all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.
- The driller in charge on a daily basis shall inspect drill rigs and related support equipment and vehicles. These inspections shall be recorded/documented.
- Preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or established internal policies, schedules, and equipment standard operating procedures (SOPs).
- Only designated qualified persons shall operate machinery and mechanized equipment.
- Records of tests and inspections shall be maintained at the site by the operating contractor, shall be made available upon request of the designated authority, and shall become part of the official project file.

- Equipment not found to be in safe operating condition, or when a deficiency affecting the safe operation of the equipment is identified, the equipment shall immediately be taken out of service and its use prohibited until safe conditions have been corrected.

- All equipment shall be kept in the Exclusion Zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas. Note: This not typical for construction sites. It would be for remediation sites.

- All equipment must have an audible alarm that sounds when the equipment is moving in reverse.

I. Trenching and Excavation Safety

All trenching and excavation operations will be accomplished in accordance with the requirements of 29 CFR 1926.650. The following safe operating guidelines apply to open trenches or excavations exceeding 4 feet in depth **or** of any depth if in unstable soil conditions, as required by 29 CFR 1926.650. An excavation is any manmade cut, cavity, trench, or depression in an earth surface, formed by earth removal; a trench is a narrow excavation (in relation to its length) made below the surface of the ground.

I.1 Excavation Construction Guidelines

The following are minimum requirements and must be met before any personnel are permitted to enter any excavation:

- Excavated materials will be stored and retained at least 2 feet from the edge of the excavation (Note: This procedure must be observed even when excavation/trench entry will not occur).

- Trees, boulders, and other surface encumbrances that create a hazard will be removed or made safe before excavation is begun.

- Special precautions will be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation.

- Except in hard rock, excavations below the level of the base of the footing of any foundation or retaining wall will not be permitted unless the wall is underpinned and all other precautions have been taken to ensure the stability of the adjacent walls.

- All ladders used in excavation operations will be in accordance with the requirements of 29 CFR 1926 Subpart L.

- Excavations will be inspected at least daily, or more often as conditions warrant, by a competent person to ensure that changes in temperature, precipitation, shallow groundwater, overburden, nearby building weight, vibrations, or nearby equipment operation have not caused weakening of sides, faces, and flows. The SSO will accompany the competent person and document this inspection in the daily safety log.

- Diversion ditches, dikes, or other suitable means will be used to prevent water from entering an excavation and for drainage of the excavation.

- When mobile equipment is used or allowed adjacent to excavations, stop logs or barricades will be installed. The grade will always be away from the excavation.

- Dust conditions during excavation will be kept to a minimum. Wetting agents shall be used upon the direction of the SSO.

- Field personnel shall not enter any excavation without specific direction for any reason except to rescue injured individuals who have fallen into the excavated area.

- All excavations will be marked and protected at all times to ensure site personnel, visitors, or unauthorized personnel do not enter without permission or fall into the trench.

- Personnel will work in pairs when working around an excavation of 2 feet or more.

I.2 Trench Entry Requirements

The following requirements must be met before any personnel are permitted to enter any excavation:

- Expected hazardous ground movement areas and banks which are more than 4 feet high (or less if soil is deemed unstable by the competent person) shall be shored, laid back to a stable slope, shielded, or equivalent.

- Sides of trenches or excavations in unstable or soft material which are 4 feet or more in depth (or less if soil is deemed unstable by the competent person) shall be shored, sheeted, braced, sloped, or equivalent.

- Sides of excavations in hard compact soil, including embankments, are shored or otherwise supported when the trench is 4 feet or more in depth (less if soil is deemed unstable by the qualified person).

- Materials used for sheeting, sheet piling, bracing, shoring, and underpinning shall be in good, serviceable condition.

- A means of egress (ladder, ramps, stairways, etc.) shall be accessible at any location inside the excavation without requiring more than 25 feet of lateral travel distance.

- Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins when the competent person subjects excavations to vibrations as deemed necessary.

I.3 Atmosphere & Testing

Before an employee enters an excavation that is greater than 4 feet in depth (or less if soil is deemed unstable by the competent person), the atmosphere must be tested to ensure that an oxygen deficient or hazardous atmosphere does not exist. If the concentration of any airborne contaminant exceeds one-half its permissible exposure limit (PEL) or other applicable occupational exposure limit (OEL), the airborne oxygen concentration is less than 19.5 percent, or explosivity exceeds 10 percent of the lower explosive limit (LEL), then no personnel shall be permitted to enter the excavation until such engineering controls or other hazard controls are instituted to eliminate or control hazard.

HEAVY EQUIPMENT CERTIFICATION REQUIREMENTS

Initial Equipment Inspection Checklist

TO: _____ DATE: _____

FROM: **ARCADIS**

Project Name: **Mississippi Bluffs**

Project Location: **Vicksburg, Mississippi**

1. This form provides certification of machinery and mechanized equipment to be used on the referenced project for the following work:

Description of Equipment Work:	
Project Site:	
Owner of Equipment: Address:	
Dates (Duration) of Equipment Work:	

2. Inspection and certification of machinery and mechanized equipment, as required by the ARCADIS Project Team, have been made prior to but within 7 calendar days advance of use on the project site. Re-certification will be required for equipment that is used on the project site for more than 1 year.

