FORMER EMCA SITE

SITE NO. 360025

MAMARONECK, NEW YORK

INTERIM REMEDIAL ACTION WORK PLAN

PREPARED FOR:

ROHM AND HAAS COMPANY

SUBMITTED BY:

URS CORPORATION

OCTOBER 2004

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
cm/sec	centimeters per second
EE/CA	engineering evaluation/cost analysis
ft	feet (foot)
IRM	interim remedial action
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
RI	remedial investigation
TOGS	Technical and Operational Guidance Series
URS	URS Corporation
VOCs	volatile organic compounds
ZVI	zero valent iron
µg/L	micrograms per liter

1.0 INTRODUCTION

This work plan presents details of an interim remedial action (IRM) that will be conducted at the Rohm and Haas former EMCA site located in Mamaroneck, Westchester County, New York (Figure 1). The plan was developed in response to a request from Rohm & Haas Company and presents a program to inject sodium lactate and emulsified soybean oil to stimulate biological processes that will treat site groundwater contaminated by 1,1,2 – trichloro-1,2,2- trifluoroethane (Freon 113). All work at the site will be performed in close coordination with the site owner, Cablevision of Westchester (Cablevision).

Key personnel involved in the project are listed below:

Name	Affiliation	Address	Phone/Fax	Function
Edward Tokarski	Rohm and Haas	3100 State Road Croydon, PA 19021	215-785-7244 (7077)	Project Manager
Ronald Lantzy	Rohm and Haas	3100 State Road Croydon, PA 19021	215-785-7456 (7077)	Technical Manager
Robert Vaszil	Cablevision of Westchester	Six Executive Plaza Yonkers, NY 10701	203-223-0348	Site Owner Contact
Ronnie Lee	NYSDEC	625 Broadway, 12th Floor Albany, NY 12233	518-402-~~9622~~ (~~9627~~) 9768	NYSDEC Project Manager
Bruce Przybyl	URS	77 Goodell Street Buffalo, NY 14202	716-856-5636 (2545)	URS Project Manager

Notes:

NYSDEC New York State Department of Environmental Conservation

URS URS Corporation

2.0 SITE BACKGROUND

The former EMCA property is a 0.6-acre site located in a mixed residential/industrial area in Mamaroneck, New York (Figures 1 and 2). The site was formerly owned by the Rohm and Haas Company and used for manufacture of high conductivity precious metal paste used in circuits by the electronics industry. Manufacturing was discontinued in 1988 and the current site owner is Cablevision of Westchester.

2.1 Previous Investigations

Preliminary site investigations performed by Goldberg-Zoino Associates of New York (GZANY 1988) and Woodward-Clyde Consultants (WWC 1989) involved drilling, installation of groundwater monitoring wells, and sampling and analysis of soil, groundwater, and air (both indoor and outdoor). Results of the investigations revealed that groundwater beneath the northeastern section of the site contained benzene and chlorinated solvents (Freon 113) at concentrations above the NYSDEC Class GA Water Quality Standards presented in Technical and Operational Guidance Series (TOGS) 1.1.1, June 1998 (amended April 2000). The site was subsequently listed on the New York State Registry of Inactive Hazardous Waste Disposal Sites (No. 360025).

In March 1999, Rohm and Haas Company signed a Consent Order with the NYSDEC agreeing to conduct additional investigations to further evaluate the nature and extent of contamination at the site. URS performed fieldwork in October 1999 and July 2000 that included sampling and analysis of soil, soil gas, and groundwater. Hydraulic conductivity testing and groundwater elevation monitoring were also performed.

Investigation results were presented in a Remedial Investigation (RI) Report prepared by URS (URS 2000). The RI report characterized site hydrogeology, which is summarized below:

- The site is underlain by unconsolidated glacial and alluvial sand containing zones of gravel, silt, and clay to a depth of 32 feet (ft) below ground surface (bgs), which represents the deepest boring drilled at the site.

- Groundwater occurs under unconfined (water table) conditions and the water table beneath the site varies between approximately 4 to 6 ft bgs (Table 1). The groundwater flow direction is northwest across the site, towards the Sheldrake River, at a gradient of approximately 0.005 foot/foot (Figure 3).

- Hydraulic conductivity of the water table aquifer ranges between 7×10^{-3} centimeters per second (cm/sec) to 2×10^{-2} cm/sec.

The RI report and an additional round of groundwater sampling undertaken in July 2001 established the nature and extent of site contamination, which is summarized below (URS 2002).

- Petroleum volatile organic compounds (VOCs) and chlorinated VOCs (primarily Freon 113) were detected in vadose zone soil gas. The petroleum VOCs and chlorinated VOCs other than Freon 113 were attributed to offsite sources.

- Ambient air quality (both indoor and outdoor) is not a media of concern based on analyses conducted by ENVIRON (1992) and the New York State Department of Health (NYSDOH 2000).

- Soil contamination was not identified at concentrations above the Recommended Soil Cleanup Objectives presented in NYSDEC Technical and Administrative Guidance Memorandum #4046 *"Determination of Soil Cleanup Objectives and Cleanup Levels"*.

- Groundwater is contaminated by chlorinated VOCs (primarily Freon 113) and to a lesser degree, petroleum VOCs (Table 2). Groundwater monitoring performed in July 2001 indicated that the principal contaminant of concern in groundwater is Freon 113. Groundwater contaminant concentrations have generally decreased over time.

- The highest concentrations of tetrachloroethene, trichloroethene, 1,1,2-trichloroethane, 1,2-dichloroethene (both isomers), 1,1-dichloroethane, vinyl chloride, and chloroethane in groundwater were detected in upgradient monitoring wells GZ-07 and MW-01, indicating an upgradient source of these compounds.

- At the time of the RI report, groundwater analytical data for natural attenuation parameters did not provide strong evidence that reductive dechlorination of Freon 113 was occurring in the saturated zone.

2.2 Engineering Evaluation/Cost Analysis

An Engineering Evaluation/Cost Analysis (EE/CA) was performed to evaluate remedial options for Freon 113 contamination in groundwater (URS 2002). The remedial action objective established in the EE/CA was to reduce the maximum concentration of Freon 113 in groundwater to a level approaching the New York State groundwater standard (5 micrograms per liter [µg/L] or parts per billion).

The following alternatives were evaluated in detail in the EE/CA:

- Monitored natural attenuation.

- In-situ application of a Hydrogen Release Compound.

- Injection of vegetable oil.

- Injection of zero valent iron (ZVI) using the Ferox process.

- Injection of ZVI in a guar carrier.

All of these alternatives included the application of an oxygen-releasing compound in the event that vinyl chloride is produced as a by-product of the remediation.

The EE/CA recommended further evaluation of the following promising remedial alternatives using a pilot study at the former EMCA site:

- Injection of vegetable oil.
- Injection of ZVI in a guar carrier (as a potential contingency).

2.3 Pilot Study

A pilot study was conducted between May 2003 and July 2004 to evaluate the effectiveness of emulsified oil injection as a method to stimulate biological processes that result in the reductive dechlorination of Freon 113 in site groundwater.

The following activities were performed:

- Installation of two monitoring wells (MW-06 and MW-07).
- Injection of commercially prepared emulsified oil (Edible Oil Substrate – EOS™) manufactured by EOS Remediation, Inc. and a commercially prepared sodium lactate solution (WILCLEAR™ Sodium Lactate) manufactured by JRW Technologies.
- A groundwater-monitoring program to establish background conditions and provide analytical data to facilitate evaluation of the technology's effectiveness.

Analytical results associated with the pilot study for all analytes are listed in Table 2 and are shown graphically on Figure 4 for Freon 113. Sampling dates are shown below.

Date	Purpose
May 20-21, 2003	Background
June 10-11, 2003	Background
July 22-23, 2003	1-month after substrate injection
September 17-18, 2003	3-months after substrate injection
December 17-18, 2003	6-months after substrate injection
July 22-23, 2004	13-months after substrate injection

Results of the pilot study indicated that injection of EOS™ and sodium lactate was successful in stimulating in-situ anaerobic biodegradation of Freon 113. Monitoring data that supported this assessment include:

- A reduction of Freon 113 concentrations in source area and downgradient wells.
- An increase of Freon 123a, Freon 1113, and chloride concentrations, which are degradation byproducts, in source area and downgradient wells.
- Geochemical data (high methane and the absence of sulfate) that indicated the study area shifted towards a more highly reducing environment.

Based on the results of the latest sampling event (July 22-23, 2004), an additional injection of sodium lactate and emulsified oil was recommended to continue and enhance conditions favorable for continued degradation of site contaminants. Based on this data it is recommended that this IRM be conducted at the site and consist of the following elements:

- Injection of sodium lactate at locations similar to where the emulsified oil and sodium lactate were injected during the pilot study.

- Injection of emulsified oil and sodium lactate upgradient of MW-03 to provide for a longer lasting enhancement of the anaerobic conditions at MW-03 and to create conditions favorable for the degradation of site contaminants in the vicinity of MW-02 and MW-06.

- Injection of sodium lactate between MW-03 and MW-07 to supplement conditions favorable for the degradation of contaminants in the downgradient portion of the plume.

- Injection of sodium lactate in the immediate vicinity of GZ-06 to provide conditions favorable for the degradation of contaminants at this upgradient location.

3.0 OBJECTIVE

The IRM will be performed in a portion of the contaminant plume, which is located around wells MW-02, MW-03, MW-06, and MW-07, and at upgradient well GZ-06 (Figure 5). The objective of the IRM is to maintain and stimulate biological processes that result in the reductive dechlorination of Freon 113 and daughter products (Freon 123a and Freon 1113) in the saturated zone.

4.0 SCOPE OF THE INTERIM REMEDIAL ACTION

4.1 Scope

The IRM injections will be conducted in an area that encompasses wells MW-02, MW-03 and MW-06, in an area between MW-03 and downgradient well MW-07, and at a separate location surrounding upgradient well GZ-06 (Figure 5). The treatment zone will extend from the top of the water table surface, approximately 5 ft bgs, to the maximum depth of contamination detected in previous investigations, which is 25 ft bgs. Sodium lactate (WILCLEAR™) and emulsified soybean oil (EOS™) will be injected as outlined below.

- MW-03 area – WILCLEAR™ (a commercially prepared sodium lactate solution) will be injected at 12 locations centered on well MW-03. The purpose of these injections is to further stimulate the existing anaerobic conditions at MW-03 immediately and at downgradient location MW-07 over time. EOS™ will not be injected in this area because absorption of Freon compounds into the oil may delay their degradation at this locale.

- MW-02/MW-06 area – EOS™ (commercially prepared emulsified soybean oil) and WILCLEAR™ solutions will be injected at 10 locations that encompass wells MW-02 and MW-06. Both solutions will be injected to establish anaerobic conditions favorable for reductive dechlorination. The EOS™ will dissolve slowly over time, enabling the favorable conditions in this area to persist. Also, the injections will impact downgradient areas (at MW-03 and MW-07) to maintain favorable conditions over time.

- MW-07 area - WILCLEAR™ will be injected at 3 locations between wells MW-03 and MW-07. The injection will immediately place sodium lactate between MW-03 and MW-07 to further stimulate existing anaerobic conditions favorable for reductive dechlorination. The propagation of anaerobic conditions from the MW-03 area (described above) may take between 45 to 60 days to reach this area.

- GZ-06 area – WILCLEAR™ will be injected at 3 locations around well GZ-06. Freon 113 concentrations have fluctuated in this area and have apparently not been impacted by the pilot study injections. The injection of WILCLEAR™ will promote anaerobic conditions favorable for reductive dechlorination in this area.

Details of the WILCLEAR™ and EOS™ products and injection process are presented in Section 4.2 and Section 5.3, respectively. It is anticipated that the entire remaining Freon plume will be impacted by these injections and that reductive dechlorination will continue on site for at least 1-year following injection.

4.2 Product Information

Commercially prepared WILCLEAR™ sodium lactate, purchased from JRW Technologies, Inc. (Lexana, Kansas) and EOS™ emulsified oil, purchased from EOS Remediation, Inc. (Raleigh, North Carolina), will be used for the IRM.

WILCLEAR™ sodium lactate is a high purity sodium lactate concentrate formulated to enhance microbial activity in-situ for biodegradation and reduction of chlorinated solvents. The product is prepared at the factory (Waukegan, Illinois) and shipped to the site in 55-gallon polyethylene drums or in 5-gallon plastic pails. Product information is provided in Appendix A.

EOS™ is a proprietary mixture of emulsified food-grade oil, lactate and yeast extract formulated to stimulate anaerobic biological activity for the reductive dechlorination of chlorinated aliphatic hydrocarbons. The product is prepared at the factory and shipped to the job site in 55-gallon drums. Product information is provided in Appendix A.

4.3 Data Analysis and Reporting

An IRM report will be prepared after the substrates have been injected. The report will provide information on the injection process and include information on the injection method and parameters (interval, amount, and pressure).

5.0 FIELD PROGRAM

All field activities will be coordinated with appropriate personnel from Cablevision, the current property owner.

5.1 Utility Clearance/Work Coordination

Prior to substrate injection, each proposed location will be cleared to avoid underground utilities and structures. Commercial and private utility locating services, public utilities, the Town of Mamaroneck, and Cablevision will be contacted to provide subsurface utility information.

5.2 Decontamination

All injection equipment will be cleaned with steam or hot high-pressure water prior to use at the site and prior to demobilization from the site. Downhole equipment, such as drive points and rods, will also be cleaned between well and injection locations.

5.3 Substrate Injection

WILCLEAR™ sodium lactate will be shipped to the site in 5-gallon containers or in 55-gallon drums. The product will be mixed at a ratio of 10 gallons of water to 1 gallon of sodium lactate prior to injection at the MW-03, MW-07 and GZ-06 areas. The product will be mixed at a ratio of 50 gallons of water to 3 gallons of sodium lactate prior to injection at the MW-02/MW-06 area.

EOS™ is prepared and shipped in concentrated form. At the site, vitamin B12 will be added to the concentrate at an amount of 500-milliliters per 55-gallons of substrate. The substrate will be then diluted at a ratio of 4 gallons water to 1 gallon EOS™. Sodium bicarbonate will be

added to the dilute mixture at an approximate ratio of 0.4 percent to buffer the solution. Injection of the dilute EOS™ will be followed by 53 gallons of dilute sodium lactate (per hole) to distribute the substrate in the aquifer and provide additional carbon.

The quantity of WILCLEAR™ sodium lactate and EOS™ required for each area are summarized below and documented in Appendix B.

5.3.1 MW-03 Area

WILCLEAR™ sodium lactate will be applied in the MW-03 area using twelve injection points situated over a nominal 30-feet by 44-feet area centered on well MW-03 (Figure 5). Six (6) equidistant injection points will be arranged in a 5-foot grid pattern at the interior of the test area and six (6) injection points will be arranged in a 10-foot spacing at the periphery of the interior area. The 5-foot interior spacing provides closer distribution of the sodium lactate in the area that contains the highest concentration of Freon 113. The injection locations will be offset from injection locations that were used for the pilot study. The WILCLEAR™ sodium lactate will be mixed in a ratio of 10 gallons of water to 1 gallon of WILCLEAR™ to enable better distribution of the substrate in the aquifer.

The following procedure will be used to inject the sodium lactate at each point.

