904003

REPORT OF SOIL EXCAVATION AT THE MONARCH CHEMICAL SITE PRENTICE ROAD VESTAL, NEW YORK

JANUARY 1994

BUCK ENGINEERING
CONSULTING ENVIRONMENTAL ENGINEERS

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BUCK ENVIRONMENTAL SERVICES

Y04003

REPORT OF SOIL EXCAVATION AT THE MONARCH CHEMICAL SITE PRENTICE ROAD VESTAL, NEW YORK

JANUARY 1994

PREPARED FOR:

MR. DONALD BULMAN
DIRECTOR OF ENGINEERING SERVICES
TOWN OF VESTAL
VESTAL, NEW YORK

PREPARED BY:

BUCK ENGINEERING
P.O. 5150
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REPORT OF SOIL EXCAVATION AT THE MONARCH CHEMICAL SITE - PRENTICE ROAD, VESTAL, NY

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REPORT OF SOIL EXCAVATION AT THE MONARCH CHEMICAL SITE - PRENTICE ROAD, VESTAL, NY

BACKGROUND AND INTRODUCTION

The Monarch Chemical site is located on Prentice Road in the Town of Vestal. The site is listed by regulatory agencies as an inactive hazardous waste disposal site and has been assigned a classification which indicates that the site conditions represent a significant threat to the public health or environment. The site has been assigned NYSDEC site code 704003 and EPA I.D.# NYD010780146. Unknown quantities of trichloroethylene (TCE) have been disposed of at the site. Groundwater contamination has been detected in groundwater in Town of Vestal well 4-2 which is located approximately 250 ft. north of the site.

Buck Engineering was retained by the Town of Vestal to perform a subsurface investigation at site in April 1993. The objective of the investigation was to obtain current information regarding subsurface contamination.

The Town of Vestal provided copies of previous engineering studies conducted at the Monarch Chemical and adjacent sites. A previous hydrogeological investigation of organic contamination at the site was conducted in 1980 that included the installation of two monitoring wells at the site. The report concluded that some level of contamination was present in the soil and groundwater. In addition, a groundwater exploration investigation was conducted for the Town of Vestal Water District No. 4 by R.J. Martin, P.E in 1983. The Martin report involved a groundwater investigation of Town of Vestal water wells located in the vicinity of the Monarch Chemical site.

During the April 1993 investigation, five (5) test pits were excavated at the site in positions believed to be the locations of a former waste disposal dry well and soil samples were obtained for laboratory analysis. One of the two groundwater monitoring wells formerly installed at the site was found and a sample was obtained for laboratory analysis.

The Monarch Chemical site is rectangular in shape, approximately one acre in size and is located on the west side of Prentice Road, approximately 1/2 mile north of the junction of Prentice Road and Old Vestal Road. The site investigation work took place on the western section of the property, in an unpaved parking area at the rear of the building occupying the site.

Buck Engineering was retained by the Town of Vestal in the fall of 1993 to excavate contaminated soil from the Monarch Chemical site. The on-site work was conducted on December 14, 1993. Gary Dyer Excavating was retained to provide excavation services. Personnel from Buck Engineering were

Background and Introduction (Con't.)

on-site to provide excavation oversight, collect soil samples, and monitor ambient atmospheric conditions.

Two soil samples were obtained, one from the soil excavated from around and under a former dry well, and the other from the bottom of the excavation. The excavated soil sample was analyzed via gas chromatograph using the TCLP methodology for toxic metals and for volatile and BNA compounds. The soil sample from the bottom of the excavation was analyzed via gas chromatograph using EPA Method 8010 for halogenated organic compounds.

Mr. Scott Rodabaugh of the Kirkwood office of the NYSDEC and Mr. Donald Bulman of the Town of Vestal were on-site during the excavation activities.

This report summarizes the on-site excavation activities and the analytical results. The following section provides an executive summary. Subsequent sections include a description of on-site activities, laboratory and on-site results, and a conclusions and recommendations section. Laboratory reports, a site plan, a project work plan, a site-specific health and safety plan and credentials are provided in appendices.

EXECUTIVE SUMMARY

Buck Engineering was retained by the Town of Vestal in the fall of 1993 to excavate a former dry well and surrounding soil from the former Monarch Chemical site located on Prentice Road in the Town of Vestal. The site is currently listed by both the NYSDEC and the USEPA as an inactive hazardous waste disposal site as a result of barrel cleaning operations conducted at the site in the past. The residue from these operations was discharged to the subsurface soils.

The on-site excavation activities were performed in December 14, 1993. Excavation services were provided by Gary Dyer Excavating of Endicott, New York.

The former dry well structure and surrounding soil were excavated with the material stockpiled on plastic sheeting for later disposal off-site. A total of approximately 26 cu. yd. of material was excavated.

A soil sample obtained from the bottom of the excavation was analyzed via gas chromatography and found to contain chlorinated compounds at high concentrations, indicating the presence of contaminated soil below the limits of the excavation.

A composite soil sample from the stockpiled material was analyzed via gas chromatography and other methods for toxic metals and volatile organic compounds. Contaminant concentrations in this sample were found to be below regulatory limits for hazardous waste but significantly higher than NYSDEC groundwater standards.

It is recommended that:
- a copy of this report be provided to the NYSDEC;
- copies of the laboratory reports resulting from the analysis of the stockpiled material be provided to the intended disposal site; and
- the excavated material be removed from the site and disposed of according to applicable regulations.

ON-SITE ACTIVITIES

Five (5) test pits were excavated at the Monarch Chemical site in April 1993. A detailed description of the excavation activities and observations is provided in a report published in May 1993 by Buck Engineering. The excavation of test pit 5 in April 1993 revealed the presence of a cylindrical concrete structure consisting of one or more concrete pipe sections, 24 in. diameter, that extended from the surface to a depth of approximately 6 ft. The interior of the pipe was filled with soil and the structure appeared to be a former dry well. HNu meter readings in the range of 50 to 200 ppm were obtained from soil in the immediate vicinity of this structure and analysis of a soil sample from near the base of the structure indicated a concentration of 51,000 ug/kg of tetrachloroethene. The objective of the December 1993 excavation activity was to remove the concrete pipe and soil from the immediate vicinity of the pipe.