	Identification of Equipment (Make, Model, Serial Number)	Date of Certification
1		
2		
3		

3. The above listed equipment has been inspected and tested as indicated above, and is CERTIFIED TO BE IN SAFE OPERATING CONDITION BY THE FOLLOWING COMPETENT INDIVIDUAL:

Name: _____ Title: _____

Company: _____

Signature: _____ Date: _____

4. If there are any questions regarding this certification, please contact the following ARCADIS Project Team representative: _____

Daily Heavy Equipment Inspection Checklist

EQUIPMENT I.D. NO:_____

EQUIPMENT NAME: _____

DATE: ___/___/_____ PROJECT #: _____ CONTRACT #: _____

ITEM INSPECTED	INSPECTOR'S INITIALS
Falling Object Protective Structure (FOP)	
Roll-Over Protective Structure (ROP)	
Seat Belts	
Operators Seat Bar(s)	
Side Shields, Screens, or Cabs	
Lift Arm Restraining Device	
Grab Handles	
Back-Up Alarm(s) – Working	
Lights	
Guards	
Horn	
Anti-Skid Tread Steps Clear of Mud	
Safety Signs (Counterbalance swing area)	
Fire Extinguisher (arrow in green, monthly inspection)	
General Condition	
Fuel Condition	
Oil (Full, No Leaks)	
Clear of Extra Materials	
Controls Function Properly	
Damaged Parts	
Hydraulic System (Full, No Leaks)	
Parking Brake	
Lift Arm and Bucket	
Tires/Tracks	
Steering	
Hours at Time of Inspection	
Time Inspected	
Site Name	
Inspector's Name (Printed)	

INSTRUCTIONS – Inspect all applicable items indicated each shift prior to use. Note any unsatisfactory conditions on the back of this sheet and bring to the attention of the supervisor immediately. Operators are required to sign in on this sheet the first time that they operator the equipment each day.

J. Underground and Aboveground Utilities

Various forms of underground and aboveground utility lines or pipes (carrying water, wastewater, gas, and/or electricity) may be encountered during work activities. Prior to the start of intrusive operations activities, all utilities must be located and measures must be instituted to avoid contact with these structures. All utility lines and/or piping will be identified and rendered controlled (through Lockout/Tagout procedures) or protected from damage.

Should any operations cause equipment to come into contact with utility lines, the SSO and the PHSM will be notified immediately and an Incident Report will be completed. Work will be suspended until the appropriate actions for the particular situations can be taken.

Work involving machinery with high extensions (backhoes, etc.) in the vicinity of overhead power lines shall not be conducted within the limits prescribed in the table below. The distance may be lengthened if directed by the Client or the electric company and any specified distances will be strictly followed.

Safe distances from overhead power lines are as follows:

Voltage Range (phase to phase, RMS)	Approach Distance (inches)
300 V and less	Avoid contact
Over 300 V, not over 750 V	12
Over 750 V not over 2 kV	18
Over 2 kV, not over 15 kV	24
Over 15 kV, not over 37 kV	36
Over 37 kV, not over 87.5 kV	42
Over 87.5 kV, not over 121 kV	48
Over 121 kV, not over 140 kV	54

From 1910.238(b)(7)(iii)

A Utilities and Structures Checklist is attached and may be used to verify that all utilities have been marked.

Utilities and Structures Checklist

Project: **Mississippi Bluffs** Prepared By: _____

Location: **Vicksburg, Mississippi** Date: _____

Instructions. This checklist may be used as a safety measure to ensure that all underground utility lines and other underground structures, as well as aboveground power lines, are clearly marked out in the area selected for boring or excavation. **DRILLING OR EXCAVATION WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.**

Arrangements for underground utility mark-outs are best made at the time of the preliminary site visit to allow Client and/or utility company sufficient time. Keep completed checklist and maps on site; send copy to the PM.

Assignment of Responsibility. Client is responsible for having underground utilities and structures located and marked. Preferably, the utilities themselves should mark out the lines.

Drilling or Excavation Sites. Attach a map of the property showing the proposed drilling or excavation site (or if sites are widely separated, several maps) clearly indicating the area(s) checked for underground utilities or underground structures and the location of aboveground power lines.

Utilities and Structures			
Type	**Not Present**	**Present**	**How Marked** (flags, paint, wooden stakes, etc.)
Petroleum Products Line			
Natural Gas Line			
Steam Line			
Water Line			
Sewer Line			
Storm Drain			
Telephone Cable			
Electric Power Line			
Product Tank			
Septic Tank/Drain Field			
Overhead Power Line			

Name and affiliation of person who marked out underground lines or structures

Name	Organization	Phone

K. Visible Dust Suppression

In the event that airborne concentrations of dust and dust-laden chemical contaminants are found to exceed established action levels, the SSO will implement appropriate mitigation measures to include water-suppression techniques. If mitigation measures are found to be inadequate (contaminant concentrations cannot be reduced below Health and Safety Plan [HASP] requirements), the SSO will halt on-site operations until effective control can be achieved.

L. Chemicals and Other Hazardous Substances

L.1 Benzene

Benzene is a known human carcinogen. Prolonged skin contact with benzene or excessive inhalation of its vapor may cause headache, weakness, loss of appetite, and lassitude. Continued exposure can cause collapse, bronchitis, and pneumonia. The most important health hazards are cancer (leukemia), bone marrow effects, and injuries to the blood-forming tissue from chronic low-level exposure.

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals that are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil and can pass through the soil into underground water.

Benzene does not build up in plants or animals.

Chemical Name	Physical Description	Health Effects	TLV 8-hr TWA	Physical Properties	Special Precautions
Benzene	Colorless to light yellow liquid with aromatic odor	Irritant to eyes, skin, and lungs; affects nervous system; considered carcinogen	0.5 ppm	Flammable liquid LEL 1.2% Flash point – 12°F	Known to cause leukemia in humans

°F Degrees Fahrenheit. ppm Parts per million. TWA Time weighted average.
LEL Lower explosive level. TLV Threshold limit value.