- A pressure-activated injection probe and drive rod assembly will be advanced to 25 ft bgs and retracted slightly.
- Clean (potable) water will be poured into the rods to displace air, thus preventing any injection of air into the treatment zone.
- The vadose zone will be sealed using hydrated bentonite chips.
- Dilute WILCLEAR™ sodium lactate will be pumped into the treatment zone while withdrawing the drive rods at a uniform rate (injection volumes are listed below).

Location	Sodium Lactate Quantity		
	(concentrate vol/hole)	(dilute vol/hole)	(volume/4-ft interval)
MW-03 (Interior Area)	3.9 gallons	43 gallons	8.5 gallons
MW-03 (Exterior Area)	24.3 gallons	268 gallons	53.5 gallons

10:1

- The ground surface will be finished with asphalt or concrete to match the existing site conditions.

5.3.2 MW-02/MW-06 Area

WILCLEAR™ sodium lactate and EOS™ solutions will be applied over a nominal 30-feet by 44-feet area surrounding MW-02 and MW-06 using ten (10) equidistant points arranged in a 10-foot spacing.

The following procedure will be used at each point:

- A pressure-activated injection probe and drive rod assembly will be advanced to 25 ft bgs and retracted slightly.
- Clean (potable) water will be poured into the rods to displace air, thus preventing any injection of air into the treatment zone.
- The vadose zone will be sealed using hydrated bentonite chips.
- Dilute EOS™ will be pumped into the treatment zone while the rods are withdrawn at a uniform rate over a 4-ft increment (injection volumes are listed below).
- The pressure-activated probe will be re-advanced 4-ft and dilute sodium lactate, mixed at a ratio of 50 gallons of water to three gallons of sodium lactate, will be

pumped into the treatment zone while the rods are withdrawn at a uniform rate (injection volumes are listed below).

Substrate or Fluid	Quantity	
	(volume/hole)	(volume/4-ft interval)
EOS™	110 gallons	22 gallons
Dilute WILCLEAR™ sodium lactate	53 gallons	10.6 gallons

- The probe withdrawal and injection process will be repeated over successive 4-ft intervals until a depth of 5-ft bgs is reached.
- The ground surface will be finished with asphalt or concrete to match the existing site conditions.

5.3.3 MW-07 and GZ-06 Areas

Sodium lactate will be injected using the procedure documented in Section 5.3.1. The WILCLEAR™ sodium lactate will be mixed in a ratio of 10 gallons of water to 1 gallon WILCLEAR™ to enable better distribution of the substrate in the aquifer. The injection volumes listed below will be used.

Location	Sodium Lactate Quantity		
	(concentrate vol/hole)	(dilute vol/hole)	(volume/4-ft interval)
MW-07	13.9 gallons	153.4 gallons	30.7 gallons
GZ-06	10.1 gallons	110.9 gallons	22.2 gallons

5.4 Field Documentation

Field activities will be documented using field notebooks, photographs, and standard field forms. Field notebooks will serve as the primary record of activities at the site. Field notebooks will be bound with consecutively numbered pages. All entries into the notebook will

contain a variety of information including: dates, times, weather, personnel at the site and affiliations, equipment being used, level of personnel protective equipment, instrument calibration, drilling information, sampling/measurement data, and any other relevant information. If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed. Field notebooks will be stored in a project file when not in use.

6.0 REFERENCES

ENVIRON Corporation (ENVIRON). (1992). *Indoor Air Sampling at TCI Cable of Westchester, Inc. – Mamaroneck, New York.* Princeton, New Jersey. September.

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NYSDOH. 2000. *Freon 113 Concentrations in Air- July 11, 2000.* (Data Summary Table).

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URS. 2002. *Final Draft Engineering Evaluation/Cost Analysis (EE/CA) Report, Former EMCA Site, Mamaroneck, New York.* Buffalo, New York. June.

Woodward-Clyde Consultants (WWC). 1989. *Risk Assessment, Former EMCA Site, Mamaroneck, New York.* 15 July.

TABLES

TABLE 1
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ELEVATION MEASUREMENTS

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
GZ-03	1981	2713	100.28		102.71		1						
MWN								5/19/2003 1745	9.18	93.53	0.00	93.53	Riser slightly bent
MWN								6/10/2003 0730	6.69	96.02	0.00	96.02	
MWN								7/22/2003 1059	8.82	93.89	0.00	93.89	
MWN								7/23/2003 1325	8.31	94.40	0.00	94.40	
MWN								9/17/2003 1010	8.54	94.17	0.00	94.17	
MWN								12/17/2003 0720	6.42	96.29	0.00	96.29	
MWN								7/22/2004 0000	8.54	94.17	0.00	94.17	
GZ-06	1987	2890	99.9		101.55		1						
MWN								5/19/2003 1752	7.38	94.17	0.00	94.17	
MWN								5/21/2003 1135	7.37	94.18	0.00	94.18	
MWN								6/10/2003 0715	6.17	95.38	0.00	95.38	
MWN								7/22/2003 1110	7.42	94.13	0.00	94.13	
MWN								7/23/2003 0800	7.30	94.25	0.00	94.25	
MWN								9/17/2003 0942	7.44	94.11	0.00	94.11	
MWN								12/17/2003 0645	6.08	95.47	0.00	95.47	
MWN								7/22/2004 0000	7.44	94.11	0.00	94.11	
MW-01	1872	2795	99.5		99.22		1						
MWN								5/19/2003 1757	5.42	93.80	0.00	93.80	
MWN								6/10/2003 0716	3.55	95.67	0.00	95.67	
MWN								7/22/2003 1000	5.49	93.73	0.00	93.73	
MWN								7/23/2003 1348	5.32	93.90	0.00	93.90	
MWN								9/17/2003 0929	5.46	93.76	0.00	93.76	
MWN								12/17/2003 0642	3.25	95.97	0.00	95.97	
MWN								7/22/2004 0000	5.40	93.82	0.00	93.82	
MW-02	2038	2846	99.18		99.18		1						
MWN								5/19/2003 1724	5.88	93.30	0.00	93.30	

NM - No Measurement

The value noted in the column labeled Specific Gravity is an assumed value for free product, if found.

Type:
MWN Monitoring Well
SG Staff Gauge

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Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MWN								5/20/2003 1053	5.91	93.27	0.00	93.27	
MWN								6/10/2003 0719	4.54	94.64	0.00	94.64	
MWN								7/22/2003 1020	5.72	93.46	0.00	93.46	
MWN								7/23/2003 1341	5.63	93.55	0.00	93.55	
MWN								9/17/2003 0938	5.79	93.39	0.00	93.39	
MWN								9/18/2003 0859	5.89	93.29	0.00	93.29	
MWN								12/17/2003 0650	4.27	94.91	0.00	94.91	
MWN								7/22/2004 0000	5.85	93.33	0.00	93.33	
MW-03	2059	2809	99.61		99.35		1						
MWN								5/19/2003 1719	6.22	93.13	0.00	93.13	
MWN								5/21/2003 1350	6.21	93.14	0.00	93.14	
MWN								6/10/2003 0721	4.91	94.44	0.00	94.44	
MWN								7/22/2003 1032	6.13	93.22	0.00	93.22	
MWN								7/23/2003 1200	NM	-	NM	-	Car Parked Over Well
MWN								9/17/2003 0951	6.09	93.26	0.00	93.26	
MWN								12/17/2003 0657	3.91	95.44	0.00	95.44	
MWN								7/22/2004 0000	6.08	93.27	0.00	93.27	
MW-04	2101	2746	98.84		98.61		1						
MWN								5/19/2003 1721	5.54	93.07	0.00	93.07	
MWN								5/20/2003 1414	5.57	93.04	0.00	93.04	
MWN								6/10/2003 0724	3.92	94.69	0.00	94.69	
MWN								7/22/2003 1040	5.33	93.28	0.00	93.28	
MWN								7/23/2003 1140	5.15	93.46	0.00	93.46	
MWN								9/17/2003 0959	5.33	93.28	0.00	93.28	
MWN								12/17/2003 0710	3.86	94.75	0.00	94.75	
MWN								7/22/2004 0000	5.36	93.25	0.00	93.25	

NM - No Measurement

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Type:
MWN Monitoring Well
SG Staff Gauge

Filter = ([tblGWD].[LOGDATE]>#5/1/2003#))

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MW-05	2160.091194	2784.442553	98.25		98.14		1						
MWN								5/19/2003 1730	5.17	92.97	0.00	92.97	
MWN								5/20/2003 0829	5.22	92.92	0.00	92.92	
MWN								6/10/2003 0724	3.92	94.22	0.00	94.22	
MWN								7/22/2003 1053	5.09	93.05	0.00	93.05	
MWN								7/23/2003 1144	4.81	93.33	0.00	93.33	
MWN								9/17/2003 1003	5.10	93.04	0.00	93.04	
MWN								12/17/2003 0717	3.43	94.71	0.00	94.71	
MWN								7/22/2004 0000	5.19	92.95	0.00	92.95	
MW-06	2036.09641	2825.78627			NA								
MWN								6/10/2003 1329	5.22		0.00		
MWN								7/22/2003 1010	6.00		0.00		
MWN								7/23/2003 1334	5.82		0.00		
MWN								9/17/2003 0948	5.98		0.00		
MWN								9/18/2003 0735	6.05		0.00		
MWN								12/17/2003 0654	4.81		0.00		
MWN								7/22/2004 0000	6.06		0.00		
MW-07	2090.71043	2783.86481			NA								
MWN								6/10/2003 1500	5.07		0.00		
MWN								7/23/2003 0945	6.03		0.00		
MWN								9/17/2003 0955	6.20		0.00		
MWN								12/17/2003 0659	4.44		0.00		
MWN								7/22/2004 0000	6.21		0.00		
WS-01	2252	2592			92.00		1						
SG								5/19/2003 1822	1.95	90.05	0.00	90.05	Top of wooden stake
SG								7/22/2003 1120	1.5	90.50	0.00	90.50	
SG								7/23/2003 1352	1.25	90.75	0.00	90.75	

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FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ELEVATION MEASUREMENTS

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
SG								9/17/2003 1019	1.52	90.48	0.00	90.48	
SG								12/17/2003 0725	NM	-	NM	-	Unable to Locate
SG								7/22/2004 0000	NM	-	NM	-	
WS-02	2080	2496			92.00		1						
SG								7/22/2004 0000	NM	-	NM	-	
WS-03	1939	2425			92.00		1						
SG								7/22/2004 0000	NM	-	NM	-	
WS-04	1413.469	2285.50			97.00		1						
SG								5/19/2003 1817	4.92	92.08	0.00	92.08	
SG								7/22/2003 1132	4.47	92.53	0.00	92.53	
SG								7/23/2003 1400	4.34	92.66	0.00	92.66	
SG								9/17/2003 0920	4.57	92.43	0.00	92.43	
SG								12/17/2003 0730	3.70	93.30	0.00	93.30	
SG								7/22/2004 0000	4.53	92.47	0.00	92.47	

NM - No Measurement

The value noted in the column labeled Specific Gravity is an assumed value for free product, if found.

Type:
MWN Monitoring Well
SG Staff Gauge

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		GZ-06	GZ-06	GZ-06	GZ-06	GZ-06
Sample ID		GZ06_52103	GZ06	GZ06-091703	GZ-06-121803	GZ06
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		05/21/03	07/23/03	09/17/03	12/18/03	07/22/04
Parameter	Units					
Volatiles						
Acetone	UG/L	5.0 U	10 U	5.0 U	5.0 U	NA
Benzene	UG/L	5.0 U	10 U	5.0 U	5.0 U	NA
Methyl ethyl ketone (2-Butanone)	UG/L	R	R	R	R	NA
Chlorotrifluoroethene (Freon-1113)	UG/L	NA	NA	NA	NA	24
1,1-Dichloroethene	UG/L	0.8 J	1.5 J	2.0 U	2.0 U	NA
cis-1,2-Dichloroethene	UG/L	5.0 U	10 U	5.0 U	5.0 U	NA
Ethylbenzene	UG/L	4.0 U	8 U	4.0 U	4.0 U	NA
2-Hexanone	UG/L	5.0 U	10 U	5.0 U	5.0 U	NA
4-Methyl-2-Pentanone	UG/L	5.0 U	10 U	5.0 U	5.0 U	NA
Tetrachloroethene	UG/L	0.6 J	2 U	0.5 J	1.0 U	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	UG/L	100	230	74	5.0 U	100 J
Vinyl Chloride	UG/L	5.0 U	10 U	5.0 U	5.0 U	NA
Xylene (total)	UG/L	5.0 U	10 U	5.0 U	5.0 U	NA
1,2-Dichloro-1,1,2-trifluoroethane (Freon-123A)	UG/L	20	41	26	0.7 J	36
Dissolved Gases						
Methane	UG/L	140	98	89	5.9	48
Total Metals						
Iron	UG/L	2,390	866	517 J	173	NA
Dissolved Metals						
Iron	UG/L	2,290	778	583 J	85.3 B	NA
Miscellaneous Parameters						
Chloride	MG/L	559	474	477 J	218	1,610
Nitrogen, Ammonia (As N)	MG/L	0.1 U	0.1 U	0.1 U	0.1 U	NA

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		GZ-06	GZ-06	GZ-06	GZ-06	GZ-06
Sample ID		GZ06_52103	GZ06	GZ06-091703	GZ-06-121803	GZ06
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		05/21/03	07/23/03	09/17/03	12/18/03	07/22/04
Parameter	Units					
Miscellaneous Parameters						
Nitrogen, Kjeldahl, Total	MG/L	0.5 U	0.7	1.3	0.57	NA
Nitrogen, Nitrate	MG/L	0.1 U	NA	0.58	0.1 U	NA
Nitrogen, Nitrate-Nitrite	MG/L	NA	0.12 J	NA	NA	NA
Sulfate	MG/L	25.2	27.5	32.4	5.0 U	20.8
Ferrous Iron (field)	MG/L	2.8	9.6	0.25	0.03	NA
Ferric Iron (lab)	MG/L	0.1 U	0.1 U	0.52	0.143	NA
Fluoride	MG/L	0.1 U	0.1 U	0.1 U	0.32	1.00 U
Oil & Grease	MG/L	NA	NA	R	NA	NA
Tentatively Identified Compound						
Chlorotrifluoroethene (FREON-1113)	UG/L	0 U	0 U	5.4	0 U	NA

Flags assigned during chemistry validation are shown.