Excavation services were provided by Gary Dyer Excavating. A tracked backhoe was used.

Ambient air readings were obtained with an HNu photoionization detector prior to the start of excavation activities in the immediate vicinity of the former dry well and around the perimeter of the property. All ambient HNu meter readings were less than 1 ppm.

UV resistant plastic sheeting was spread on the surface of the ground prior to the start of excavation to contain the excavated soil.

Soil excavation was begun at the site of the former dry well. The dry well was located 58 ft. west of the rear of the building and 68 ft. southwest of the northwest corner of the building. The concrete pipe sections forming the dry well were completely removed. Additional soil was removed from around and beneath the former dry well. The approximate dimensions of the pit when the excavation activities were completed were 10 ft. wide (east/west), by 9 ft. long (north/south), by 8 ft. deep. Approximately 26 cu. yd. of material were excavated. All excavated materials were placed on the prepared plastic sheeting.

HNu meter readings were obtained throughout the excavation activities. HNu meter readings from soil near the top of the concrete pipe were in the range of 20 to 40 ppm. HNu meter reading from soil near the bottom of the concrete pipe were in the range of 150 to 180 ppm. HNu meter readings from soil in the bottom of the pit after excavation was complete were in the range of 5 to 10 ppm. A soil sample from the bottom of the excavation was obtained for laboratory examination. HNu meter readings obtained around the perimeter of the site

On-Site Activities (Con't.)

and around the excavated soil pile during the excavation activities were less than 1 ppm.

At the conclusion of the excavation activities, a composite soil sample was obtained from the soil pile for laboratory analysis. The soil pile was then covered with plastic sheeting and the sheeting was ballasted. Bank-run gravel was hauled to the site by a Town of Vestal vehicle to backfill the excavation.

Following the completion of excavation activities at the site of the former dry well, a north/south trench was excavated at a location approximately 65 ft. west of the dry well excavation. The purpose of the trench excavation was to determine if there was a discharge pipe beneath the surface n this area that may have been connected to the dry well in the past. The trench excavation was approximately 5 ft. deep. No indication of a discharge pipe was found and the trench was backfilled with the spoil from the trench excavation.

ANALYTICAL RESULTS

Two soil samples were obtained for laboratory analysis from the December 1993 excavation activity at the Monarch Chemical site. One sample, from the bottom of the excavation, was analyzed via gas chromatograph using EPA Method 8010 for halogenated organic compounds. The analytical results were:

Recommended Soil Cleanup (TAGM 4046)

Chloroform	604 ug/kg	300 ug/kg
Tetrachloroethene	135,000 ug/Kg	1400 ug/kg
1,1,1-Trichloroethane	565 ug/kg	800 ug/kg
Trichloroethene	1,730 ug/Kg	700 ug/kg

A second composite soil sample was taken from the pile of excavated soil. The TCLP Extraction Method 1311 was used for this sample with the resulting extract analyzed for toxic metals and volatile and BNA compounds. The analytical results were:

Toxic metals:

	Result	Regulatory Limit
Arsenic	ND	
Barium	0.26 mg/L	100 mg/L
Cadmium	ND	
Chromium	ND	
Lead	ND	
Mercury	ND	
Selenium	ND	
Silver	0.24 mg/L	5.0 mg/L

Volatile and BNA compounds:

	Result	Regulatory Limit
Tetrachloroethylene	0.464 mg/L	0.7 mg/L
Trichloroethylene	0.008 mg/L	0.5 mg/L
Hexachloroethane	0.150 mg/L	0.15 mg/L

The laboratory reports resulting from the analyses are provided in an appendix.

CONCLUSIONS

The former dry well structure that was excavated during this project is believed to have received the discharge from a former barrel washing operation located at the site. The former dry well and surrounding soil excavated during this project totalled approximately 26 cu. yd. The excavated material was placed on UV resistant plastic sheeting for disposition at an off-site location.

Laboratory analysis of a soil sample obtained from the bottom of the excavation revealed significant concentrations of volatile chlorinated compounds, primarily indicating that the soil beneath the 8 ft. level contains significant contamination.

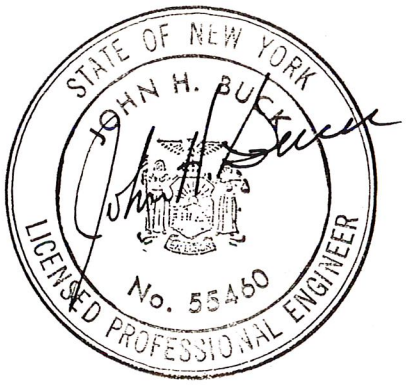
Laboratory analysis of a composite soil sample obtained from the excavated soil pile revealed toxic metal and volatile chlorinated contaminant concentrations primarily below the regulatory limit for hazardous waste. However, while the organic contaminant concentrations in the TCLP liquid extract are below hazardous waste levels, the concentration of these compounds are approximately 100 times higher than NYSDEC groundwater standards.

CERTIFICATION

We certify that to the best of our knowledge, belief, and information, the descriptions and information given in this report are truthfully presented.

Phillip W. Shaffner — 2/2/94

Phillip W. Shaffner — Date



John H. Buck, P.E.
NYS LN 055460

APPENDIX A

LABORATORY REPORTS

Copies of a laboratory reports resulting from the analysis of soil samples obtained from the former Monarch Chemical site are provided on the following pages.