L.2 Heavy Metals

Heavy metals that are potentially found on site include arsenic, barium, cadmium, chromium, lead, molybdenum, selenium, silver. Areas where potential exposure to these metals may occur include laboratory hood and liquid in laboratory sinks. Routes of exposure include ingestion and inhalation. Heavy metals are toxic and can cause severe organ damage and can affect the central nervous system. The likelihood of exposure to elevated levels of these metals during this project is low; however, precaution should be taken when performing activities in identified areas. Atmosphere containing potential airborne heavy metals shall not be entered without proper PPE in accordance with this HASP.

L.3 Pentachlorophenol (PCP)

PCP is a manufactured chemical that does not occur naturally. Pure PCP exists as colorless crystals. Impure PCP (the form usually found at hazardous waste sites) is dark gray to brown and exists as dust, beads, or flakes. PCP was widely used as a pesticide and wood preservative. Since 1984, the purchase and use of PCP has been restricted to certified applicators. It is no longer available to the general public. It is still used industrially as a wood preservative for utility poles, railroad ties, and wharf pilings.

Studies in workers show that exposure to high levels of PCP can cause the cells in the body to produce excess heat. When this occurs, a person may experience a very high fever, profuse sweating, and difficulty breathing. The body temperature can increase to dangerous levels, causing injury to various organs and tissues and even death. Liver effects and damage to the immune system have also been observed in humans exposed to high levels of PCP for a long time. Damage to the thyroid and reproductive system has been observed in laboratory animals exposed to high doses of PCP. Some of the harmful effects of PCP are caused by the other chemicals present in technical grade PCP. The USEPA has determined that PCP is a probable human carcinogen and the International Agency for Cancer Research (IARC) considers it possibly carcinogenic to humans.

L.4 Perchloroethylene (PCE) (aka Tetrachloroethene)

High concentrations of PCE (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used PCE to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of PCE are not known.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that PCE can cause liver and kidney damage. Exposure to very high levels of PCE can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

PCE is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for PCE include tetrarchloroethylene and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell PCE when it is present in the air at a level of 1 part PCE per million parts of air or more, although some can smell it at even lower levels.

- Much of the PCE that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the PCE in soil or underground water.

In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.

Chemical Name	Physical Description	Health Effects	TLV 8-hr TWA	Physical Properties	Special Precautions
PCE	Colorless liquid with a chloroform-like odor	Irritant to eyes, skin, and lungs; affects nervous system	25 ppm	Noncombustible liquid	Animal carcinogen Chlorinated solvent

ppm Parts per million. TLV Threshold limit value. TWA Time weighted average

L.5 Phthalates

Phthalates such as bis(2-ehtylhexl)phthalate have very low acute toxicities and only in high doses can they cause weight loss, breathing difficulties, and drowsiness.

L.6 Polychlorinated Biphenyl (PCBs)

PCBs are usually found as a mixture of the chlorinated phenyl compounds—the exact mix determines the desired performance criteria. PCBs have a low vapor pressure, making inhalation an unlikely exposure route. Skin contact can lead to the production of an acne-like condition known as chloracne. Additionally, PCBs are absorbed through the skin, so contact should be avoided. Chronic exposure can lead to liver damage and possible reproductive effects. PCBs have also been identified as a potential human carcinogen.

Information on PCB compounds is presented for site contaminant awareness. While the potential for site personnel to sustain significant inhalation exposures to volatilized PCB compounds during the site activities of this project is minimal, there is the potential for inhalation of PCB-contaminated dust and from skin contact. Handling of contaminated soil presents skin exposure hazards. Use of dust suppression techniques (as appropriate) and the proper use of PPE will adequately protect personnel. Atmosphere containing potential airborne PCBs shall not be entered without proper PPE in accordance with this HASP.

L.7 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of more than 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot. Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are

found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people. Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure, but these effects have not been seen in people. The Department of Health and Human Services has determined that some PAHs may reasonably be expected to be carcinogens. Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

L.8 Trichloroethene (TCE)

Breathing small amounts of TCE may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Breathing large amounts of TCE may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage. Skin contact with TCE for short periods may cause skin rashes.

TCE is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

TCE is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

- TCE dissolves a little in water, but it can remain in groundwater for a long time.
- TCE quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- TCE evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- TCE may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- TCE does not build up significantly in plants and animals.

Chemical Name	Physical Description	Health Effects	TLV 8-hr TWA	Physical Properties	Special Precautions
TCE	Colorless liquid with a chloroform-like odor	Irritant to eyes, skin, and lungs; affects nervous system	50 ppm	Combustible liquid LEL 8%	Animal carcinogen Chlorinated solvent

LEL Lower explosive level.
ppm Parts per million.
TLV Threshold limit value.
TWA Time weighted average.

L.9 Vinyl Chloride

Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death.

People who work frequently with vinyl chloride have developed nerve damage and immune reactions. Other workers have developed problems with the blood flow in their hands; the tips of their fingers turn white and hurt when they are in cold temperatures. Sometimes, the bones in the tips of their fingers have broken down. Vinyl chloride on your skin can cause numbness, redness, and blisters.

Animal studies have shown that long-term (365 days or longer) exposure to vinyl chloride can damage the sperm and testes. It has not been proven that vinyl chloride causes birth defects in humans, but animal studies have shown that breathing vinyl chloride can harm unborn offspring and may also cause increases in early miscarriages.

Vinyl chloride is a colorless, flammable gas at normal temperatures with a mild, sweet odor. It is a manufactured substance that is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and furniture and automobile upholstery.