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Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-02	MW-02	MW-02	MW-02	MW-02
Sample ID		MW02-5-20-03	MW02-5-20-03DUP	DUP-7_22_03	MW02-7_22_03	MW02-091803
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		05/20/03	05/20/03	07/22/03	07/22/03	09/18/03
Parameter	Units		Field Duplicate (1-1)	Field Duplicate (1-1)		
Volatiles						
Acetone	UG/L	140 J	130 J	R	R	5.0 U
Benzene	UG/L	50 U	25 U	50 U	50 U	5.0 U
Methyl ethyl ketone (2-Butanone)	UG/L	R	R	R	R	R
Chlorotrifluoroethene (Freon-1113)	UG/L	NA	NA	NA	NA	NA
1,1-Dichloroethene	UG/L	4.4 J	5.1 J	8.2 J	7.5 J	2.0 U
cis-1,2-Dichloroethene	UG/L	50 U	25 U	50 U	50 U	5.0 U
Ethylbenzene	UG/L	40 U	20 U	40 U	3.4 J	4.0 U
2-Hexanone	UG/L	50 U	25 U	50 U	50 U	5.0 U
4-Methyl-2-Pentanone	UG/L	50 U	25 U	50 U	50 U	5.0 U
Tetrachloroethene	UG/L	10 U	5.0 U	10 U	10 U	1.0 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	UG/L	710	880	1,000	1,000	54
Vinyl Chloride	UG/L	50 U	25 U	50 U	50 U	5.0 U
Xylene (total)	UG/L	50 U	25 U	7.1 J	11 J	5.0 U
1,2-Dichloro-1,1,2-trifluoroethane (Freon-123A)	UG/L	34 J	40	40 J	41 J	7.8
Dissolved Gases						
Methane	UG/L	26	32	54	52	410
Total Metals						
Iron	UG/L	27,800	28,300	30,100	30,900	63,800 J
Dissolved Metals						
Iron	UG/L	27,900	28,200	30,500	30,500	60,900 J
Miscellaneous Parameters						
Chloride	MG/L	338	338	307	283	839
Nitrogen, Ammonia (As N)	MG/L	3.3	3.4	4.1	3.8	11.5

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-02	MW-02	MW-02	MW-02	MW-02
Sample ID		MW02-5-20-03	MW02-5-20-03DUP	DUP-7_22_03	MW02-7_22_03	MW02-091803
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		05/20/03	05/20/03	07/22/03	07/22/03	09/18/03
Parameter	Units		Field Duplicate (1-1)	Field Duplicate (1-1)		
Miscellaneous Parameters						
Nitrogen, Kjeldahl, Total	MG/L	6.6	6.2	6.6	6.1	17.1
Nitrogen, Nitrate	MG/L	0.15	0.16	0.1 U	0.1	0.1 U
Nitrogen, Nitrate-Nitrite	MG/L	NA	NA	NA	NA	NA
Sulfate	MG/L	44	46	32.3	32.5	4.8
Ferrous Iron (field)	MG/L	25.3	NA	25.7	28.0	49.3
Ferric Iron (lab)	MG/L	2.5	3	4.4	2.9	48.3
Fluoride	MG/L	0.28	0.3	0.37	0.39	0.3
Oil & Grease	MG/L	NA	NA	NA	NA	5 U
Tentatively Identified Compound						
Chlorotrifluoroethene (FREON-1113)	UG/L	0 U	0 U	0 U	0 U	0 U

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-02	MW-02	MW-03	MW-03	MW-03
Sample ID		MW-02-121803	MW-02	MW03_52103	MW03	DUP-91703
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		12/18/03	07/22/04	05/21/03	07/23/03	09/17/03
Parameter	Units					Field Duplicate (1-1)
Volatiles						
Acetone	UG/L	5.0 U	NA	250 U	78	110
Benzene	UG/L	5.0 U	NA	250 U	2.3	2.2
Methyl ethyl ketone (2-Butanone)	UG/L	R	NA	R	130 J	69 J
Chlorotrifluoroethene (Freon-1113)	UG/L	NA	14	NA	NA	NA
1,1-Dichloroethene	UG/L	2.0 U	NA	33 J	2.0 U	2.0 U
cis-1,2-Dichloroethene	UG/L	5.0 U	NA	250 U	5.0 U	5.0 U
Ethylbenzene	UG/L	4.0 U	NA	200 U	0.3 J	4.0 U
2-Hexanone	UG/L	5.0 U	NA	250 U	5.0 U	19
4-Methyl-2-Pentanone	UG/L	5.0 U	NA	250 U	5.0 U	11
Tetrachloroethene	UG/L	1.0 U	NA	50 U	1.0 U	1.0 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	UG/L	12	21 J	5,800	68	26
Vinyl Chloride	UG/L	5.0 U	NA	250 U	5.0 U	5.0 U
Xylene (total)	UG/L	5.0 U	NA	250 U	1.1 J	5.0 U
1,2-Dichloro-1,1,2-trifluoroethane (Freon-123A)	UG/L	3.3 J	4 J	78 J	43	180
Dissolved Gases						
Methane	UG/L	320	140	86	56	2,400
Total Metals						
Iron	UG/L	69,000	NA	1,170	150,000	174,000 J
Dissolved Metals						
Iron	UG/L	69,300	NA	267	152,000	187,000 J
Miscellaneous Parameters						
Chloride	MG/L	769	238	113	143	99.2 J
Nitrogen, Ammonia (As N)	MG/L	11.9	NA	0.36	2.7	0.86

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-02	MW-02	MW-03	MW-03	MW-03
Sample ID		MW-02-121803	MW-02	MW03_52103	MW03	DUP-91703
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		12/18/03	07/22/04	05/21/03	07/23/03	09/17/03
Parameter	Units					Field Duplicate (1-1)
Miscellaneous Parameters						
Nitrogen, Kjeldahl, Total	MG/L	16.9	NA	1.3	10.8	4.5
Nitrogen, Nitrate	MG/L	0.1 U	NA	2	NA	0.1 U
Nitrogen, Nitrate-Nitrite	MG/L	NA	NA	NA	0.1 UJ	NA
Sulfate	MG/L	5.0 U	15.2	32.7	26.9	5.0 U
Ferrous Iron (field)	MG/L	6.3	NA	0.5	3.7	25.5
Ferric Iron (lab)	MG/L	62.7	NA	0.67	146	67.0
Fluoride	MG/L	0.31	0.294	0.28	0.44	0.27
Oil & Grease	MG/L	NA	NA	NA	NA	R
Tentatively Identified Compound						
Chlorotrifluoroethene (FREON-1113)	UG/L	0 U	NA	0 U	7.0	6.2

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-03	MW-03	MW-03	MW-03	MW-04
Sample ID		MW03-091703	DUP1_121703	MW-03_121703	MW-03	MW04-5-20-03
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		09/17/03	12/17/03	12/17/03	07/23/04	05/20/03
Parameter	Units		Field Duplicate (1-1)			
Volatiles						
Acetone	UG/L	110	130 J	120 J	NA	5.0 U
Benzene	UG/L	1.8	10 U	10 U	NA	5.0 U
Methyl ethyl ketone (2-Butanone)	UG/L	65 J	39 J	38 J	NA	R
Chlorotrifluoroethene (Freon-1113)	UG/L	NA	NA	NA	68 J	NA
1,1-Dichloroethene	UG/L	2.0 U	4.0 U	4 U	NA	2.0 U
cis-1,2-Dichloroethene	UG/L	5.0 U	10 U	10 U	NA	5.0 U
Ethylbenzene	UG/L	4.0 U	8.0 U	8 U	NA	4.0 U
2-Hexanone	UG/L	16	10 U	10 U	NA	5.0 U
4-Methyl-2-Pentanone	UG/L	11	10 U	10 U	NA	5.0 U
Tetrachloroethene	UG/L	1.0 U	4.9	4.6	NA	1.0 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	UG/L	16	150	150	4,900 J	5.0 U
Vinyl Chloride	UG/L	5.0 U	10 U	10 U	NA	5.0 U
Xylene (total)	UG/L	5.0 U	10 U	10 U	NA	5.0 U
1,2-Dichloro-1,1,2-trifluoroethane (Freon-123A)	UG/L	110	170	160	3,900	5.0 U
Dissolved Gases						
Methane	UG/L	2,500	7,200	4,900	2,700	380
Total Metals						
Iron	UG/L	178,000 J	156,000	164,000	NA	18,400
Dissolved Metals						
Iron	UG/L	186,000 J	167,000	176,000	NA	18,500
Miscellaneous Parameters						
Chloride	MG/L	91.5 J	224	192	71.7	238
Nitrogen, Ammonia (As N)	MG/L	0.95	1.4	1.2	NA	1.6

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-03	MW-03	MW-03	MW-03	MW-04
Sample ID		MW03-091703	DUP1_121703	MW-03_121703	MW-03	MW04-5-20-03
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		09/17/03	12/17/03	12/17/03	07/23/04	05/20/03
Parameter	Units		Field Duplicate (1-1)			
Miscellaneous Parameters						
Nitrogen, Kjeldahl, Total	MG/L	4.4	4.0	4.0	NA	6.2
Nitrogen, Nitrate	MG/L	0.1 U	0.1 U	0.1 U	NA	0.1 U
Nitrogen, Nitrate-Nitrite	MG/L	NA	NA	NA	NA	NA
Sulfate	MG/L	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Ferrous Iron (field)	MG/L	27.9	23.5	30.0	NA	17.6
Ferric Iron (lab)	MG/L	93.0	132	134	NA	0.76
Fluoride	MG/L	0.2	0.22	0.25	0.397	0.27
Oil & Grease	MG/L	R	NA	NA	NA	NA
Tentatively Identified Compound						
Chlorotrifluoroethene (FREON-1113)	UG/L	0 U	0 U	0 U	NA	0 U

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-04	MW-04	MW-04	MW-05	MW-05
Sample ID		MW-04_121703	Dup1	MW-04	MW05_52103	MW-05-121803
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		12/17/03	07/22/04	07/22/04	05/21/03	12/18/03
Parameter	Units		Field Duplicate (1-1)			
Volatiles						
Acetone	UG/L	5.0 U	NA	NA	5.0 U	5.0 U
Benzene	UG/L	5.0 U	NA	NA	5.0 U	5.0 U
Methyl ethyl ketone (2-Butanone)	UG/L	R	NA	NA	R	R
Chlorotrifluoroethene (Freon-1113)	UG/L	NA	10 U	10 U	NA	NA
1,1-Dichloroethene	UG/L	2.0 U	NA	NA	2.0 U	2.0 U
cis-1,2-Dichloroethene	UG/L	5.0 U	NA	NA	5.0 U	5.0 U
Ethylbenzene	UG/L	4.0 U	NA	NA	4.0 U	4.0 U
2-Hexanone	UG/L	5.0 U	NA	NA	5.0 U	5.0 U
4-Methyl-2-Pentanone	UG/L	5.0 U	NA	NA	5.0 U	5.0 U
Tetrachloroethene	UG/L	1.0 U	NA	NA	0.4 J	1.0 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	UG/L	5.0 U	10 UJ	0.7 J	5.0 U	5.0 U
Vinyl Chloride	UG/L	5.0 U	NA	NA	5.0 U	5.0 U
Xylene (total)	UG/L	5.0 U	NA	NA	5.0 U	5.0 U
1,2-Dichloro-1,1,2-trifluoroethane (Freon-123A)	UG/L	5.0 U	10 U	10 U	5.0 U	5.0 U
Dissolved Gases						
Methane	UG/L	35	69	99	27	6.7
Total Metals						
Iron	UG/L	3,640	NA	NA	2,110	15,500
Dissolved Metals						
Iron	UG/L	3,760	NA	NA	1,670	39.7 U
Miscellaneous Parameters						
Chloride	MG/L	294	158	161	49.8	27.5
Nitrogen, Ammonia (As N)	MG/L	1.2	NA	NA	0.25	0.1 U

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-04	MW-04	MW-04	MW-05	MW-05
Sample ID		MW-04_121703	Dup1	MW-04	MW05_52103	MW-05-121803
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		12/17/03	07/22/04	07/22/04	05/21/03	12/18/03
Parameter	Units		Field Duplicate (1-1)			
Miscellaneous Parameters						
Nitrogen, Kjeldahl, Total	MG/L	1.9	NA	NA	3.6	0.61
Nitrogen, Nitrate	MG/L	0.1 U	NA	NA	0.22	0.18
Nitrogen, Nitrate-Nitrite	MG/L	NA	NA	NA	NA	NA
Sulfate	MG/L	9.4	10.8	10.8	50.1	61.4
Ferrous Iron (field)	MG/L	2.2	NA	NA	1.7	0.07
Ferric Iron (lab)	MG/L	1.3	NA	NA	0.43	15.4
Fluoride	MG/L	0.19	0.304	0.302	0 U	0.12
Oil & Grease	MG/L	NA	NA	NA	NA	NA
Tentatively Identified Compound						
Chlorotrifluoroethene (FREON-1113)	UG/L	0 U	NA	NA	0 U	0 U

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-05	MW-06	MW-06	MW-06	MW-06
Sample ID		MW-05	MW06-6-10-03	MW06-7_22_03	MW06-091803	MW-06_121703
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		07/23/04	06/10/03	07/22/03	09/18/03	12/17/03
Parameter	Units					
Volatiles						
Acetone	UG/L	NA	10 U	5.0 U	5.0 U	10 U
Benzene	UG/L	NA	10 U	5.0 U	5.0 U	10 U
Methyl ethyl ketone (2-Butanone)	UG/L	NA	R	R	R	R
Chlorotrifluoroethene (Freon-1113)	UG/L	10 U	NA	NA	NA	NA
1,1-Dichloroethene	UG/L	NA	4 U	1.2 J	2.0 U	4 U
cis-1,2-Dichloroethene	UG/L	NA	10 U	1.7 J	1.4 J	1.3 J
Ethylbenzene	UG/L	NA	8 U	4.0 U	4.0 U	8 U
2-Hexanone	UG/L	NA	10 U	5.0 U	5.0 U	10 U
4-Methyl-2-Pentanone	UG/L	NA	10 U	5.0 U	5.0 U	10 U
Tetrachloroethene	UG/L	NA	2 U	1.0 U	1.0 U	2 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	UG/L	0.5 J	220	180	97	250
Vinyl Chloride	UG/L	NA	10 U	1.2 J	5.0 U	10 U
Xylene (total)	UG/L	NA	10 U	5.0 U	5.0 U	10 U
1,2-Dichloro-1,1,2-trifluoroethane (Freon-123A)	UG/L	10 U	8.8 J	9.5	8.6	14
Dissolved Gases						
Methane	UG/L	47	49	81	99	78
Total Metals						
Iron	UG/L	NA	14,400	10,500	8,370 J	7,690
Dissolved Metals						
Iron	UG/L	NA	14,300	10,300	8,470 J	7,670
Miscellaneous Parameters						
Chloride	MG/L	63.9	184	82.3	74.6	84.0
Nitrogen, Ammonia (As N)	MG/L	NA	0.19	0.33	0.31	0.36

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-05	MW-06	MW-06	MW-06	MW-06
Sample ID		MW-05	MW06-6-10-03	MW06-7_22_03	MW06-091803	MW-06_121703
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		07/23/04	06/10/03	07/22/03	09/18/03	12/17/03
Parameter	Units					
Miscellaneous Parameters						
Nitrogen, Kjeldahl, Total	MG/L	NA	0.72	1.1	0.88	0.79
Nitrogen, Nitrate	MG/L	NA	0.33	0.1 U	0.1 U	0.1 UJ
Nitrogen, Nitrate-Nitrite	MG/L	NA	NA	NA	NA	NA
Sulfate	MG/L	42.3	32	30.5	39.2	39.1
Ferrous Iron (field)	MG/L	NA	14.3	8.6	6.0	8.7
Ferric Iron (lab)	MG/L	NA	0.12	1.9	8.4	1.0 U
Fluoride	MG/L	0.103	0.46	0.56	0.37	0.42
Oil & Grease	MG/L	NA	NA	NA	5 U	NA
Tentatively Identified Compound						
Chlorotrifluoroethene (FREON-1113)	UG/L	NA	0 U	5.7	0 U	0 U