BUCK ENVIRONMENTAL LABORATORIES INC.
ACCREDITED ENVIRONMENTAL ANALYSIS
3845 ROUTE 11 SOUTH, CORTLAND, N.Y. 13045
P.O. BOX 5150 607-753-3403

TOXICITY CHARACTERISTICS LEACHING PROCEDURE
METALS

Client: **TOWN OF VESTAL**
Project: Monarch Chemical
Sample: Soil - Soil Pile

Report Date: 01/19/94
Date Received: 12/14/93
Sampled By: P. Shaffner
Extraction: TCLP 1311
% Solids: 85.9%
Lab Log No: 9312222

Cas No.	Compound	Regulatory Level (mg/L)	Result (mg/L)
7440-39-2	Arsenic	5.0	ND (<.100)
7440-39-3	Barium	100.0	.26
7440-43-9	Cadmium	1.0	ND (<.050)
7440-47-3	Chromium	5.0	ND (<.050)
7439-92-1	Lead	5.0	ND (<.100)
7439-97-6	Mercury	0.2	ND (<.0008)
7782-49-2	Selenium	1.0	ND (<.100)
7440-22-4	Silver	5.0	.24

Fluid Extraction Method: Fluid #1

ND - None detected greater than detection limits noted.

These analyses are certified as conforming to generally accepted laboratory practices and requirements of the New York State Health Department ELAP program.

John H. Buck, P.E.
Laboratory Director
NYS ELAP ID 10795

BUCK ENVIRONMENTAL LABORATORIES INC.
ACCREDITED ENVIRONMENTAL ANALYSIS
3845 ROUTE 11 SOUTH, CORTLAND, N.Y. 13045
P.O. BOX 5150 607-753-3403

TOXICITY CHARACTERISTICS LEACHING PROCEDURE
VOLATILE AND BNA COMPOUNDS

Client: **TOWN OF VESTAL**
Report Date: 01/19/94
Date Received: 12/14/93
Project: Monarch Chemical
Sampled By: P. Shaffner
Extraction: TCLP 1311 %
Solids: 85.9% Sample:
Soil - Soil Pile
Lab Log No: 9312222

Cas No.	Compound	Regulatory Level (mg/L)	Result (mg/L)
71-43-2	Benzene	0.5	ND (<.005)
56-23-5	Carbon Tetrachloride	0.5	ND (<.005)
108-90-7	Chlorobenzene	100.0	ND (<.005)
67-66-3	Chloroform	6.0	ND (<.005)
106-46-7	1,4-Dichlorobenzene	7.5	ND (<.005)
107-06-2	1,2-Dichloroethane	0.5	ND (<.005)
75-35-4	1,1-Dichloroethylene	0.7	ND (<.005)
78-93-3	Methyl Ethyl Ketone	200.0	ND (<.100)
127-18-4	Tetrachloroethylene	0.7	.464
79-01-6	Trichloroethylene	0.5	.008
75-01-4	Vinyl Chloride	0.2	ND (<.010)
121-14-2	2,4-Dinitrotoluene	0.13	ND (<.020)
118-74-1	Hexachlorobenzene	0.13	ND (<.010)
87-68-3	Hexachlorobutadiene	0.5	ND (<.010)
67-72-1	Hexachloroethane	3.0	.150
98-95-3	Nitrobenzene	2.0	ND (<.010)
110-86-1	Pyridine	5.0	ND (<.020)
95-48-7	o-Cresol	200.0	ND (<.020)
108-39-4	m-Cresol	200.0	ND (<.020)
106-44-5	p-Cresol	200.0	ND (<.020)
- - -	Cresol	200.0	ND (<.020)
87-86-5	Pentachlorophenol	100.0	ND (<.010)
95-95-4	2,4,5-Trichlorophenol	400.0	ND (<.020)
88-06-2	2,4,6-Trichlorophenol	2.0	ND (<.010)

ND - None detected greater than detection limits noted.

Fluid Extraction Method: Fluid #1

These analyses are certified as conforming to generally accepted laboratory practices and requirements of the New York State Health Department ELAP program.

John H. Buck, P.E.
Laboratory Director
NYS ELAP ID 10795

BUCK ENVIRONMENTAL LABORATORIES INC.
ACCREDITED ENVIRONMENTAL ANALYSIS
3845 ROUTE 11 SOUTH, CORTLAND, N.Y. 13045
P.O. BOX 5150 607-753-3403

LABORATORY REPORT
Lab Log No: 9312222

Client: *Town of Vestal*
605 Vestal Parkway West
Vestal, NY 13850

Site: Monarch Chemical

Report Date: 01/31/94
Sampling Date: 12/14/93
Sampled By: P. Shaffner
Date Received: 12/14/93
Analyzed by: EAC, 01/01/94

Sample ID: Soil-Bottom of Excavation

VOLATILES BY METHOD EPA 8010

ANALYTE	CAS #	UNITS	DL	RESULT
Bromobenzene	108-86-1	ug/kg	125	ND
Bromodichloromethane	75-27-4	ug/kg	125	ND
Bromoform	75-25-2	ug/kg	125	ND
Bromomethane	74-83-9	ug/kg	125	ND
Carbon Tetrachloride	56-23-5	ug/kg	125	ND
Chlorobenzene	108-90-7	ug/kg	125	ND
Chloroethane	75-00-3	ug/kg	125	ND
2-Chloroethylvinyl ether	110-75-8	ug/kg	125	ND
Chloroform	67-66-3	ug/kg	125	*604*
Chloromethane	74-87-3	ug/kg	125	ND
Dibromochloromethane	124-48-1	ug/kg	125	ND
Dibromomethane	74-95-3	ug/kg	125	ND
1,2-Dichlorobenzene	95-50-1	ug/kg	125	ND
1,3-Dichlorobenzene	541-73-1	ug/kg	125	ND
1,4-Dichlorobenzene	106-46-7	ug/kg	125	ND
Dichlorodifluoromethane	75-71-8	ug/kg	125	ND
1,1-Dichloroethane	75-34-3	ug/kg	125	ND
1,2-Dichloroethane	107-06-2	ug/kg	125	ND
1,1-Dichloroethene	75-35-4	ug/kg	125	ND
trans-1,2-Dichloroethene	156-60-5	ug/kg	125	ND
cis-1,2-Dichloroethene	156-59-2	ug/kg	125	ND
1,2-Dichloropropane	78-87-5	ug/kg	125	ND
cis-1,3-Dichloropropene	10061-01-5	ug/kg	125	ND
trans-1,3-Dichloropropene	10061-02-6	ug/kg	125	ND
Methylene Chloride	75-09-2	ug/kg	125	ND
1,1,2,2-Tetrachloroethane	79-34-5	ug/kg	125	ND
1,1,1,2-Tetrachloroethane	630-20-6	ug/kg	125	ND
Tetrachloroethene	127-18-4	ug/kg	125	*135000*
1,1,1-Trichloroethane	71-55-6	ug/kg	125	*565*
1,1,2-Trichloroethane	79-00-5	ug/kg	125	ND
Trichloroethene	79-01-6	ug/kg	125	*1730*
Trichlorofluoromethane	75-69-4	ug/kg	125	ND
1,2,3-Trichloropropane	96-18-4	ug/kg	125	ND
Vinyl Chloride	75-01-4	ug/kg	125	ND

ND - None detected greater than detection limit (DL) noted.
These results are certified as conforming with generally accepted laboratory standards and requirements of the New York State Department of Health ELAP Program.