Vinyl chloride also results from the breakdown of other substances, such as trichloroethane, trichloroethylene, and tetrachloroethylene. Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

In the environment:

- Liquid vinyl chloride evaporates easily into the air. Vinyl chloride, if it is near the surface of soil or water, can also evaporate.
- Vinyl chloride in the air can break down within a few days to other substances, some of which can be harmful.
- Small amounts of vinyl chloride can dissolve in water.
- Vinyl chloride formed from the breakdown of other chemicals can enter groundwater.
- Vinyl chloride is unlikely to build up in plants or animals.

Chemical Name	Physical Description	Health Effects	TLV 8-hr TWA	Physical Properties	Special Precautions
Vinyl Chloride	Colorless gas or liquid with a pleasant odor at high concentrations	Weakness, abdominal pain, gastrointestinal bleeding, affects liver and nervous system	1 ppm	Flammable gas LEL 3.6%	Carcinogen of the liver

LEL Lower explosive level.
ppm Parts per million.
TLV Threshold limit value.
TWA Time weighted average.

M. *Decontamination*

All personnel and equipment entering any controlled work area must be adequately decontaminated prior to exiting the area. The procedures should be adopted for site-specific decontamination procedures.

M.1 *Personnel Decontamination*

Decontamination procedures must be carried out on all personnel who have been in contact with contaminated materials. Under no circumstances (except emergency evacuations) will personnel be allowed to leave a controlled work area where contaminants are exposed without performing decontamination.

Decontamination of personnel should be performed at a Personal Decontamination Station on the project site and should consist primarily of soap and water washing 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 procedure appropriate to the degree of contamination should be established. The extent of washing required, or modifications to the sequence, may be specified as appropriate.

The designated decontamination areas will be located between the lines, which mark the boundaries of the Exclusion Zone (EZ) and the Contamination Reduction Zone (CRZ). This configuration will ensure that all personnel and equipment leaving the clean side of the decontamination area will be entering the Support Zone (SZ), which will be considered a contaminant free area.

Level D Personnel Decontamination

Personnel exiting the EZ while site activities require the use of Level D PPE will perform decontamination in the designated decontamination area in accordance with the following guidelines:

- Place tools, instruments, samples, and trash at an appropriate location. The equipment drop area should be clean and dry and, at a minimum, plastic bags should be available for trash. Waste PPE will not be placed in the same containers as general trash.

- Inspect equipment, samples, and, if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples, and tools prior to removal from the decontamination areas back into the support zone.

- Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.

- Prior to exiting the decontamination areas, personnel will wash their hands with soap and water in order to minimize the potential for contaminant exposure from the final handling of equipment and PPE.

Modified Level D Personnel Decontamination

Where activities are performed in Modified Level D PPE, personnel will perform decontamination using the following guidelines:

- Place tools, instruments, samples, and trash at an appropriate location. The equipment drop area should be clean and dry and, at a minimum, plastic bags should be available for trash. Waste PPE will not be placed in the same containers as general trash.

- Inspect equipment, samples, and, if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples, and tools prior to removal from the decontamination areas.

- Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.

- Untape wrists and ankles.

- Remove outer work gloves and place in an appropriate container specified for waste PPE.

- Remove outer Tyvek coveralls and place them in an appropriate container specified for waste PPE.

- Remove inner protective gloves and place them in an appropriate container specified for waste PPE.

- Wash hands using soap and water (separate from other decontamination cleaners/solutions).

Level C Personnel Decontamination

Personnel involved in activities that require the use of Level C PPE will observe the following decontamination guidelines:

- Place tools, instruments, samples, and trash at an appropriate location. These areas should be clean and dry and, at a minimum, contain plastic bags for trash. Waste PPE will not be placed in the same containers as general trash.

- Inspect equipment, samples, and, if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples, and tools prior removal from the decontamination areas. Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.

- Untape wrists and ankles.

- Remove outer work gloves and place them in an appropriate container specified for waste PPE.

- Remove outer Tyvek coveralls and place them in an appropriate container specified for waste PPE.

- Wipe off and remove respirator mask (also goggles if worn).
- Remove inner protective gloves and place them in an appropriate container specified for waste PPE.
- Wash hands using soap and water (separate from other decontamination cleaners/solutions).

M.2 Equipment Decontamination

Heavy equipment used for this project is expected to contact hazardous substances as defined by HAZWOPER and, therefore, will require decontamination procedures. Proper decommissioning procedures of heavy equipment will be instituted by the SSO.

Decontamination During Emergencies

Often during emergencies, the need to quickly respond to an accident or injury must be weighed against the risk to the injured party from chemical exposure. It may be that the time lost or the additional handling of an injured person during the decontamination process may cause greater harm to the individual than the exposure that would be received by undressing that person without proper decontamination.

An additional consideration to include when bypassing decontamination of injured personnel is the acceptance of contaminated personnel at emergency medical facilities. Many facilities will not accept contaminated personnel. Site response personnel should accompany contaminated victims to the medical facility to advise on matters involving decontamination.

Disposal of Decontamination Wastes and PPE

Disposal of waste associated with the project will be handled in accordance with the specification for each identified contaminant. The SSO will determine the disposal requirements as the situation arises.

N. Dust, Fumes, and Mists

Many materials can become airborne and create hazards when they are inhaled, when they contact the skin or mucous membranes, or when they settle out of the air onto surfaces that people come into contact with or onto food or other items from which we ingest the materials. It is important that these hazards are controlled to avoid these routes of exposure. Below is a detailed discussion of each.