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-06	MW-07	MW-07	MW-07	MW-07
Sample ID		MW-06	MW07-6-10-03	MW07	MW07-91703	MW-07_121703
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		07/23/04	06/10/03	07/23/03	09/17/03	12/17/03
Parameter	Units					
Volatiles						
Acetone	UG/L	NA	250 U	500 U	250 U	50 U
Benzene	UG/L	NA	250 U	500 U	250 U	14
Methyl ethyl ketone (2-Butanone)	UG/L	NA	R	R	R	R
Chlorotrifluoroethene (Freon-1113)	UG/L	5 J	NA	NA	NA	NA
1,1-Dichloroethene	UG/L	NA	100 U	68 J	100 U	20 U
cis-1,2-Dichloroethene	UG/L	NA	250 U	500 U	250 U	50 U
Ethylbenzene	UG/L	NA	200 U	400 U	200 U	49
2-Hexanone	UG/L	NA	250 U	500 U	250 U	50 U
4-Methyl-2-Pentanone	UG/L	NA	250 U	500 U	250 U	50 U
Tetrachloroethene	UG/L	NA	50 U	100 U	50 U	10 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	UG/L	140 J	5,400	8,500	6,100	370
Vinyl Chloride	UG/L	NA	250 U	500 U	250 U	50 U
Xylene (total)	UG/L	NA	250 U	500 U	250 U	50 U
1,2-Dichloro-1,1,2-trifluoroethane (Freon-123A)	UG/L	23	68 J	130 J	130 J	940
Dissolved Gases						
Methane	UG/L	40	740	420	1,200	1,700
Total Metals						
Iron	UG/L	NA	21,300	21,200	32,700 J	38,900
Dissolved Metals						
Iron	UG/L	NA	20,800	20,800	32,500 J	38,900
Miscellaneous Parameters						
Chloride	MG/L	60.5	140	168	300 J	328
Nitrogen, Ammonia (As N)	MG/L	NA	0.39	0.6	0.66	0.99

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

N:\11172730.00000\DB\PROGRAM\program.md
Printed: 10/11/2004 10:49:36 AM
[LOGDATE] >= #5/20/2003# AND [MATRIX] = 'WG

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-06	MW-07	MW-07	MW-07	MW-07
Sample ID		MW-06	MW07-6-10-03	MW07	MW07-91703	MW-07_121703
Matrix		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)		-	-	-	-	-
Date Sampled		07/23/04	06/10/03	07/23/03	09/17/03	12/17/03
Parameter	Units					
Miscellaneous Parameters						
Nitrogen, Kjeldahl, Total	MG/L	NA	1.2	1.8	2.1	2.8
Nitrogen, Nitrate	MG/L	NA	0.1 U	NA	0.1 U	0.1 U
Nitrogen, Nitrate-Nitrite	MG/L	NA	NA	0.1 UJ	NA	NA
Sulfate	MG/L	33.5	32.8	31	23.6	5.0 U
Ferrous Iron (field)	MG/L	NA	20.2	19.8	33.8	19.5
Ferric Iron (lab)	MG/L	NA	1	1.4	14.1	19.4
Fluoride	MG/L	0.467	0.33	0.25	0.24	0.19
Oil & Grease	MG/L	NA	NA	NA	5.44 U	NA
Tentatively Identified Compound						
Chlorotrifluoroethene (FREON-1113)	UG/L	NA	0 U	0 U	0 U	0 U

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-07
Sample ID		MW-07
Matrix		Groundwater
Depth Interval (ft)		-
Date Sampled		07/22/04
Parameter	**Units**	
Volatiles		
Acetone	UG/L	NA
Benzene	UG/L	NA
Methyl ethyl ketone (2-Butanone)	UG/L	NA
Chlorotrifluoroethene (Freon-1113)	UG/L	210
1,1-Dichloroethene	UG/L	NA
cis-1,2-Dichloroethene	UG/L	NA
Ethylbenzene	UG/L	NA
2-Hexanone	UG/L	NA
4-Methyl-2-Pentanone	UG/L	NA
Tetrachloroethene	UG/L	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	UG/L	110 J
Vinyl Chloride	UG/L	NA
Xylene (total)	UG/L	NA
1,2-Dichloro-1,1,2-trifluoroethane (Freon-123A)	UG/L	50
Dissolved Gases		
Methane	UG/L	2,500
Total Metals		
Iron	UG/L	NA
Dissolved Metals		
Iron	UG/L	NA
Miscellaneous Parameters		
Chloride	MG/L	303
Nitrogen, Ammonia (As N)	MG/L	NA

Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

TABLE 2
FORMER EMCA SITE, MAMARONECK, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

Location ID		MW-07
Sample ID		MW-07
Matrix		Groundwater
Depth Interval (ft)		-
Date Sampled		07/22/04
Parameter	Units	
Miscellaneous Parameters		
Nitrogen, Kjeldahl, Total	MG/L	NA
Nitrogen, Nitrate	MG/L	NA
Nitrogen, Nitrate-Nitrite	MG/L	NA
Sulfate	MG/L	5.0 U
Ferrous Iron (field)	MG/L	NA
Ferric Iron (lab)	MG/L	NA
Fluoride	MG/L	0.190
Oil & Grease	MG/L	NA
Tentatively Identified Compound		
Chlorotrifluoroethene (FREON-1113)	UG/L	NA

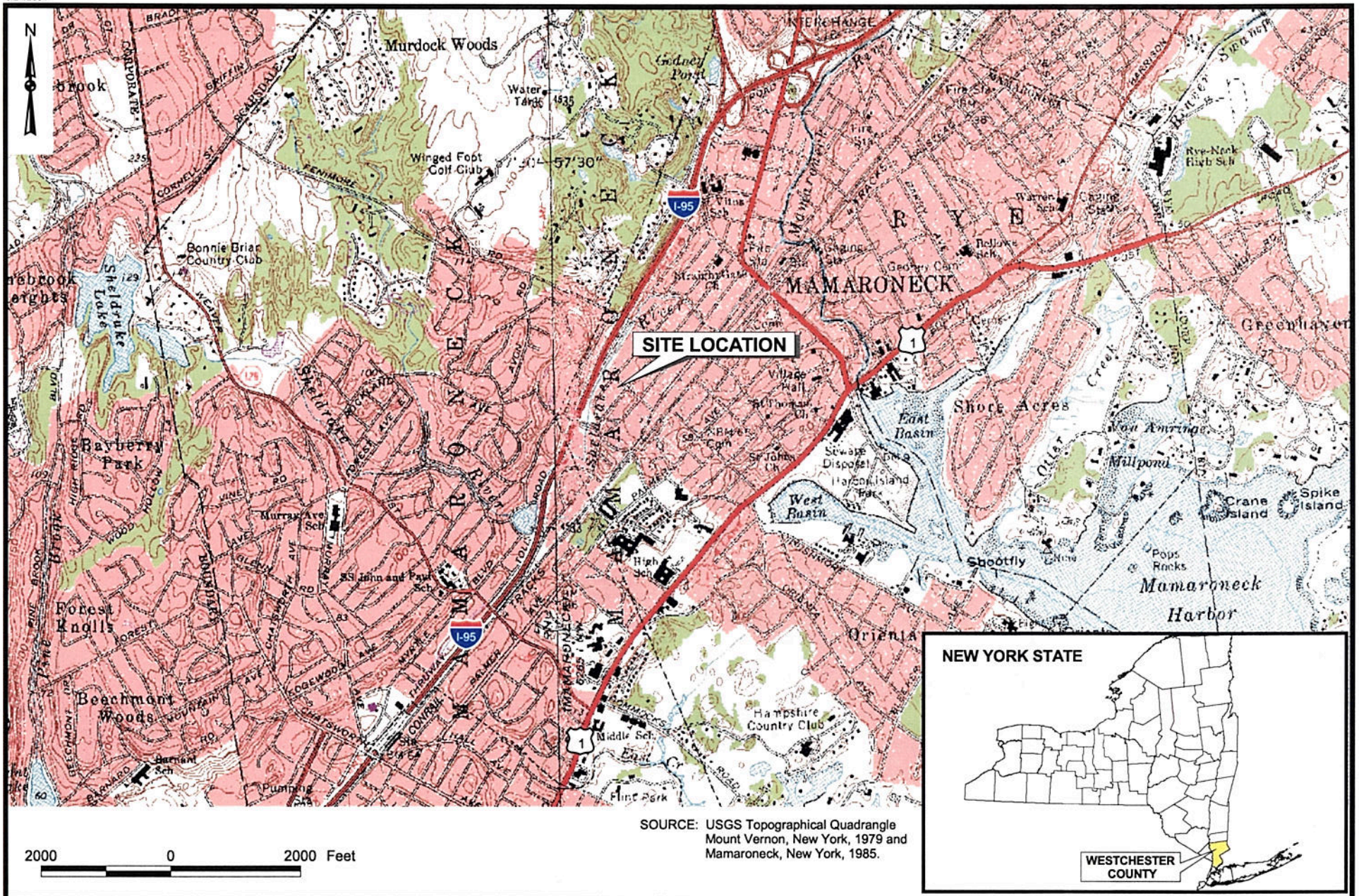
Flags assigned during chemistry validation are shown.

Only Detected Results Reported.

Detection Limits shown are PQL

FIGURES

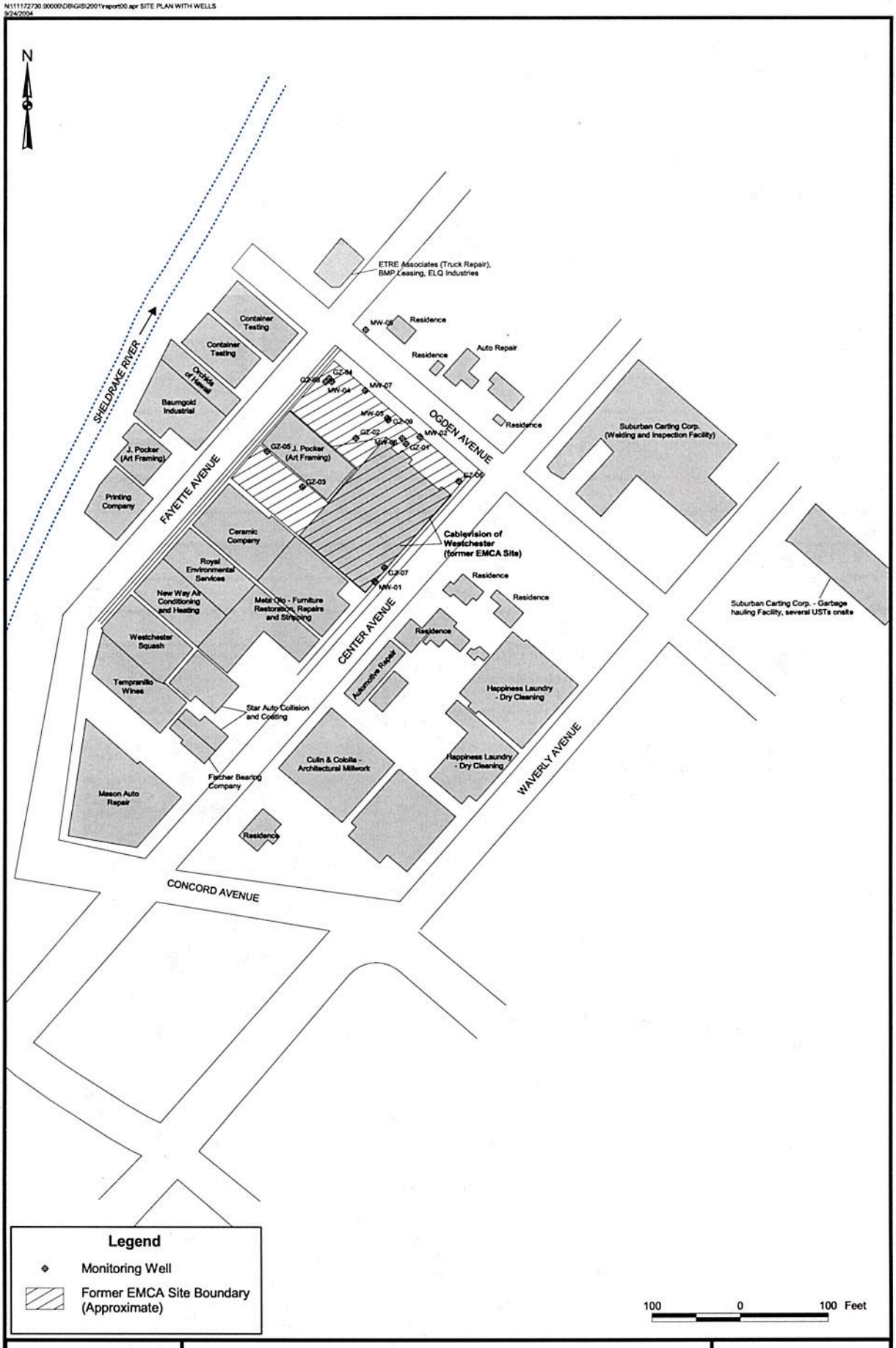
N:\11172730.00000\DB\GIS\2001\report00.apr SITE LOCATION
9/24/2004



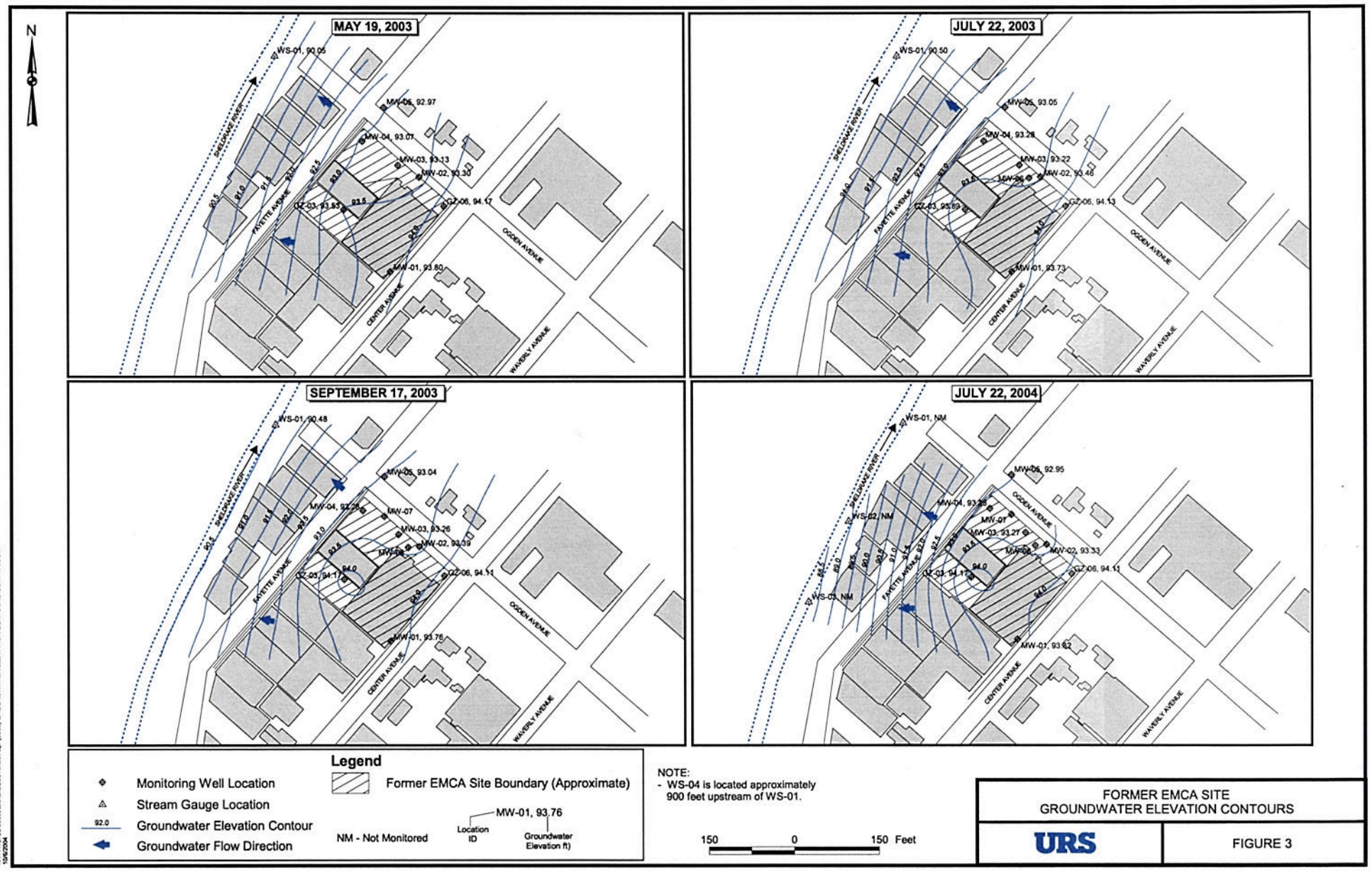
SOURCE: USGS Topographical Quadrangle Mount Vernon, New York, 1979 and Mamaroneck, New York, 1985.