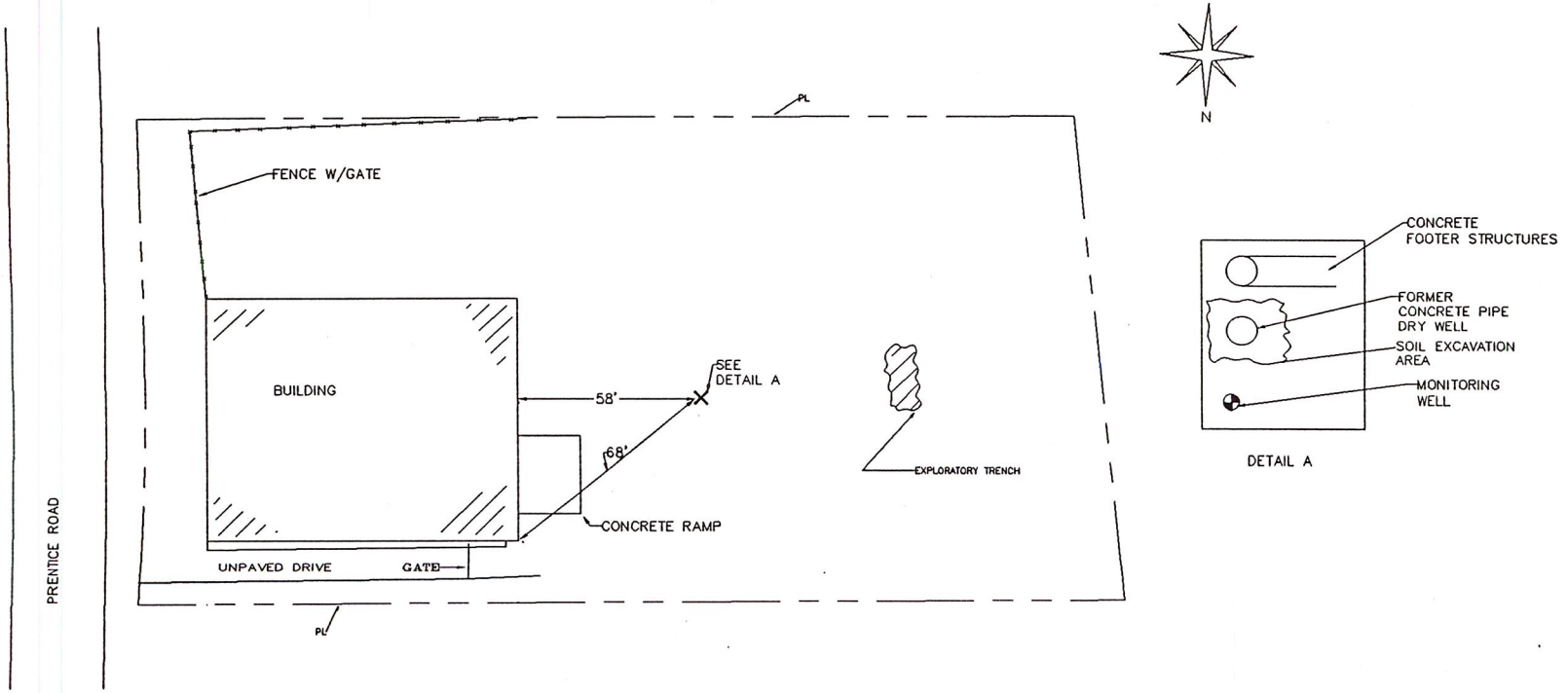
John Buck

Laboratory Director
ELAP ID - 10795

APPENDIX B

SITE SKETCH

A site sketch showing the excavation locations, the re-discovered groundwater monitoring well location and other prominent features is provided on the following page.



SITE SKETCH	REVISIONS
	DRD 1/28/94
FORMER MONARCH CHEMICAL SITE PRENTICE ROAD VESTAL, NEW YORK	
	BY DRD
BUCK ENGINEERING 3845 ROUTE 11 SOUTH, P.O. BOX 5150 CORTLAND, N.Y. 13045 607-753-3403	DATE 2/25/93
	NO. 1 OF 1
	SCALE 1"=60'

APPENDIX C

CREDENTIALS

Copies of appropriate engineering and laboratory credentials are provided on the following pages.

THE UNIVERSITY OF THE STATE OF NEW YORK

EDUCATION DEPARTMENT

BE IT KNOWN THAT

JOHN H. BUCK

HAVING GIVEN SATISFACTORY EVIDENCE OF THE COMPLETION OF PROFESSIONAL AND OTHER REQUIREMENTS PRESCRIBED BY LAW IS QUALIFIED TO PRACTICE AS A

PROFESSIONAL ENGINEER

IN THE STATE OF NEW YORK

IN WITNESS WHEREOF THE EDUCATION DEPARTMENT GRANTS THIS LICENSE UNDER ITS SEAL AT ALBANY, NEW YORK THIS TWENTY-FIRST DAY OF APRIL, 1978.