N.1 Dust

Dust is small particles of dry matter. Dust can be generated by handling, crushing, grinding, rapid impact, detonation, and breakdown of certain organic or inorganic materials, such as rocks, ore, metal, coal, wood, and grains. Under certain conditions such as wind and disturbances such as driving, drilling, earth moving, etc., these dusts can become airborne. The hazards associated with the dust greatly depend on the size of the dust particles and their content. Dusts laden with metals such as lead, cadmium, arsenic, or chromium or dusts that have semivolatile compounds adsorbed on to them such as PCB, pesticides, or others increase the hazards above inert materials. It is important to understand the potential contaminants and their concentrations in the source from which the dust is being formed.

Dust particles may be small enough that they are respirable, capable of being drawn deep into the lungs when inhaled. Some dusts, such as certain forms of asbestos, chrystalline silica, cotton dust, wood dust, metal dusts, and coal dust, remain lodged deep inside the lungs where they can eventually cause cancer or other chronic health effects such as emphysema, pneumoconiosis, and bronchitis. At the very least, most dusts are respiratory irritants. They can also cause mucous membrane irritation in the eyes and nose. Dusts that are not respirable can lead to hazards associated with skin contact and ingestion and cause physical hazards from visibility problems, equipment deterioration or malfunction, complaints from neighbors of the site, or regulatory compliance issues.

Some dusts can form explosive mixtures in air. Grain dust or flour are combustible materials that can be reduced to a dust that has an extremely high surface area and can burn quite rapidly. When the concentrations of air and dust fall within the explosive limits and are ignited, fire and explosion occur. Essentially any material that can burn can explode as a dust.

OSHA and the American Conference of Governmental Industrial Hygienists (ACGIH) exposure levels for dusts are as follows (several other compounds have PELs and threshold limit values [TLVs]; see the respective reference for more details). If the dusts generated on the site have any of these hazardous constituents, additional procedures and requirements may apply and these constituents should be further identified and assessed.

Type of Dust	OSHA PEL 8-Hour TWA (mg/m^3)
Inert Dust or Particulates Not Otherwise Regulated (PNOR)	15
Respirable Inert Dust or PNOR	5
Lead	0.050 (PEL); 0.030 (AL)
Silica	See note below
Cotton	Ranges from 0.2 to 0.75 depending on type
Cadmium	0.005 (PEL); 0.0025 (AL)
Arsenic (Inorganic)	0.010 (PEL); 0.005 (AL)
Calcium Carbonate	15 for total; 5 for respirable
Coal	See note below
Portland Cement	15 for total; 5 for respirable
Aluminum Metal	15 for total; 5 for respirable
Boron Oxide	15 for total
Calcium Hydroxide	15 for total; 5 for respirable
Calcium Sulfate	15 for total; 5 for respirable
Copper Dust	1
Grain Dust	10
Gypsum	15 for total; 5 for respirable
Limestone	15 for total; 5 for respirable
Malathion	15
Starch	15 for total; 5 for respirable
Sucrose	15 for total; 5 for respirable

AL	Action level where specific regulatory requirements are applicable.
Coal	Depends on the amount of crystalline silica (See Table Z-3 of OSHA 1910.1000).
mg/m^3	Milligram per cubic meter.
Mppcf	Millions of particles per cubic foot of air.
PEL	Permissible Exposure Level based on an 8-hour Time Weighted Average (TWA).
Silica	The PEL is calculated from the percent of crystalline silica in the material (See Table Z-3 of OSHA 1910.1000).

By calculating the ratio of total dust to the content of specific compounds in the soil or dust producing media, the measurement of airborne total dust can provide some rough estimates of the airborne concentrations of those particular compounds without having to complete laboratory analysis. However, it still may be necessary to conduct sampling to determine actual exposure or measurements of airborne contaminants based on regulatory, client, and project requirements.

Control of dust at its source is the most appropriate means of controlling the hazard. This may include wetting the source with water or surfactant, covering it, or removing it. Based on site conditions including weather and site activities, the SSHO and the PM will determine the most appropriate control process.

Appropriate PPE is outlined in the PPE section of this HASP.

N.2 Fumes

Fume refers to small particulate or liquid droplets given off by a substance as a result of a chemical transformation such as reaction, heating, explosion, or detonation. The term applies particularly to very fine solid or liquid particles as a suspension in air. Activities that can create fumes include welding, soldering, brazing, and other activities that generally convert a solid material to a vapor stage for a short period of time with condensation taking place to convert the vapor back to a solid, very small particle in a very short period of time. Often fume is made up of a metal like lead, arsenic, cadmium and others. Chemical reactions can result in a fume of hydrochloric acid or other corrosive compound. The hazards associated with fumes are similar to that of dusts; however, the fume is smaller, which means it can get deeper into the lungs, and is generally more concentrated with the material from which it was formed.

The hazard controls for fumes will greatly depend on the makeup of the fume and should be addressed elsewhere in this HASP. There are OSHA PELs and ACGIH TLVs that have been developed for certain types of fumes. For example, copper has a PEL for both dust and fume and they are different reflecting the different points of exposure that can occur from the two.

N.3 Mists

Mists are small, airborne droplets of liquid and could be made up of one or several compounds. Typically, these liquids become airborne through some type of mechanical force that aerosolizes the liquid. These droplets can coagulate forming larger droplets and fall out of the air. However, they can also remain suspended and become an exposure issue via inhalation or dermal contact. The specific hazards will be dependent on the compounds making up the mist. Those hazards are identified in other sections of this HASP.

O. Ergonomic Hazards

O.1 Hazards

- Low back pain.
- Musculoskeletal disorders.
- Repetitive strain injuries.
- Tension neck syndrome.
- Carpal tunnel syndrome.
- White finger.

O.2 Definitions

Carpal Tunnel Syndrome: The compression and entrapment of the median nerve where it passes through the wrist into the hand in the carpal tunnel. The median nerve is the main nerve that extends down the arm to the hand and provides the sense of touch to most of the hand.