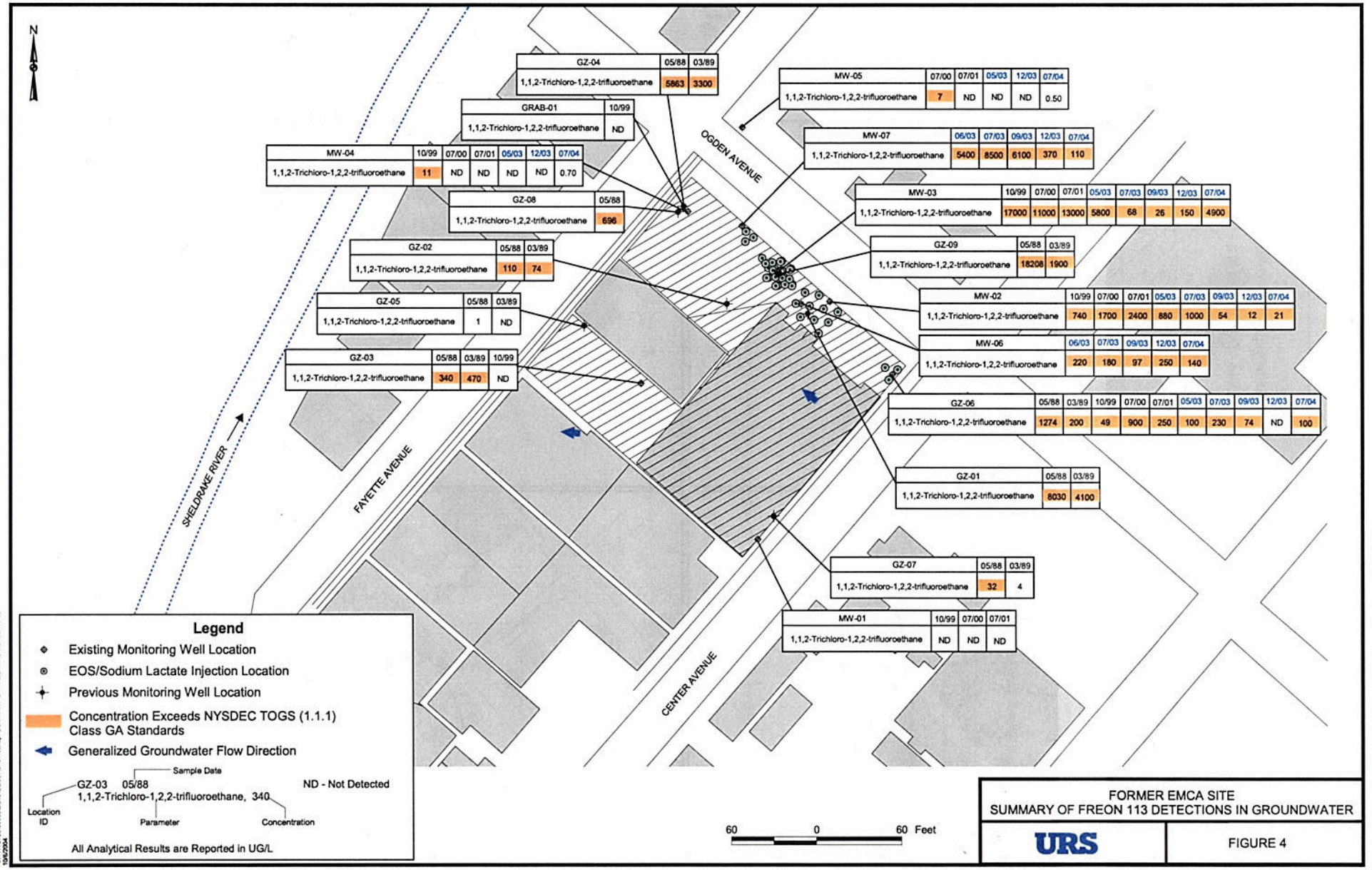
URS	FORMER EMCA SITE LOCATION MAP	FIGURE 1

N:\111172730.00000\DB\GIS\2001\report00.apr SITE PLAN WITH WELLS
9/24/2004



URS	FORMER EMCA SITE SITE PLAN WITH WELLS	FIGURE 2


MAY 19, 2003
WS-01, 90.05
MW-05, 92.97
MW-04, 93.07
MW-03, 93.13
MW-02, 93.30
GZ-06, 94.17
GZ-03, 93.93
MW-01, 93.80
JULY 22, 2003
WS-01, 90.50
MW-05, 93.05
MW-04, 93.28
MW-03, 93.22
MW-02, 93.48
GZ-06, 94.13
GZ-03, 93.89
MW-01, 93.73
SEPTEMBER 17, 2003
WS-01, 90.48
MW-05, 93.04
MW-07
MW-03, 93.26
MW-02, 93.39
GZ-06, 94.11
GZ-03, 94.17
MW-01, 93.76
JULY 22, 2004
WS-01, NM
MW-05, 92.95
MW-04, 93.35
WS-02, NM
MW-07
MW-03, 93.27
MW-02, 93.33
GZ-06, 94.11
GZ-03, 94.17
WS-03, NM
MW-01, 93.82
SHELDRAKE RIVER
FAYETTE AVENUE
CENTER AVENUE
OGDEN AVENUE
WAVERLY AVENUE
N
Legend
Monitoring Well Location
Stream Gauge Location
92.0 Groundwater Elevation Contour
Groundwater Flow Direction
Former EMCA Site Boundary (Approximate)
NM - Not Monitored
MW-01, 93.76
Location ID
Groundwater Elevation ft)
NOTE:
- WS-04 is located approximately 900 feet upstream of WS-01.
150 0 150 Feet
FORMER EMCA SITE
GROUNDWATER ELEVATION CONTOURS
URS
FIGURE 3



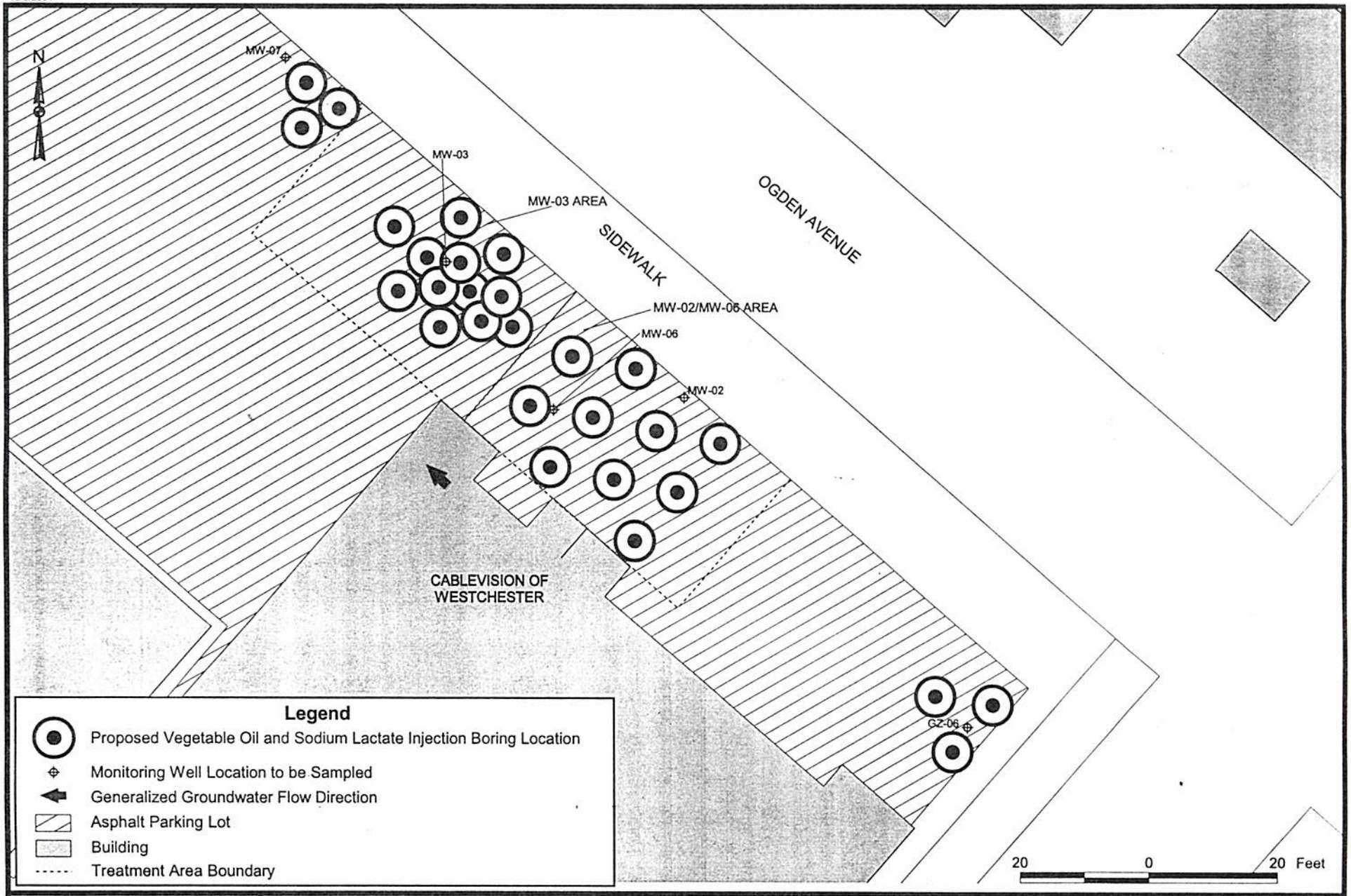
FORMER EMCA SITE
SUMMARY OF FREON 113 DETECTIONS IN GROUNDWATER

URS

FIGURE 4

N:\111727\2\0 000000\GIS\2001\chemical apr SUMMARY OF FREON 113 DETECTIONS 10/5/2004

N:\11172730.00000\DB\GIS\2001\chemical.apr (ZOOM) PROPOSED INJECTION LOCATIONS
10/6/2004



URS

FORMER EMCA SITE
PROPOSED INJECTION LOCATIONS

FIGURE 5

MATERIAL SAFETY DATA SHEET

EMULSIFIED EDIBLE OIL SUBSTRATE

D.O.T. HAZARD CLASSIFICATION: NONE
0

----HMIS----
HEALTH 1
FLAMMABILITY
REACTIVITY 0
PERSONAL PROTECTION B

MANUFACTURER'S NAME

EOS Remediation, Inc
3722 Benson Drive, Suite 101
Raleigh,NC 27609

DATE OF PREPARATION
01-24-03, Rev. 02-16-04

INFORMATION TELEPHONE NO.
919-873-2204

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME	**EOS®CONCENTRATE 1.1**
PRODUCT CLASS	**VEGETABLE OIL BASED EMULSION**
CAS NUMBER	**MIXTURE**

SECTION II - HAZARDOUS INGREDIENTS

COMPONENT(S) EXPOSURE LIMIT

THIS PRODUCT IS A MIXTURE OF EDIBLE FOOD GRADE ADDITIVES AND CONTAINS NO HAZARDOUS INGREDIENTS.

SECTION III - PHYSICAL DATA

BOILING POINT:	**212°F**
SPECIFIC GRAVITY:	**.92**
VAPOR PRESSURE:	**NOT ESTABLISHED**
PERCENT VOLATILE BY VOLUME (%):	**24 (AS WATER)**
VAPOR DENSITY:	**HEAVIER THAN AIR**
EVAPORATION RATE:	**NOT ESTABLISHED**
SOLUBILITY IN WATER:	**SOLUBLE**
APPEARANCE AND ODOR:	**OFF WHITE LIQUID WITH VEGETABLE OIL ODOR**

EMULSIFIED EDIBLE OIL SUBSTRATE

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:	**>300°F**
FLAMMABLE LIMITS:	**NOT ESTABLISHED**
EXTINGUISHING MEDIA:	**CO_2, FOAM, DRY CHEMICAL NOTE: WATER, FOG, AND FOAM MAY CAUSE FROTHING AND SPATTERING.**
UNUSUAL FIRE AND EXPLOSION HAZARDS:	**BURNING WILL CAUSE OXIDES OF CARBON.**
SPECIAL FIRE FIGHTING PROCEDURES:	**WEAR SELF CONTAINED BREATHING APPARATUS AND CHEMICAL RESISTANT CLOTHING. USE WATER SPRAY TO COOL FIRE EXPOSED CONTAINERS.**

SECTION V - PHYSICAL HAZARDS

STABILITY:	**STABLE**
CONDITIONS TO AVOID:	**NONE**
INCOMPATIBILITY:	**STRONG ACIDS AND OXIDIZERS.**
HAZARDOUS DECOMPOSITION PRODUCTS:	**THERMAL DECOMPOSITION MAY PRODUCT OXIDES OF CARBON.**
HAZARDOUS POLYMERIZATION:	**WILL NOT OCCUR**

SECTION VI - HEALTH HAZARDS

SIGNS AND SYMPTOMS OF EXPOSURE:

1. Acute Overexposure - **NONE**
2. Chronic Overexposure - **NONE**

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: **NONE KNOWN**

CHEMICAL LISTED AS CARCINOGEN OR POTENTIAL CARCINOGEN:

N.T.P. - **NO** I.A.R.C. - **NO** OSHA - **NO**

EMERGENCY AND FIRST AID PROCEDURES:

1.) Inhalation-	**REMOVE TO FRESH AIR.**
2.) Eyes-	**FLUSH WITH WATER FOR 15 MINUTES, IF IRRITATION PERSISTS SEE PHYSICIAN.**
3.) Skin-	**WASH WITH MILD SOAP AND WATER.**
4.) Ingestion-	**PRODUCT IS NON-TOXIC. IF NAUSEA OCCURS, INDUCE VOMITING AND SEEK MEDICAL ATTENTION.**

EMULSIFIED EDIBLE OIL SUBSTRATE

SECTION VII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:	**NOT NORMALLY REQUIRED**
VENTILATION:	**LOCAL EXHAUST**
PROTECTIVE GLOVES:	**NOT NORMALLY REQUIRED**
EYE PROTECTION:	**NOT NORMALLY REQUIRED**
OTHER PROTECTIVE CLOTHING OR EQUIPMENT:	**NONE**

SECTION VIII - SPECIAL PRECAUTIONS AND SPILL/LEAK PROCEDURES

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: **DO NOT STORE NEAR EXCESSIVE HEAT OR OXIDIZERS.**

OTHER PRECAUTIONS: **NONE**

STEPS TO BE TAKEN IN CASE MATERIAL IS SPILLED: **SOAK UP WITH DRY ABSORBENT AND FLUSH AREA WITH LARGE AMOUNTS OF WATER.**

WASTE DISPOSAL METHODS: **DISPOSE OF ACCORDING TO FEDERAL, STATE, AND LOCAL REGULATIONS.**

SECTION IX - ADDITIONAL REGULATORY INFORMATION

SARA TITLE III

UNDER THE PROVISIONS OF TITLE 111, SECTION 311/312 OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATIONS ACT, THIS PRODUCT IS CLASSIFIED INTO THE FOLLOWING HAZARD CATEGORIES: **NONE**

THIS PRODUCT DOES **NOT** CONTAIN SECTION 313 REPORTABLE INGREDIENTS.