Gordon M. Ambach
PRESIDENT OF THE UNIVERSITY
AND COMMISSIONER OF EDUCATION

Stanley M. Greenwald
EXECUTIVE SECRETARY

LICENSE NUMBER
55460

NEW YORK STATE DEPARTMENT OF HEALTH

MARK R. CHASSIN, M.D., M.P.P., M.P.H. *COMMISSIONER*

Expires 12:01 AM April 1, 1994
ISSUED April 1, 1993
REVISED June 8, 1993

INTERIM CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10795

Director: MR. JOHN BUCK
Lab Name: BUCK ENVIRONMENTAL LABORATORIES INC
Address : PO BOX 5150 3845 ROUTE 11 S0
CORTLAND NY 13045

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES/SOLID AND HAZARDOUS WASTE

All approved subcategories and/or analytes are listed below:

Characteristic Testing :
- Corrosivity
- Ignitability
- Reactivity
- TCLP
- E.P. Toxicity - Metals Only

Miscellaneous :
- Asbestos in Friable Material
- Cyanide, Total
- Hydrogen Ion (pH)
- Sulfide (as S)

Purgeable Halocarbons (ALL)

Chlor. Hydrocarbon Pesticides (ALL)
Haloethers (ALL)
Nitroaromatics Isophorone (ALL)
Polychlorinated Biphenyls (ALL)
Priority Pollutant Phenols (ALL)

Chlorinated Hydrocarbons (ALL)
Metals I (ALL)
Polynuclear Arom. Hydrocarbon (ALL)
Phthalate Esters (ALL)
Purgeable Aromatics (ALL)

Serial No.: 021209

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DOH-3317 (12/92)

APPENDIX D

WORK PLAN

A copy of the work plan prepared for the current project is provided on the following pages.

BUCK ENVIRONMENTAL SERVICES

SOIL EXCAVATION
AT THE FORMER
MONARCH CHEMICAL SITE
PRENTICE ROAD
VESTAL, NEW YORK

DECEMBER 1993

PREPARED FOR:

MR. DONALD BULMAN
DIRECTOR OF ENGINEERING SERVICES
TOWN OF VESTAL
605 VESTAL PARKWAY WEST
VESTAL, NEW YORK 13850

AND

THE NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION

PREPARED BY:

BUCK ENGINEERING
PO BOX 5150
3145 ROUTE 11 SOUTH
CORTLAND, NEW YORK 13045
607-753-3403

TABLE OF CONTENTS

INTRODUCTION

The former Monarch Chemical site located on Prentice Road in the Town of Vestal is a listed by regulatory agencies as an inactive hazardous waste disposal site and has been assigned a classification which indicates that the site conditions represent a significant threat to the public health or environment. NYSDEC site code 704003 and EPA I.D.# NYD010780146 have been assigned to the site.

This firm was retained by the Town of Vestal to perform a subsurface investigation at the site in May 1993 in cooperation with the NYSDEC. The investigation included the excavation of five backhoe test pits and obtaining soil samples for laboratory analysis. A cylindrical concrete structure, thought to be a former dry well, was discovered during the excavation of test pit #5. The laboratory analysis of the soil samples revealed chlorinated solvent contamination at concentrations ranging from 80 to 51,000 ug/kg (primarily tetrachloroethene and trichloroethene).

This firm has been retained by the Town of Vestal to arrange for the excavation of the heavily contaminated soil from the immediate vicinity of the former dry well. The purpose of this work plan is to define the activities that are to take place related to the soil excavation activities.

SITE ADDRESS

Prentice Road, Vestal, New York.

The site is located on the west side of Prentice Road, approximately 1/2 mile north of the junction of Prentice Road and Old Vestal Road.

PROJECT SCHEDULE

The on-site work is scheduled to take place during the week of December 13, 1993.

PRE-EXCAVATION PREPARATION

Buck Engineering:

1. Prepare a site specific Health and Safety Plan for use by Buck Engineering (BE) and Buck Environmental Laboratories (BEL) personnel.

Pre-Excavation Preparation (Con't.)

2. Coordinate the excavation schedule with the Town of Vestal Engineering Department, the NYSDEC, and the excavation contractor.

3. Provide all BE and BEL employees expected to work at the site with approved respirators equipped with granular activated carbon canisters.

Excavation Contractor:

1. Provide all contractor employees expected to work at the site with approved respirators equipped with granular activated carbon canisters.

2. Obtain ultraviolet (UV) resistant plastic sheeting of minimum 6 mil thickness for use in staging excavated soil at the work site.

EXCAVATION ACTIVITY

1. Using a tracked excavator, excavate the soil in the immediate vicinity of the former dry well.
Note: The final limits of the excavations will depend upon conditions found at the site.

2. Continuously monitor the excavation activity using an HNu photoionization detector. Background readings will be obtained prior to the start of excavation.

3. Remove any soil that is encountered that has HNu meter readings greater than 5 ppm. Stage contaminated soil on UV resistant plastic sheeting. At the conclusion of excavation activities, cover the contaminated soil pile with UV resistant plastic sheeting and ballast the covering sheet to ensure it remains in place.

4. Obtain a composite soil sample from the bottom of the excavation for laboratory analysis by EPA Method 8010.

5. Backfill the excavation with clean backfill material to completely close the excavations. Backfill material will be compacted with the excavator bucket to minimize surface settling.

SITE MONITORING

Representatives of Buck Engineering will provide an 10.2 eV HNu meter for use at the site. In addition, the HNu meter will be used on a regular schedule (i.e., every 15 to 20 minutes) to monitor the ambient air at the down-wind property line. The primary chemical compounds found in the contaminated soil were tetrachloroethene and trichloroethene. In the event that HNu meter readings above the OSHA exposure limit of 25 ppm for these compounds are obtained at the down-wind property line, excavation activities will be stopped until engineering controls or other methods can be implemented to eliminate the escape of fugitive emissions from the property. In the event that excavation activities are stopped, the excavation and contaminated soil pile (in any) are to be immediately covered with plastic sheeting.

HEALTH AND SAFETY

A site specific Health and Safety Plan will be developed by Buck Engineering prior to the start of excavation activity.

APPENDIX E

HEALTH AND SAFETY PLAN

A copy of the site specific Health and Safety Plan developed for Buck Engineering and Buck Environmental Laboratories employees in connection with their work at the former Monarch Chemical site is provided on the following pages.