Ergonomics: The science of fitting the jobs to the people who work in them, rather than the person to the job.

Occupational Overuse Injuries: A range of conditions such as discomfort, strains, and sprains that affect mainly the back, neck, and limbs and which are related to the working environment or the task performed. Some of these conditions are referred to as Repetitive Strain Injuries (RSI).

Raynaud's Syndrome or White Finger: Blood vessels of the hand may be damaged from repeated exposure to vibration over a long period of time. The skin and muscles do not get the necessary oxygen from the blood and eventually die.

Tendonitis: Tendon inflammation that occurs when a muscle or tendon is repeatedly stressed by overuse or unaccustomed use.

Work-related Musculoskeletal Disorder (WMSD): An injury or illness that includes muscle strains and tears, ligament sprains, joint and tendon inflammation, pinched nerves, and spinal disc degeneration and medical conditions such as rotator cuff syndrome, trigger finger, carpal tunnel syndrome, and hand-arm vibration syndrome (HAVS) that are associated with workplace risk factors.

O.3 Procedures

Recognition

Workplace risk factors include:

- Repetitive, forceful, or prolonged motions.
- Frequent or heavy lifting.
- Pushing, pulling, or carrying heavy objects.
- Fixed or awkward work postures.
- Contact stress.
- Localized or whole body vibration.
- Cold temperatures.
- Poor lighting.
- Noise.

These factors can be intensified by work characteristics such as:

- Inadequate work-rest cycles.
- Excessive work pace or duration.
- Lack of task variability.
- Machine-paced work.
- Improper tool design.

O.4 Control Practices

Workstations

- Make workstations adjustable, enabling both large and small persons to fit comfortably and reach materials readily.
- Locate all materials in front of the worker to reduce twisting motions. Provide enough workspace.
- Avoid static loads and fixed work postures.

- The work surface should be set above elbow height for tasks involving fine visual details and below elbow height for tasks involving downward movement and heavy physical effort.
- Provide adjustable and properly designed chairs.
- Allow employees to alternate between sitting and standing.

Hand and Wrist Tasks

- Reduce the number of repetitive motions per shift.
- Maintain a neutral wrist position.
- Reduce the force or pressure on the wrists and hands.
- Avoid reaching above shoulder height, below waist level, or behind the body to minimize shoulder stress.
- Avoid repetitive work that requires full arm extension.
- Isolate hands from heat, cold, and vibration.

Hand Tool Use

- Maintain straight wrists through the work movement.
- Avoid static muscle loading.
- Reduce grip force requirements.
- Avoid sharp edges and pinch points.
- Avoid repetitive trigger-finger actions.
- Wear gloves that fit.

Lifting and Lowering

- Reduce manual lifting where possible.
- Eliminate the need to lift or lower manually by using appropriate machines.
- Reduce the weight or capacity of the object to be handled.
- Provide grips or handles to enable a load to be held closer to the body.
- Reduce load lifting, carrying, and lowering by using conveyors, hand trucks, and carts.

O.5 Training

Employees should be trained in ergonomically sound work practices:

- General awareness training
- Specific training for employees whose jobs require repetitive motions.
- Task-specific training for repetitive tasks and lifting tasks.

P. Personal Safety

If there are issues of personal safety at a project site, resources such as the client, local law enforcement officials, park or wildlife service, and animal control will be utilized as necessary to ensure the safest possible work environment. Some general guidelines are provided here, but each situation is different and actions must be taken based on the specifics of each.

P.1 Personal Safety

If it is deemed that a work site is in an area where an employee's personal safety may be at risk from potential criminal acts, the PM or SSO will work with the client and local law enforcement officials to evaluate the risk and determine what steps can be taken to minimize the risk. For example, can local law enforcement be present or make frequent drive-bys while the work is being done, should outside security be hired, should work only occur during certain times of the day, or should work not proceed at all.

In areas of risk such as this and if work proceeds, employees will not work alone and will have the ability to communicate with local law enforcement and the PM through cell phones or 2-way radios. Employees will check-in with the PM (or other specific individual) at predetermined times throughout each work day, and if employees do not call in, the PM will attempt to contact the team. If unsuccessful, the PM will notify local law enforcement.

If while on the project site and despite the other precautions set forth, an employee feels that their personal safety is at risk from potential criminal acts, the employee should leave the site immediately if possible and report their concerns to the PM or SSO so that appropriate steps can be taken as described above

P.2 Project Site In Isolated Area and Employees Working Alone

Whenever possible, employees will not work alone in isolated areas.

If the isolated area involves hiking/walking into areas that are unmarked or if there is potential to become directionally disoriented (e.g., no trails, unmarked trails, forested or highly vegetated areas), employees will be trained on the use of a compass and trail/topography maps and, if necessary, will take wilderness safety training. The PM or SSO will work with the park/wildlife service on what emergency planning is necessary (e.g., unexpected weather, animal attack, and search/rescue).

Communication through cell phones or 2-way radios will be utilized whenever possible. In addition, if employees are unable to check in on a daily basis because of the project location and cell phones or 2-way

radios do not work, consider the use of some type of transponder or global positioning system (GPS) locator device that can be used to locate the team if necessary.

Employees will check in with the PM (or other specific individual) at predetermined times throughout each work day and if employees do not call in, the PM will attempt to contact the team. If unsuccessful, the PM will notify the appropriate authorities. In addition, and especially if communication is not possible during the day, the PM will know the planned start and estimated finish times and employees will check in with the PM at the end of the work day.