THE INFORMATION CONTAINED HEREIN IS BASED ON AVAILABLE DATA AND IS BELIEVED TO BE CORRECT. HOWEVER, EOS REMEDIATION, INC. MAKES NO WARRANTY, EXPRESSED OR IMPLIED, REGARDING THE ACCURACY OF THIS DATA OR THE RESULTS TO BE OBTAINED THEREOF. THIS INFORMATION AND PRODUCT ARE FURNISHED ON THE CONDITION THAT THE PERSON RECEIVING THEM SHALL MAKE HIS/HER OWN DETERMINATION AS TO THE SUITABILITY OF THE PRODUCT FOR HIS/HER PARTICULAR PURPOSE.

EOS™ Storage, Material Handling and Injection

EOS™ Concentrate

EOS™ is prepared from a food-grade, concentrated, emulsified oil (but not intended for human consumption) that should be stored at temperatures between 40 degrees and 90 degrees Fahrenheit. Colder temperatures may slightly increase viscosity of the concentrate and require increased pumping effort to transfer the material from the container. EOS™ should be protected from freezing temperatures wherever possible, since freezing can potentially result in product separation.

Containers

EOS™ can be furnished and shipped in DOT-approved 55-gallon drums (weighing approximately 420 lbs.), 290-gallon totes (~ 2,220lbs), or 350-gallon (~2990 lbs) IBC tanks. DOT-approved 55-gallon drums with opening in the lid are the most commonly used containers. Totes have a bottom discharge valve that can be used to gravity drain or can be emptied with a small transfer pump. Totes are supported by heavy cardboard that requires inside storage and protection from puncture. IBC tanks consist of a polyethylene tank within a wire cage. IBC tanks can be stored outside and have both top and bottom discharge ports.

Water

The EOS™ concentrate is diluted with water prior to injection. A diluted mixture of 20% concentrate to 80% water is a typical injection blend. Once the blend is injected into the subsurface, it is chased with water to spread the emulsion into the aquifer. A suitable quantity of water must be identified at your project site. Natural site groundwater is usually the best source because it is available and recirculated in the aquifer. However, the aquifer must yield a sufficient volume to be extracted in a relatively short period and regulatory approval may be required for re-injecting potentially contaminated groundwater. Potable water can be used to prepare and chase the emulsion, however, pretreatment of the water with granular activated carbon (GAC) or air sparging to remove residual chlorinated disinfection byproducts and other contaminants may be required.

Handling, Mixing and Blending EOS™ Concentrate

To overcome minor settling that may occur due to prolonged storage or cold weather, remixing of the EOS™ concentrate is recommended before dilution. If drums or IBCs are used, a drum mixer can be inserted through the bung or top port to easily redistribute the concentrate. If totes are used, resuspension can be facilitated in a second mixing tank or series of drums.

EOS™ concentrate should be blended with water on site in the recommended ratio immediately prior to use. A drum pump, gravity or other centrifugal pump can be used to transfer the concentrate from the container to a final injectable-emulsion mixing vessel such as another drum, polyethylene tanks and stock watering tanks. Using a dilution proportion of 1:4, each 55-gallon drum of EOS™ concentrate provides a final mix volume of 275 gallons. When the EOS™ concentrate is supplied in totes or IBC tanks, a water meter can be used to measure the volume of EOS™ concentrate added to the tank.

Direct Push Points vs. Wells

The diluted emulsion is injected into the aquifer with a pump and hoses attached either to a well, series of wells or direct push points. Each project site must be evaluated to determine the most cost-effective injection method. EOS™ has been successfully injected through both wells and direct push borings.

Injection wells can be installed using conventional drilling equipment or direct push equipment. The top of the well screen should not extend into the unsaturated portion of the aquifer. In situations where the water table is close to the ground surface, the top of the well screen should be maintained at least 5 feet below grade. Extremely long screen lengths are not recommended, since there would be an uneven application of emulsion throughout the aquifer thickness. In situations where the emulsion is to be applied over a significant vertical distance, a series of shallow and deep injection wells should be considered. An adequate seal between the well casing and the borehole is absolutely necessary.

EOS™ can also be injected directly via direct push equipment. The emulsion can be injected through the drilling rods as the drill string is withdrawn. The process continues until the end of the bottom rod is at the top of the injection zone. The rods should then be left at this position while the chase water is injected to move the emulsion outward in the formation. The rods should be removed at the end of the water chase.

Equipment Setup for Injection

EOS™ emulsion is typically injected using low pressure pumping equipment. Either connect a single hose from the supply pump to a manifold connecting all of the injection wells or supply the injection points in a daisy chain manner with a discharge hose extending from the pump to the first injection well first back to the dilution tank. Valves on each manifold serve to balance out flow rates.

Water Chase

After the required amount of EOS™ has been injected into the aquifer, additional chase water will disperse the emulsion into the aquifer. The chase water can be added to the dilution tank after the emulsion has been pumped out with no changes in the equipment setup. In some cases, the water chase can be applied using water line pressure and no pump. Water should be applied until the calculated volume has been injected and then the valve on the wellhead or manifold is closed.

EOS Remediation, Inc.
3722 Benson Drive
Raleigh, NC 27609
(919) 873-2205 • Fax (919) 873-1074
www.eosremediation.com

WILCLEAR™

Sodium Lactate

For Bioremediation Applications

Description

JRW Technologies' WILCLEAR™ Sodium Lactate for bioremediation is a clear, slightly viscous liquid that is 60% solids by weight in USP purified water. WILCLEAR™ Sodium Lactate provides the lowest metals content, as measured by a nationally recognized analytical laboratory, of any sodium lactate available and exceeds US Pharmacopoeia standards. It is the only sodium lactate that meets all primary MCL's (maximum contaminant levels) for drinking water in a 60% form, thus minimizing concern for underground injection.

Specifications

	Specification	Typical
Sodium Lactate, % by wt.	60 ± 1.2	60 ± 0.5
H_2O	40 ± 1.2	40 ± 0.5
pH	7.0 ± 0.5	6.8 - 7.2
Color, APHA	25 max.	10
Iron, ppm	2 max	<5
Specific Gravity	1.3100-1.3400	
Citrate, Oxalate, Phosphate, Tartrate	none detected	
Sulfate	none detected	
Sugars	none detected	
Sodium, %	12.3 ± 0.2	
Odor	Practically odorless	

Applications

WILCLEAR™ Sodium Lactate is used to enhance the microbial activity in situ for biodegradation and reduction of chlorinated solvents. Technical support for bioremediation applications is provided through an exclusive agreement with SRP Technologies, developers of Bioavailability Enhancement Technology (B.E.T.™), patent pending).

Packaging

55 gallon (600 lbs. Net) Polyethylene Drums; 2.850 lb IBC's

Storage

Store unopened under dry conditions at ambient temperatures.

5/01

WILCLEAR™ LACTATE SOLUTIONS

WILCLEAR™ has lowest MCL (Maximum Contaminant Levels)

TAL metals analytical results:

		Allowable Injected Concentration:	Stated in TOS 1214 R1.	JRW Unfiltered sample results, ug/L	JRW Filtered sample results, ug/L
TAL Metal	SDWA MCL's ug/L	10 x MCL's	RDLs, ug/L	27404C-1 27404C-3 27404C-5	27404C - 3 27404C - 5 27404C - 6
Al	NA	NA	200	2110 2180 2230	2140 1690 B 1950 B
Sb	6	60	6	6 U 6 U 6 U	6 U 6 U 6 U
As	50	500	50	50 U 50 U 50 U	50 U 50 U 50 U
Ba	2000	20,000	100	50 U 50 U 57.6 B	50 U 57.1 B 51.1 B
Be	4	40	4	3 U 3 U 3 U	3 U 3 U 3 U
Cd	5	50	5	3 U 3 U 3 U	3 U 3 U 3 U
Ca	NA	NA	200	327 B 279 B 317 B	263 B 687 B 322 B
Cr	100	1000	100	52 B 65.3 B 50 U	70.5 B 61.6 B 50 U
Co	NA	NA	110	50 U 50 U 50 U	50 U 50 U 50 U
Cu	1300	13,000	80	50 U	62.9 B

				63.1 B 59.6 B	50 U 23.9 B 50 U
Fe	NA	NA	1000	850 B 1290 B 776 B	1140 B 1060 B 800 B
Pb	15, 0	150	15	3 U 5.6 B 3 U	3 U 3 U 3.6 B
Mg	NA	NA	200	282 B 266 B 260 B	200 U 407 B 306 B
Mn	NA	NA	40	40 U 40 U 40 U	40 U 40 U 40 U
Hg	2	20	2	2 U 2 U 2 U	2 U 2 U 2 U
Ni	NA	NA	100	62.8 B 69.3 B 67.9 B	64.8 B 76.7 B 66.5 B
K	NA	NA	1000	1000 U 10900 11800	11500 16200 13800
Se	50	500	50	30 U 30 U 30 U	30 U 30 U 30 U
Ag	NA	NA	10	5 U 5 U 5 U	5 U 5 U 5 U
Na	NA	NA	1000	154000000 148000000 150000000	153000000 149000000 148000000
Th	2 , 0.5	20	2	1.8 U 1.8 U 1.8 U	1.8 U 1.8 U 1.8 U
V	NA	NA	100	50 U 50 U 50 U	50 U 50 U 50 U
Zn	NA	NA	100	74.6 B 67.7 B 87.5 B	71.2 B 106 B 82.5 B

U = Analyte was analyzed for but not detected.
B = Value is less than the CRDL but greater than the IDL.
CRDL = Contract Required Detection Limit
IDL = Instrument Detection Limit
SDWA = Safe Drinking Water Act
TAL = Total Analyte List
MCL's = Maximum Contaminant Levels

Cu 1300 13,000 80 50 U

WILCLEAR

REPORT (1)

MSDS#: 955 Status: Current
Status Date: 08/03/2001
Product Name: SODIUM LACTATE 60% SOLUTION, U.S.P.

Current Company Information:
FERRO PFANSTIEHL LABORATORIES, INC.
1219 Glen Rock Avenue
Waukegan, IL 60085
Phone: 847-623-0370 Fax: 847-623-9173 Emergency: 847-623-0370
Current Company Short Name:

Manufacturer:
PFANSTIEHL LABORATORIES, INC.
1219 Glen Rock Avenue
Waukegan, IL 600850439
Phone: 847-623-0370 Emergency: 847-623-0370

Supplier:
JRW Technologies, INC.
14321 W. 96TH TERRACE
LENEXA, KS 66215.
Fax: 913-438-5554 Emergency: 913-438-5544

MSDS Prepared: 12/07/1994
MSDS Revised: 08/03/2001
Formula: CH3-CHOH-COONa
Keyword: ORGANIC ACID SALT
Stock Item(s):
S-110-2

****

Physical/Chemical Characteristics

Boiling Point: EQ 105 °C
Specific Gravity: EQ 1.323 H2O=1 @ 20 deg. C
Vapor Density: Air=1 NA
Evaporation Rate: NA
Melt/Freeze Point: NA
pH: BT 6.5 7.5
% Volatile: NA
Vapor Pressure: NA
Pour Point: NA
Viscosity: Cst NA
Molecular Weight: EQ 112.07
Solubility In Water: SOLUBLE
Appearance/Odor: CLEAR AND COLORLESS LIQUID, ODORLESS
Physical State: Liquid

****

FIRE AND EXPLOSION DATA:

Closed Cup Flash Pt.: NA
Open Cup Flash Point: NA
Auto Ignition: NA
Fire Point: NA
LEL/LFL: NA
UEL/UFL: NA

****

DOT INFORMATION:

DOT hazard Class: NA
Label: NA

Proper Shipping Name: SODIUM LACTATE 60%

Preparers Info.: GREGORY A. KOLAR TITLE: DIRECTOR
SAFETY/ENVIRONMENTAL

****

COMPOSITION/INFORMATION ON INGREDIENTS

Component Name: SODIUM LACTATE
Product: Yes Percent: EQ 60
CAS No.: 72-17-3
Exposure Limits
Limit Note: OSHA PPM: NA \ ACGIH PPM: NA \ OSHA STEL PPM: NA

Component Name: WATER
Percent: EQ 40
CAS No.: 7732-18-5
Exposure Limits
Limit Note: OSHA PPM: NA \ ACGIH PPM: NA \ OSHA STEL PPM: NA

****

HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components (optional) [Specific Chemical Identity: Common Name(s)]	OSHA PEL	ACGIH TLV	Other Limits	% Recommended
None				

****

FIRE AND EXPLOSION HAZARD DATA

Flash Point: NA Flammable Limits: NA LEL: NA UEL: NA
Extinguishing Media: Water, Carbon Dioxide or Dry Chemical.
Special Fire Fighting Procedures: Wear self-contained breathing apparatus.
Unusual Fire and Explosion Hazards: Fire may produce irritating or toxic fumes.

****

REACTIVITY DATA

Stability: Stable. Conditions to Avoid: NA
Incompatibility (Materials to Avoid): NA
Hazardous Decomposition or Byproducts: NA
Hazardous Polymerization: Will not occur.

****

HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? NA Ingestion? Yes

REPORT (1)

Health Hazards (Acute and Chronic): No specific data. Low order of toxicity. The chemical, physical, and toxicological properties have not been thoroughly investigated.
Carcinogenicity: NTP? NA IARC Monographs? NA OSHA Regulated? NA
TSCA Registered? Yes
Signs and symptoms of Exposure: NA
Medical Conditions Generally Aggravated by Exposure: NA
Emergency and First Aid Procedures:
SKIN:
In case of contact with skin, immediately wash with soap and water while removing contaminated clothing.
EYE:
In case of contact with eyes, immediately flush eyes with water for at least 15 minutes, lifting eyelids during flushing to facilitate irrigation. Get medical attention if necessary.
INHALATION:
If inhaled, remove person from contaminated atmosphere to fresh air
INGESTION:
If swallowed, get medical attention.