BUCK ENVIRONMENTAL SERVICES

HEALTH AND SAFETY PLAN
FOR
SOIL EXCAVATION
AT
MONARCH CHEMICAL SITE
PRENTICE ROAD
VESTAL, NEW YORK

DATE PREPARED: APRIL 19, 1993

DATE REVISED: DECEMBER 6, 1993

PREPARED FOR:

MR. DONALD BULMAN
DIRECTOR OF ENGINEERING SERVICES
TOWN OF VESTAL
VESTAL, NEW YORK

PREPARED BY:

BUCK ENGINEERING
P.O. BOX 5150
3845 ROUTE 11 SOUTH
CORTLAND, NEW YORK 13045
607-753-3403

DISCLAIMER

Buck Engineering (BE) and Buck Environmental Laboratories, Inc. (BEL) do not guarantee the health and safety of any person entering this site. Due to the history of hazardous waste disposal at the site, it is not possible to discover, evaluate and provide protection for all possible hazards which may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this site. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior research and evaluation by trained personnel. While BE and BEL do not object to the use of this Health and Safety Plan by other firms or individuals, BE and BEL accept no liability for such use.

DISCLAIMER

Buck Engineering (BE) and Buck Environmental Laboratories, Inc. (BEL) do not guarantee the health and safety of any person entering this site. Due to the history of hazardous waste disposal at the site, it is not possible to discover, evaluate and provide protection for all possible hazards which may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this site. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior research and evaluation by trained personnel. While BE and BEL do not object to the use of this Health and Safety Plan by other firms or individuals, BE and BEL accept no liability for such use.

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HEALTH AND SAFETY PLAN FOR
SOIL EXCAVATION AT MONARCH CHEMICAL

INTRODUCTION: Buck Engineering has been retained by the Town of Vestal to supervise the excavation of soil contaminated with chlorinated solvents at the former Monarch Chemical site, primarily tetrachloroethene and trichloroethene.

The general scope of work includes a the excavation of soil in the immediate vicinity of a former dry well and obtaining samples for laboratory analysis.

SITE ADDRESS: Monarch Chemical
Prentice Road
Vestal, NY
(See attached location map)

PROJECT SCHEDULE: The on-site work will take place during the week of December 13, 1993.

PROJECT STAFF: John H. Buck, P.E. - Project Director
Phillip W. Shaffner - On-site Manager
Eric Monsen - Staff Geologist and
Chairman of the Safety Committee

PERSONNEL COVERED BY PLAN: This Health and Safety Plan is intended only for employees of Buck Engineering (BE) and Buck Environmental Laboratories, Inc. (BEL).

MONARCH CHEMICAL CONTACT: Mr. Donald Bulman
Director of Engineering Services
Town of Vestal
605 Vestal Parkway
Vestal, NY 13850
Telephone: 607-748-1514

SITE DESCRIPTION: The former Monarch Chemical site is located on the west side of Prentice Road in the Town of Vestal, approximately 3/4 mile north of the junction of Prentice Road and Old Vestal Road. The site is rectangular with a building located on the easterly portion and a parking or storage area located behind the building to the west. There is a driveway from Prentice Road that borders the building on the north that leads to the rear parking area. The excavation will occur in the storage and parking area at the rear of the building.

SITE ACTIVITIES:
- Excavation of contaminated soil in the immediate vicinity of a former dry well;
- Obtain a soil sample from the excavation for laboratory analysis; and
- Place excavated soil on plastic sheeting for later disposal.

OVERALL SITE HAZARD POTENTIAL: Low

WORK AREA: The designated work area is the storage/parking area located behind the building.

EXCLUSION ZONE: None

CONTAMINATION REDUCTION ZONE: None

SUPPORT ZONE: None

DECONTAMINATION PROCEDURES: None

POTENTIAL HAZARDS:

Physical
- A tracked excavator will be used for excavation purposes.
- The depth of the excavation may create the danger of cave-ins (Note: No personnel are to enter the excavations.)

Chemical
- High concentrations of chlorinated solvents, primarily tetrachloroethene (TTE) and trichloroethene (TCL), have been found in soil samples obtained from backhoe test pits at the site. The levels of these compounds expected to be encountered during site activities may exceed the OSHA permissible exposure levels of 25 ppm. Information sheets on TTE and TCL are attached.

Confined Space Entry
- None planned.

FIELD MONITORING EQUIPMENT: HNu meter

PROTECTIVE EQUIPMENT:

Hard hats
Safety glasses
Ear plugs
Negative pressure respirators with activated carbon filters
Tyvec protective overalls
Disposable gloves

PROTECTIVE CLOTHING: Level D (normal work clothes)

Note: Respirators and protective coveralls (Level C) are to be available on-site as a safety precaution in the event that airborne concentrations of chlorinated solvents that exceed the OSHA exposure limit of 25 ppm are encountered during the excavation process. In this event, all on-site personnel will wear respirators and protective coveralls

EMERGENCY ESCAPE ROUTES: Not applicable.

Note: In the event of an emergency, all project staff are to meet on Prentice Road, in front of the building.

EMERGENCY ASSISTANCE:

Ambulance:	911
Fire Department:	911
Medical Assistance:	911
Police - Sheriff:	911
- State Police	911

DIRECTIONS TO NEAREST HOSPITAL: Take Prentice Road south to Old Vestal Road. Turn left on Old Vestal Road and travel east to Route 201 north. Follow Route 201 north, across the Susquehanna River and around the Johnson City traffic circle to Main Street in Johnson City. Exit from Route 201 onto Main Street and turn right (east). Wilson Hospital is located approximately 1/2 mile ahead and there are signs on Main Street directing you to the Emergency Entrance.

WHOM TO CONTACT IN CASE OF EMERGENCY:

Buck Engineering	Mr. John Buck	607-753-3403
Town of Vestal	Mr. Donald Bulman	607-748-1514

NAME OF PERSON THAT PREPARED THE PLAN: Phillip W. Shaffner

DESIGNATED SAFETY OFFICER: Eric Monsen

PLAN REVIEW AND APPROVAL:

Eric Monsen — Date: 12/8/93

Phillip W. Shaffner — Date: 12/8/93

John H. Buck — Date: 12/8/93

PROJECT STAFF ACKNOWLEDGMENTS: Please sign below indicating that you have read the plan, that you understand the plan, and that all safety related questions you may have been addressed to your satisfaction.