If employees will be moving from isolated area to isolated area, for each day that this will occur, there will be:

- Established beginning and ending locations;
- Planned start and estimated finish times; and
- Planned routes that will be followed throughout the day.

Employees will not deviate from this schedule without first contacting the PM. It may also be appropriate and necessary to notify the client, law enforcement, or park/wildlife officials of these schedules.

The PM should also check with local authorities in regard to any hunting season that may be in session and if it is possible that hunters may be present in the area in which ARCADIS personnel will be working. If so, employees will wear brightly colored hardhats/hats and reflective vests, will not work before sunrise and work will end 30 minutes before dusk, and employees will be advised to make lots of noise by talking loudly at regular intervals or carrying a radio to help ensure that they aren't mistaken for an animal/bird.

P.3 Employees Working Late/Early Hours

Whenever possible, employees will not work before sunrise and work will be completed before dark. If this is not possible, employees will wear appropriate reflective apparel and have appropriate lighting, such as portable lighting, flashlights, or headlamps as appropriate for the activity being conducted. Personal security will be assessed and measures taken as discussed above if appropriate.

P.4 No or Limited Cell Phone Service

The PM will assess if any other type of communication such as 2-way radios is appropriate for the area. If not, the PM will know the planned start and estimated finish times and employees will check in with the PM at the end of the work day. In addition, if employees are unable to check in on a daily basis because of the project location and 2-way radios do not work, consider the use of some type of transponder or GPS locator device that can be used to locate the team if necessary.

If employees will be moving from area to area within a day or over several days, each time the crew moves, the team will:

- Establish beginning and ending locations;

- Plan start and estimated finish times; and

- Plan routes that will be followed throughout the period.

Employees will not deviate from the schedule or planned route without first contacting the PM. It may also be appropriate and necessary to notify the client, law enforcement, or park/wildlife officials of these schedules and routes.

P.5 Potentially Dangerous Wildlife

The local park or wildlife service should be contacted to verify what type of potentially dangerous wildlife may be in or around the work site, to provide their recommendations on avoiding contact, and, if contact is made, how to react appropriately. If the chance for contact with potentially dangerous wildlife is high, it may be necessary to work with the park/wildlife service to have a member of their staff on site while work is being performed and/or to have personnel receive additional training on avoiding and reacting to the particular animal(s). Protection from wildlife may require specific protection devices like pepper spray, bear-proof canisters, or other devices as recommended by wildlife experts.

P.6 Guard or Stray Dogs

If the client utilizes guard dogs at the site, the PM or SSO will work with the client each day to ensure that the dogs are unable to gain access to any area in which ARCADIS personnel will or could be working. ARCADIS personnel will also carry pepper spray or a similar product that can be used to protect themselves in case a guard dog does come into the work area.

If stray dogs are known to be in an area in which ARCADIS personnel will be working, the PM or SSO will work with local animal control to have the dogs removed from the area. ARCADIS personnel will carry pepper spray or similar product as recommended by animal control that can be used to protect themselves from a dog that may become aggressive.

MAPQUEST.

Start: **4280 Rifle Range Rd**
Vicksburg, MS 39180-5502, US

End: **Parkview Regional Medical Ctr**: 601-631-2131
100 Mcauley Dr, Vicksburg, MS 39183, US

Notes:

Directions	Distance
Total Est. Time: 8 minutes **Total Est. Distance:** 6.04 miles	
1: Start out going NORTH on RIFLE RANGE RD toward GREY OAKS DR.	0.1 miles
2: Turn RIGHT onto WARRENTON RD.	<0.1 miles
3: WARRENTON RD becomes OLD US-61 / WASHINGTON ST.	<0.1 miles
4: Merge onto I-20 E.	4.3 miles
5: Take the W. CLAY ST exit- EXIT 4B- toward NATIONAL PARK.	0.1 miles
6: Merge onto US-80 W / CLAY ST.	1.0 miles
7: Turn RIGHT onto BALDWIN FERRY RD.	<0.1 miles
8: Turn LEFT onto GROVE ST.	0.1 miles
9: End at **Parkview Regional Medical Ctr** 100 Mcauley Dr, Vicksburg, MS 39183, US	
Total Est. Time: 8 minutes **Total Est. Distance:** 6.04 miles	

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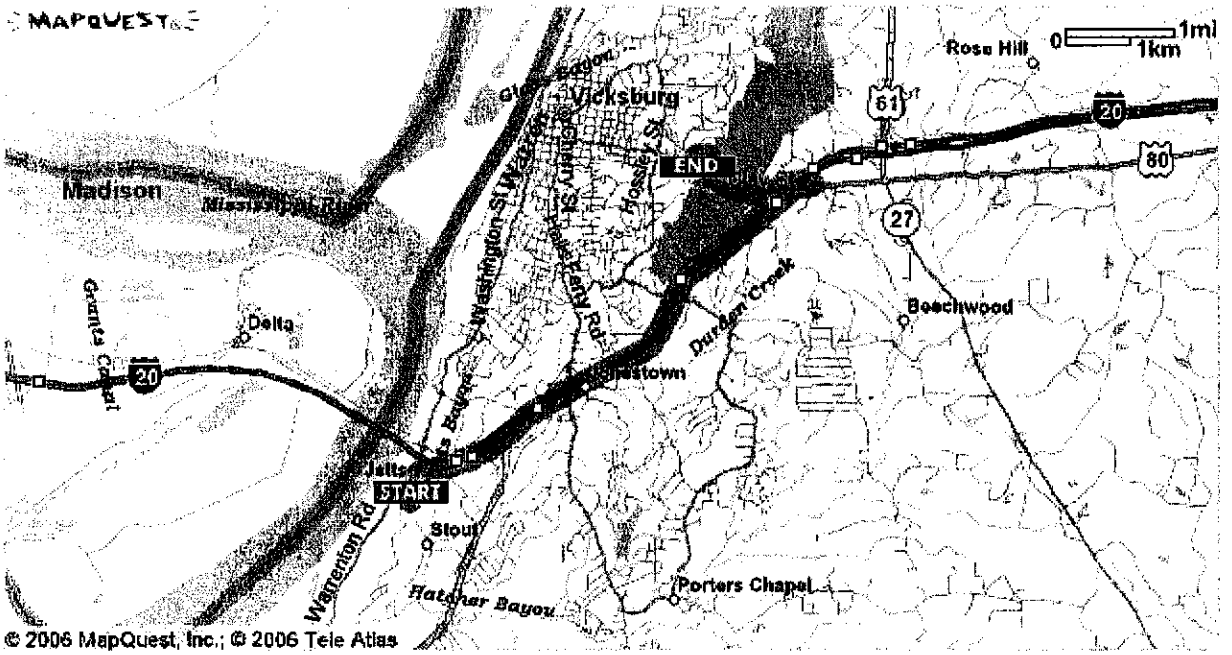