****

PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to Be Taken in Case Material is Released or Spilled: Contain spill and place material in drum for disposal. Dispose of according to all local, state and federal regulations at an approved waste treatment facility.
Precautions to Be Taken in Handling and Storing: Store in cool, dry area to preserve product quality.
Other Precautions: NA

****

CONTROL MEASURES/PERSONAL PROTECTIVE EQUIPMENT

Respiratory Protection (Specify Type): None.
Ventilation: General Ventilation: Is recommended.
Local Exhaust: Is recommended.
Other: NA
Protective Gloves: Are recommended.
Eye Protection: Is recommended.
Other Protective Clothing or Equipment: NA
Work/Hygienic Practices: NA

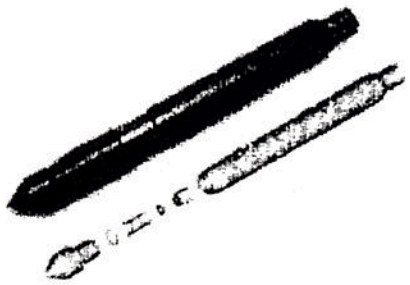
END OF REPORT.

Geoprobe® News

Spring 2002 Newsletter
Request printed version

Pressure-Activated Injection Probe

The **Pressure-Activated Injection Probe (18735)** allows for either top-down or bottom-up injection of remediation materials when using any Geoprobe grout or injection machine. Unlike conventional injection methods, the Pressure-Activated Injection Probe ensures accurate placement of the material into the intended injection interval. The probe also acts as a backflow preventer, keeping injection material IN the ground and not ON the ground! The unique internal spool design of this probe insures that the injection ports do not clog with soil.



[Home] [Up] [2002 ASTM Standards Available] [Model 6610DT Probing Machine]
[Low-Flow Sampling with Pneumatic Bladder Pump] [Groundwater Sampling: Turbidity vs. Low Flow]
[Seismic Cone Penetration Testing Equipment] [Dual Tube 21 Liner Grooving Tool]
[Pressure-Activated Injection Probe] [Service Kit for Geoprobe Machines] [Polyethylene Grout Plugs]
[Tom Christy travels to Congo, Africa] [Science Camp]

Geoprobe® News

Spring 2002 Newsletter
Request printed version

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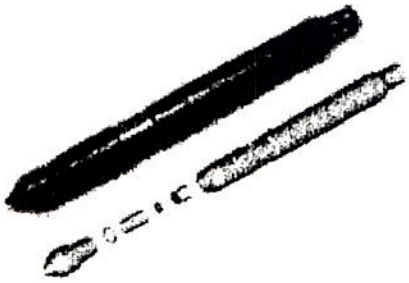

[Home] [Up] [2002 ASTM Standards Available] [Model 6610DT Probing Machine]
[Low-Flow Sampling with Pneumatic Bladder Pump] [Groundwater Sampling: Turbidity vs. Low Flow]
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[Pressure-Activated Injection Probe] [Service Kit for Geoprobe Machines] [Polyethylene Grout Plugs]
[Tom Christy travels to Congo, Africa] [Science Camp]

Website last revised:
June 14, 2002

APPENDIX B

CALCULATION

1.0 Purpose

This calculation estimates the amount of sodium lactate and emulsified oil to inject in a groundwater plume containing Freon at the Rohm and Haas former EMCA Site in Mamaroneck, New York. The substrates will be injected as an Interim Remedial Measure to enhance intrinsic bioremediation of the Freon plume.

2.0 Data & Assumptions

- The target compounds are Freon 113, Freon 123a, and Freon 1113 in groundwater at concentrations that are listed in Table 2 of the IRM Work Plan for 7/22/04 and 7/23/04.

- The maximum depth of contamination (GZ-08, 5/88) is 25 ft bgs (Ref. 1).

- Groundwater occurs under water table conditions and the water table surface is approximately 5 ft. below ground surface as listed in Table 1 of the IRM Work Plan.

- Saturated soil consists of fine to coarse sand with trace to some silt. Assume total porosity (η) = 0.4 (Ref. 2), soil bulk density of 110 lb/ft^3, and organic carbon content (f_{oc}) of 1%.

- Remediation will occur within four distinct areas that are noted below and shown on Figure 5 of the IRM Work Plan:

    1. An area centered on well MW-03 (MW-03 area).
    2. An area that encompasses wells MW-02 and MW-06 (MW-02/MW-06 area).
    3. An area that surrounds well GZ-06 (GZ-06 area).
    4. An area between well MW-03 and well MW-07.

- Sodium lactate will be applied to the MW-03 area using 12 injection points that are spaced at distances of 5 ft (interior area A_1) and 10 ft (exterior area A_2) see Page 3 of 18. The sodium lactate will be diluted with water at a ratio of 10:1 (vol: vol).

- Emulsified soybean oil will be applied to the MW/02MW-06 area using 10 equally spaced injection points within an area of approximately 30 ft by 44 ft, see Page 6 of 18.

- Sodium lactate will be applied to the MW-02/MW-06 using the 10 equally spaced injection points installed for the emulsified soybean oil, see Page 6 of 18. The sodium lactate will be mixed with water at a ratio of 50 gal. water to 3 gal. sodium lactate and injected into each point immediately after the emulsified oil is applied.

- Sodium lactate will be applied to an area that surrounds well GZ-06 using 3 equally spaced injection points 10 feet apart, see Page 10 of 18. The sodium lactate will be diluted with water at a ratio of 10:1 (vol: vol).

- Sodium lactate will be applied to an area between MW-03 and MW-07 using 3 equally spaced injection points 7.5 feet apart, see Page 11 of 18. The sodium lactate will be diluted with water at a ratio of 10:1 (vol: vol).

- The following commercially prepared products will be used:

    1. WILCLEAR^{TM} Sodium Lactate manufactured by JRW Technologies, Inc.

    2. Edible Oil Substrate (EOS^{TM}) manufactured by EOS Remediation, Inc.

4.0 Calculations

3.1 Sodium Lactate Application Quantities

The approximate amount of sodium lactate required is calculated on Page 4 of 18 (MW-03 interior area), Page 5 of 18 (MW-03 exterior area), Page 7 of 18 (MW-02/MW-06 area), Page 11 of 18 (GZ-06 area), Page 13 of 18 (MW-07 area) and summarized below.

MW-03 Area (interior) ≅ 260lbs (260 gals dilute solution)

MW-03 Area (exterior) ≅ 1,615 lbs (1,606 gals dilute solution)

MW-02/MW-06 Area ≅ 325lbs (515 gals dilute solution)

GZ-06 Area ≅ 335 lbs (333 gals dilute solution)

MW-07 Area ≅ 465 lbs (460 gals dilute solution)

3.2 Emulsified Oil Application Quantities

The amount of EOS™ required for the MW-02/MW-06 area is calculated using software prepared by EOS Remediation, Inc. and summarized below.

- Emulsified Edible Oil Barrier Design Software (Beta Version 1.3), see Page 8 of 18.
- Emulsified Edible Oil Residual Saturation Software, see Page 9 of 18.

MW-02, MW-03, MW-06 Area ≅ 1,688lbs (1,100 gals dilute solution)

URS

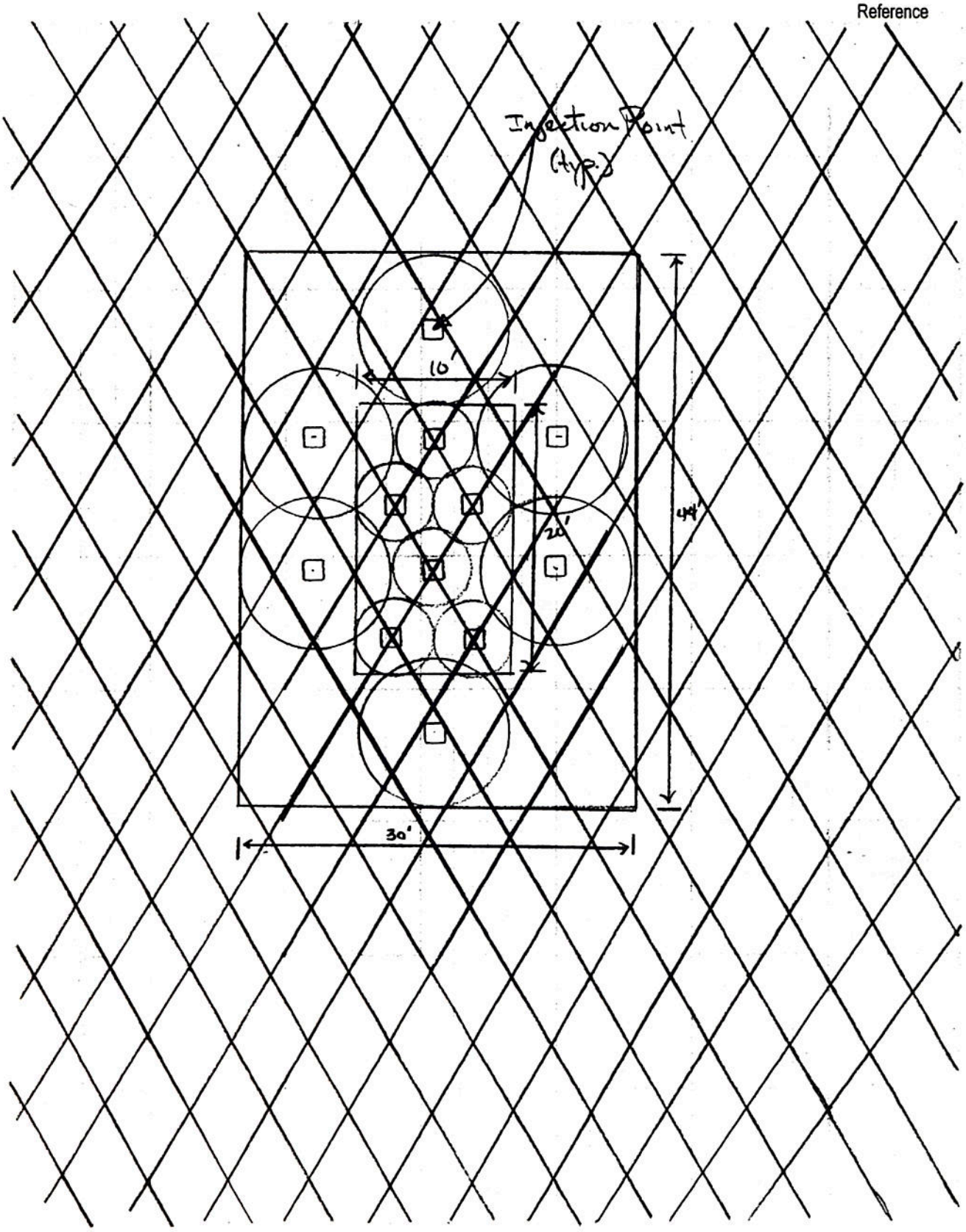
Page 3 of 18

Job ROHM & HAAS - FORMER EMCA Project No. 11173570.00000 Sheet ___ of ___

Description INJECTION POINT LAYOUT Computed by JRS Date 9/20/04

MW-03 AREA Checked by MP Date 9/27/04

Reference



Sodium Lactate Design for Plume Area/Grid Treatment

Site Name: Rohm & Haas Former EMCA Site
Location: Mamaroneck, New York

MW03 Area - Interior

Sodium Lactate ($C_3H_5NaO_3$) — Ref.

Pure H_2 Yield	22.4 lb pure Sodium Lactate/lb H	
Sodium Lactate % (by weight)	60	WILCLEAR™ Sodium Lactate
Capacity to supply H_2	37.3 lb Sodium Lactate solution/lb H	
Density of Sodium Lactate	11.05 lb/gal	WILCLEAR™ Sodium Lactate

Site Conceptual Model

Width of Treatment Area	10 ft	} 200 ft²
Length of Treatment Area	20 ft	
Depth to Water Table	5 ft	
Thickness of Contaminated Zone	20 ft	
Aquifer Material	sand	
Porosity	0.4	
Treatment Zone Pore Volume	1,600 ft³	11,970 gal.

Dissolved Phase Electron Donor Demand

	Contaminant Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) contam/H_2	H_2 Req (lb)
cis-1,2-dichloroethene (DCE)	0.0000	0.0	24.2	0.0000
Vinyl Chloride (VC)	0.0000	0.0	31.2	0.0000
Carbon tetrachloride	0.0000	0.0	19.2	0.0000
Chloroform	0.0000	0.0	19.9	0.0000
Freon 113	4.9000	0.5	31.2	0.0157
Freon 123a	3.9000	0.4	38.0	0.0103
Freon 1113	0.0680	0.01	52.5	0.0001

Well MW-03 (7/04) ↓

Sorbed Phase Electron Donor Demand

Soil bulk density	110	lb/cf
Fraction of organic carbon: foc	0.01	range: 0.0001 to 0.01

	Koc (L/kg)	Contaminant Conc (mg/kg)	Mass (lb)	Stoich. (wt/wt) contam/H_2	H_2 Req. (lb)
cis-1,2-dichloroethene (DCE)	80	0.0000	0.00	24.2	0.0000
Vinyl Chloride (VC)	2.5	0.0000	0.00	31.2	0.0000
Carbon tetrachloride	110	0.0000	0.00	19.2	0.0000
Chloroform	34	0.0000	0.00	19.9	0.0000
Freon 113	372	18.2280	8.02	31.2	0.2568
Freon 123a		0.0000	0.00	38.0	0.0000
Freon 1113		0.0000	0.00	52.5	0.0000

Competing Electron Acceptors

	Electron Acceptor Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) elec. acceptor/H_2	H_2 Req. (lb)
Oxygen	1.00	0.10	8.0	0.01
Nitrate	1.15	0.11	12.4	0.01
Est. Mn reduction demand (potential amt. of Mn+2 formed)	1.00	0.10	27.5	0.00
Est. Fe reduction demand (potential amt. of Fe+2 formed)	20.00	2.00	55.9	0.04
Estimated sulfate reduction demand	30.00	3.00	12.0	0.25

Microbial Demand Factor	4	
Safety Factor (SF)	4	

Mass Requirements

	H_2 (lb)	Sodium Lactate (lb)	(gal)	
Dissolved Phase Contamination	0.0	1.0	0.1	
Adsorbed Phase Contamination	0.3	9.6	0.9	
Competing Electron Acceptors	0.3	11.6	1.1	
Competing Microbial Processes	1.1	42.2	3.8	
Subtotal	1.7	64.4	5.8	
Total (with SF)		257.6	23.3	concentrated solution

Dose Requirements

No. Injection Points	6		
Injection Interval	20 ft.		
Sodium Lactate Required	42.9 lbs/hole 3.9 gal/hole	2.1 lbs/ft. 0.2 gal/ft	
Water/Sodium Lactate Dilution (vol/vol)	10 :1		
Dilute Sodium Lactate Required	42.7 gal/hole	2.1 gal/ft	256.5 gal. dilute solution
Injection Point Spacing	5 ft.		
Injection Point Pore Vol.	157 ft³	1,175 gal	
Sodium Lactate/Pore Vol. Ratio	3.64 %		
Injection Distance (from borehole)	0.48 ft (radius)	0.95 ft (diameter)	

Sodium Lactate Design for Plume Area/Grid Treatment

Site Name: Rohm & Haas Former EMCA Site
Location: Mamaroneck, New York

MW03 Area - Exterior

Sodium Lactate ($C_3H_5NaO_3$) — Ref.