John H. Buck — Date:

Phillip W. Shaffner — Date: 12/8/93

Eric Monsen — Date: 12/8/93

Attachments: 1. Information sheet on TTE and TCL.

RECORD OF SAFETY MEETINGS

Date	Conducted By	Names of persons attending

BUCK ENGINEERING
CONSULTING ENVIRONMENTAL ENGINEERS
3845 ROUTE 11 SOUTH, CORTLAND, N.Y. 13045
P.O. BOX 5150 607-753-3403

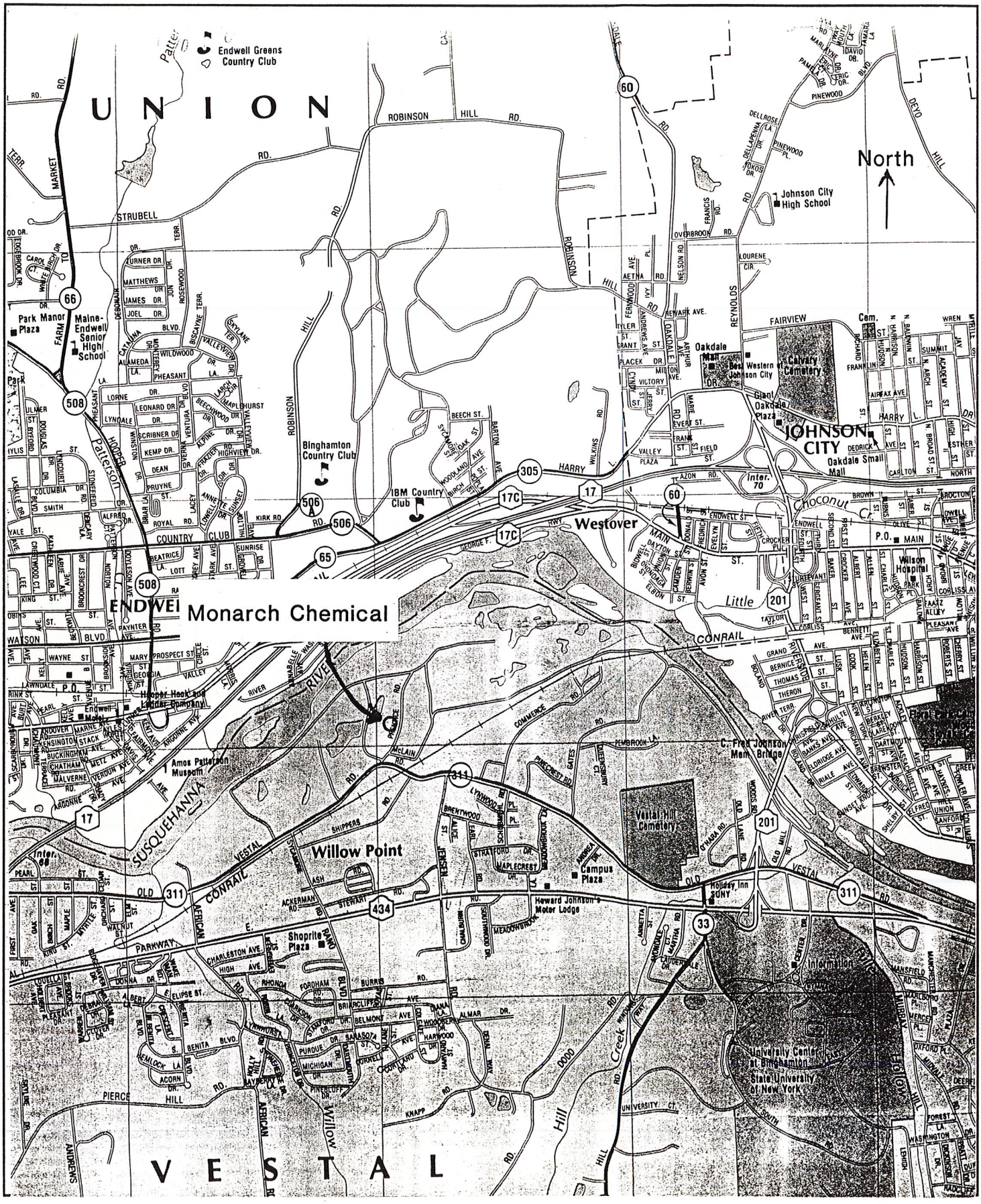
JOB Monarch Chemical Site Location Map

SHEET NO. _____ OF _____

CALCULATED BY EHM DATE 4-23-93

CHECKED BY _____ DATE _____

SCALE _____



TETRACHLOROETHYLENE

TTE

Common Synonyms	Watery liquid	Colorless	Sweet odor
Tetracap Perclene Perchloroethylene Perk	Sinks in water. Irritating vapor is produced.		

Stop discharge if possible.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
Poisonous gases are produced when heated.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $Cl_2C{=}CCl_2$
3.3 IMO/UN Designation: 9.0/1897
3.4 DOT ID No.: 1897
3.5 CAS Registry No.: 127-18-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Ethereal; like chloroform; mildly sweet

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: For high vapor concentrations use approved canister or air-supplied mask; chemical goggles or face shield; plastic gloves.
5.2 Symptoms Following Exposure: Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury.
5.3 Treatment of Exposure: INHALATION: if illness occurs, remove patient to fresh air, keep him warm and quiet, and get medical attention. INGESTION: induce vomiting only on physician's recommendation. EYES AND SKIN: flush with plenty of water and get medical attention if irritation or injury occurs.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 100 ppm for 60 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or throat if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 5 ppm
5.11 IDLH Value: 500 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic, irritating gases may be generated in fires.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Dry cleaning and industrial grades: 95+ %
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 165.83
12.3 Boiling Point at 1 atm: 250°F = 121°C = 394°K
12.4 Freezing Point: —8.3°F = —22.4°C = 250.8°K
12.5 Critical Temperature: 657°F = 347°C = 620°K
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.63 at 20°C (liquid)
12.8 Liquid Surface Tension: 31.3 dynes/cm = 0.0313 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 44.4 dynes/cm = 0.0444 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.116
12.12 Latent Heat of Vaporization: 90.2 Btu/lb = 50.1 cal/g = 2.10×10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