Start:
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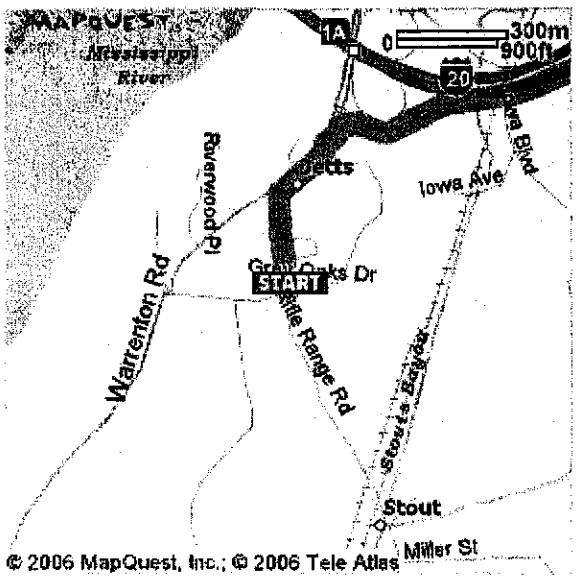

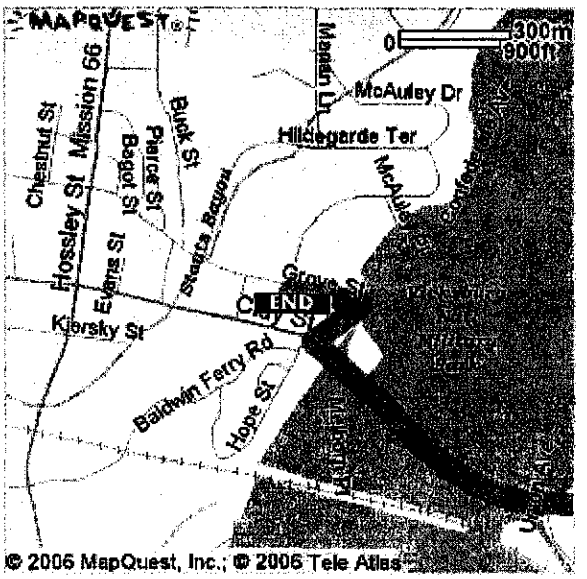

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WorkCare 1-800-455-6155
(24 hours/day, 7 days/week)

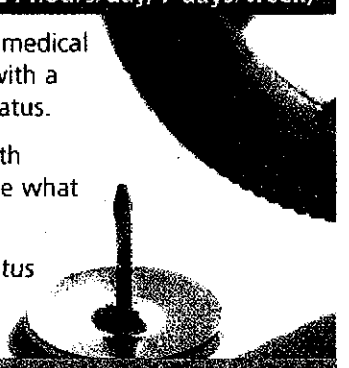
What to do when an injury or illness occurs on-the-job

- If you have experienced a work-related injury or illness, **prior to** seeking medical treatment (beyond first aid), contact your supervisor or office administrator (OA) *and* contact WorkCare.
- Why call WorkCare? WorkCare provides initial medical assistance and advice to ARCADIS employees who have sustained a work-related injury or illness.
- If it is decided that professional medical treatment is warranted, WorkCare will assist you in identifying a clinic.
- If your supervisor or OA is not available, **do not wait**; contact WorkCare before seeking professional medical treatment.

If you require immediate assistance, seek medical treatment first and then contact your supervisor or OA and WorkCare.

Things to remember ...

WorkCare 1-800-455-6155
(24 hours/day, 7 days/week)



- If you sustain a work-related injury and seek professional medical treatment, you need to provide your OA and supervisor with a medical release from your doctor that notes your work status.
- If the doctor has told you that you can return to work with restrictions, be sure that the doctor outlines on the release what work restrictions you are to follow.
- Keep your OA and supervisor advised as to your work status and upcoming medical appointments.

Questions about incident/near miss reporting? Contact your regional Health & Safety (H&S) manager or the corporate H&S department.

Imagine the result

ARCADIS
Infrastructure, environment, facilities

ARCADIS

Appendix F

Visitor Acknowledgement and Acceptance of HASP

Visitor Acknowledgement and Acceptance of HASP

By signing below, I waive, release, and discharge the Owner of the site and ARCADIS G&M, Inc., and their employees from any future claims for bodily and personal injuries which may result from my presence at, entering, or leaving the site and in any way arising from or related to any and all known and unknown conditions on the site.

Name	Company	Reason for Visit	Date/Time On Site	Date/Time Off Site