TTE TETRACHLOROETHYLENE

12.17 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
35	103.400
40	103.099
45	102.900
50	102.599
55	102.299
60	102.000
65	101.700
70	101.400
75	101.099
80	100.799
85	100.500
90	100.200
95	99.910
100	99.610
105	99.320
110	99.020
115	98.730
120	98.429
125	98.139
130	97.839
135	97.549
140	97.250
145	96.959
150	96.669
155	96.370
160	96.080

12.18 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	.198
10	.200
20	.201
30	.202
40	.203
50	.204
60	.205
70	.206
80	.207
90	.208
100	.210
110	.211
120	.212
130	.213
140	.214
150	.215
160	.216
170	.217
180	.218
190	.220
200	.221
210	.222

12.19 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	N
	O
	T
	P
	E
	R
	T
	I
	N
	E
	N
	T

12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
55	.958
60	.929
65	.900
70	.873
75	.848
80	.823
85	.800
90	.777
95	.756
100	.736
105	.716
110	.698
115	.680
120	.663
125	.647
130	.631
135	.616
140	.601
145	.588
150	.574
155	.561
160	.549
165	.537
170	.526
175	.515

12.21 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.016

12.22 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
60	.236
70	.318
80	.425
90	.561
100	.732
110	.948
120	1.217
130	1.548
140	1.953
150	2.446
160	3.042
170	3.756
180	4.607
190	5.616
200	6.805
210	8.199
220	9.824
230	11.710
240	13.890
250	16.390
260	19.260
270	22.520
280	26.230

12.23 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
60	.00702
70	.00929
80	.01216
90	.01575
100	.02022
110	.02571
120	.03242
130	.04055
140	.05032
150	.06199
160	.07583
170	.09215
180	.11130
190	.13360
200	.15940
210	.18910
220	.22330
230	.26230
240	.30660
250	.35680
260	.41330
270	.47680
280	.54790

12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	.108
25	.110
50	.113
75	.116
100	.118
125	.120
150	.122
175	.125
200	.127
225	.129
250	.131
275	.132
300	.134
325	.136
350	.138
375	.139
400	.141
425	.142
450	.143
475	.144
500	.146
525	.147
550	.148
575	.148
600	.149

TRICHLOROETHYLENE

TCL

Common Synonyms	Watery liquid	Colorless	Sweet odor
Trichloroethylene Trilene; Algylen Chlorylen Gemalgene Trethylene Trichloran; Trilene	Sinks in water. Irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, carbon dioxide, or foam.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $CHCl=CCl_2$
3.3 IMO/UN Designation: 9.0/1710
3.4 DOT ID No.: 1710
3.5 CAS Registry No.: 79-01-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Chloroform-like; ethereal

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic, vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or vinyl gloves; chemical safety goggles; face-shield; neoprene safety shoes; neoprene suit or apron for splash protection.

5.2 Symptoms Following Exposure: INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.

5.3 Treatment of Exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.

5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 50 ppm
5.11 IDLH Value: 1,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 90°F C.C.; practically nonflammable
6.2 Flammable Limits in Air: 8.0%-10.5%
6.3 Fire Extinguishing Agents: Water fog
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 770°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 38

8. WATER POLLUTION

8.1 Aquatic Toxicity: 660 mg/l/40 hr/daphnia/kill/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical; dry cleaning; degreasing; extraction
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 131.39
12.3 Boiling Point at 1 atm: 189°F = 87°C = 360°K
12.4 Freezing Point: —123.5°F = —86.4°C = 186.8°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.46 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.3 dynes/cm = 0.0293 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 34.5 dynes/cm = 0.0345 N/m at 24°C
12.10 Vapor (Gas) Specific Gravity: 4.5
12.11 Ratio of Specific Heats of Vapor (Gas): 1.116
12.12 Latent Heat of Vaporization: 103 Btu/lb = 57.2 cal/g = 2.4×10^4 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 2.5 psia

NOTES

TCL	TRICHLOROETHYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	94.669
5	94.410
10	94.150
15	93.889
20	93.629
25	93.370
30	93.110
35	92.849
40	92.589
45	92.330
50	92.070
55	91.809
60	91.549
65	91.290
70	91.030
75	90.770
80	90.509
85	90.250
90	89.990
95	89.730
100	89.469
105	89.209
110	88.950
115	88.690
120	88.429
125	88.169

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.220
10	.221
20	.223
30	.225
40	.226
50	.228
60	.230
70	.231
80	.233
90	.235
100	.236
110	.238
120	.240
130	.241
140	.243
150	.245
160	.246
170	.248

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	NOT PERTINENT

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	.800
20	.775
25	.750
30	.727
35	.705
40	.684
45	.664
50	.645
55	.627
60	.610
65	.593
70	.577
75	.562
80	.548
85	.534
90	.521
95	.508
100	.496
105	.485
110	.474
115	.463
120	.453

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
77.02	.110

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
40	.508
50	.678
60	.894
70	1.166
80	1.507
90	1.929
100	2.448
110	3.081
120	3.846
130	4.765
140	5.862
150	7.163
160	8.695
170	10.490
180	12.580
190	15.010
200	17.810
210	21.020

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
40	.01245
50	.01628
60	.02105
70	.02695
80	.03418
90	.04296
100	.05354
110	.06619
120	.08120
130	.09891
140	.11960
150	.14380
160	.17180
170	.20390
180	.24080
190	.28280
200	.33040
210	.38420

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.136
25	.139
50	.143
75	.146
100	.149
125	.152
150	.155
175	.157
200	.160
225	.162
250	.165
275	.167
300	.169
325	.172
350	.174
375	.176
400	.177
425	.179
450	.181
475	.182
500	.184
525	.185
550	.186
575	.187
600	.188