Pure H_2 Yield	22.4 lb pure Sodium Lactate/lb H	
Sodium Lactate % (by weight)	60	WILCLEAR™ Sodium Lactate
Capacity to supply H_2	37.3 lb Sodium Lactate solution/lb H	
Density of Sodium Lactate	11.05 lb/gal	WILCLEAR™ Sodium Lactate

Site Conceptual Model

Width of Treatment Area	44.0 ft	Note: Area excludes A_1 (200 ft²)
Length of Treatment Area	33.0 ft	1452 ft²
Depth to Water Table	5 ft	
Thickness of Contaminated Zone	20 ft	
Aquifer Material	sand	
Porosity	0.4	
Treatment Zone Pore Volume	10,016 ft³	74,930 gal.

Dissolved Phase Electron Donor Demand

	Contaminant Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) contaminant/H_2	H_2 Req (lb)	
cis-1,2-dichloroethene (DCE)	0.0000	0.0	24.2	0.0000	
Vinyl Chloride (VC)	0.0000	0.0	31.2	0.0000	
Carbon tetrachloride	0.0000	0.0	19.2	0.0000	
Chloroform	0.0000	0.0	19.9	0.0000	
Freon 113	4.9000	3.1	31.2	0.0981	Well MW-03 (7/04)
Freon 123a	3.9000	2.4	38.0	0.0642	
Freon 1113	0.0680	0.04	52.5	0.0008	

Sorbed Phase Electron Donor Demand

Soil bulk density	110	lb/cf
Fraction of organic carbon: foc	0.01	range: 0.0001 to 0.01

	Koc (L/kg)	Contaminant Conc (mg/kg)	Mass (lb)	Stoich. (wt/wt) contaminant/H_2	H_2 Req. (lb)
cis-1,2-dichloroethene (DCE)	80	0.0000	0.00	24.2	0.0000
Vinyl Chloride (VC)	2.5	0.0000	0.00	31.2	0.0000
Carbon tetrachloride	110	0.0000	0.00	19.2	0.0000
Chloroform	34	0.0000	0.00	19.9	0.0000
Freon 113	372	18.2280	50.21	31.2	1.6077
Freon 123a		0.0000	0.00	38.0	0.0000
Freon 1113		0.0000	0.00	52.5	0.0000

Competing Electron Acceptors

	Electron Acceptor Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) elec. acceptor/H_2	H_2 Req. (lb)
Oxygen	1.00	0.63	8.0	0.08
Nitrate	1.15	0.72	12.4	0.06
Est. Mn reduction demand (potential amt. of Mn+2 formed)	1.00	0.63	27.5	0.02
Est. Fe reduction demand (potential amt. of Fe+2 formed)	20.00	12.51	55.9	0.22
Estimated sulfate reduction demand	30.00	18.76	12.0	1.56

Microbial Demand Factor	4	
Safety Factor (SF)	4	

Mass Requirements

	H_2 (lb)	Sodium Lactate (lb)	(gal)	
Dissolved Phase Contamination	0.2	6.1	0.6	
Adsorbed Phase Contamination	1.6	60.0	5.4	
Competing Electron Acceptors	1.9	72.7	6.6	
Competing Microbial Processes	7.1	264.4	23.9	
Subtotal	10.8	403.2	36.5	
Total (with SF)		1612.9	**146.0**	concentrated solution

Dose Requirements

No. Injection Points	6		
Injection Interval	20 ft.		
Sodium Lactate Required	268.8 lbs/hole 24.3 gal/hole	13.4 lbs/ft. 1.2 gal/ft	
Water/Sodium Lactate Dilution (vol/vol)	10 :1		
Dilute Sodium Lactate Required	267.6 gal/hole	13.4 gal/ft	**1605.6** gal. dilute solution
Injection Point Spacing	10 ft.		
Injection Point Pore Vol.	628 ft³	4,700 gal	
Sodium Lactate/Pore Vol. Ratio	5.69 %		
Injection Distance (from borehole)	1.19 ft (radius)	2.39 ft (diameter)	

URS

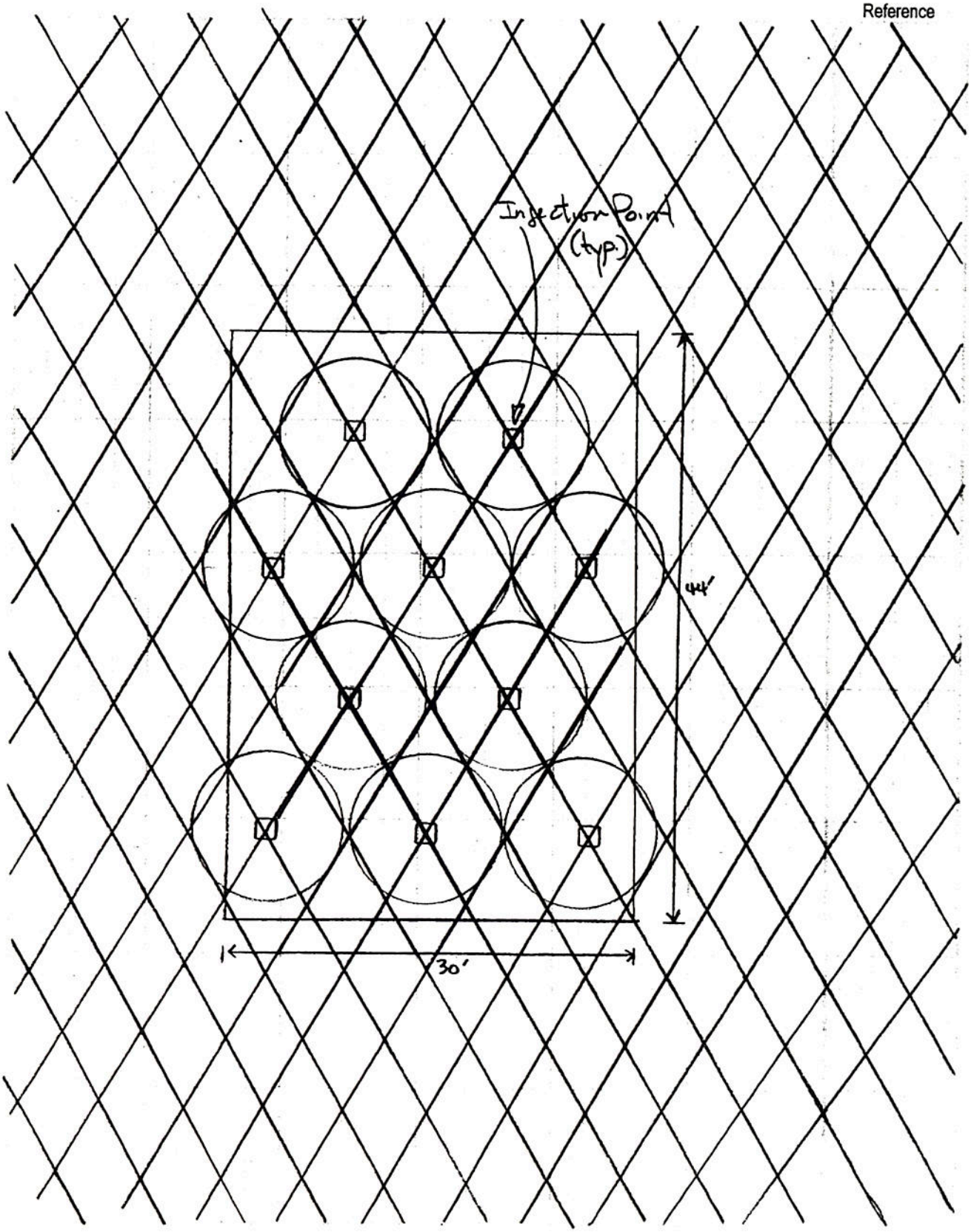
Page 6 of 18

Job ROHM & HAAS - FORMER EMCA | Project No. 11173570.00000 | Sheet ____ of ____

Description INJECTION POINT LAYOUT MW-02/MW-06 AREA | Computed by JRS | Date 9/20/04

Checked by MO | Date 9/27/04

Reference



Sodium Lactate Design for Plume Area/Grid Treatment

Site Name: Rohm & Haas Former EMCA Site

Location: Mamaroneck, New York

MW02/MW06 Area

Sodium Lactate ($C_3H_5NaO_3$) — Ref.

Pure H Yield	22.4 lb pure Sodium Lactate/lb H	
Sodium Lactate % (by weight)	60	WILCLEAR™ Sodium Lactate
Capacity to supply H	37.3 lb Sodium Lactate solution/lb H	
Density of Sodium Lactate	11.05 lb/gal	WILCLEAR™ Sodium Lactate

Site Conceptual Model

Width of Treatment Area	30.0 ft	
Length of Treatment Area	44.0 ft	
Depth to Water Table	5 ft	
Thickness of Contaminated Zone	20 ft	
Aquifer Material	sand	
Porosity	0.4	
Treatment Zone Pore Volume	10,560 ft^3	78,999 gal.

Dissolved Phase Electron Donor Demand

	Contaminant Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) contaminant/H_2	H_2 Req (lb)	
cis-1,2-dichloroethene (DCE)	0.0000	0.0	24.2	0.0000	
Vinyl Chloride (VC)	0.0000	0.0	31.2	0.0000	
Carbon tetrachloride	0.0000	0.0	19.2	0.0000	
Chloroform	0.0000	0.0	19.9	0.0000	
Freon 113	0.0805	0.1	31.2	0.0017	Avg. of wells MW-02
Freon 123a	0.0135	0.0	38.0	0.0002	& MW-06 (7/04)
Freon 1113	0.0095	0.01	52.5	0.0001	

Sorbed Phase Electron Donor Demand

Soil bulk density	110	lb/cf
Fraction of organic carbon: foc	0.01	range: 0.0001 to 0.01

	Koc (L/kg)	Contaminant Conc (mg/kg)	Mass (lb)	Stoich. (wt/wt) contaminant/H_2	H_2 Req. (lb)
cis-1,2-dichloroethene (DCE)	80	0.0000	0.00	24.2	0.0000
Vinyl Chloride (VC)	2.5	0.0000	0.00	31.2	0.0000
Carbon tetrachloride	110	0.0000	0.00	19.2	0.0000
Chloroform	34	0.0000	0.00	19.9	0.0000
Freon 113	372	0.2995	0.87	31.2	0.0278
Freon 123a		0.0000	0.00	38.0	0.0000
Freon 1113		0.0000	0.00	52.5	0.0000

Competing Electron Acceptors

	Electron Acceptor Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) elec. acceptor/H_2	H_2 Req. (lb)
Oxygen	1.00	0.66	8.0	0.08
Nitrate	1.15	0.76	12.4	0.06
Est. Mn reduction demand (potential amt. of Mn+2 formed)	1.60	1.06	27.5	0.04
Est. Fe reduction demand (potential amt. of Fe+2 formed)	38	25.06	55.9	0.45
Estimated sulfate reduction demand	25	16.48	12.0	1.37

Microbial Demand Factor	4	(chose 1X-4X)
Safety Factor (SF)	4	(chose 1X-4X)

Mass Requirements

	H_2 (lb)	Sodium Lactate (lb)	(gal)	
Dissolved Phase Contamination	0.0	0.1	0.0	
Adsorbed Phase Contamination	0.0	1.0	0.1	
Competing Electron Acceptors	2.0	74.8	6.8	
Competing Microbial Processes	0.1	4.5	0.4	
Subtotal	2.2	80.4	7.3	
Total (with SF)		321.6	**29.1**	concentrated solution

Dose Requirements

No. Injection Points	10		
Injection Interval	20 ft.		
Sodium Lactate Required	32.2 lbs/hole 2.9 gal/hole	1.61 lbs/ft. 0.15 gal/ft	
Water/Sodium Lactate Dilution (vol/vol)	16.7 :1		
Dilute Sodium Lactate Required	51.5 gal/hole	2.58 gal/ft	**515.2** gal. dilute solution
Injection Point Spacing	10 ft.		
Injection Point Pore Vol.	628 ft^3	4,700 gal	
Sodium Lactate/Pore Vol. Ratio	1.10 %		
Injection Distance (from borehole)	0.52 ft (radius)	1.05 ft (diameter)	

EOS Remediation, Inc.

Emulsified Edible Oil Barrier Design Software

Beta Version 1.3
www.eosremediation.com

Site Name:	Rohm and Haas Former EMCA Site
Location:	Mamaroneck, New York
Project No.:	11173570

Design Inputs

Width of proposed barrier perpendicular to groundwater flow	30	ft	9.1	m	

Groundwater Flow Rate/ Site Data

Minimum depth to contamination	5	ft	1.5	m	
Maximum depth of contamination	25	ft	7.6	m	
Treatment thickness	20	ft	6.1	m	
Surface area of barrier face	600	ft^2	56	m^2	
Soil Characteristics					
Nominal Soil Type (enter clay, silt, silty sand, sand, or gravel)	silty sand				
Hydraulic Characteristics					
Total Porosity (accept default or enter *n*)	0.40	(decimal)			
Effective Porosity (accept default or enter n_e)	0.25	(decimal)			
Hydraulic Conductivity (accept default or enter *K*)	30	ft/day	1.1E-02	cm/sec	
Hydraulic Gradient (accept default or enter *i*)	0.005	ft/ft			
Seepage velocity (V_s)	0.600	ft/day	0.1829	m/day	
Groundwater flowrate through barrier (Q)	90	ft^3/day	2.5485	m^3/day	2,549 L/day

Electron Acceptors

Inputs		GW Conc. (mg/L)	MW (g/mole)	e⁻ equiv./ mole	Stoichmetry Contaminant/H2 (wt/wt H_2)	Hydrogen Demand (Flux) (g H_2/ day)	Reference
Dissolved Oxygen (DO)		1	32.0	4	7.94	0.32109322	Avg. of wells MW-02,
Nitrate Nitrogen (NO_3^- - N)		1.15	62.0	5	12.30	0.2382027	MW-03 & MW-06 (7/04)
Sulfate (SO_4^{2-})		17.9	96.1	8	11.91	3.82927123	" "
Tetrachloroethene (PCE), C_2Cl_4			165.8	8	20.57		
Trichloroethene (TCE), C_2HCl_3			131.4	6	21.73		
cis-1,2-dichloroethene (c-DCE), $C_2H_2Cl_2$			96.9	4	24.05		
Vinyl Chloride (VC), C_2H_3Cl			62.5	2	31.00		
Carbon tetrachloride, CCl_4			153.8	8	19.08		
Chloroform, $CHCl_3$			119.4	6	19.74		
sym-tetrachloroethane, $C_2H_2Cl_4$			167.8	8	20.82		
1,1,1-Trichloroethane (TCA), CH_3CCl_3			133.4	6	22.06		
1,1-Dichloroethane (DCA), CH_2CHCl_2			99.0	4	24.55		
Chloroethane, C_2H_5Cl			64.9	2	32.18		
Perchlorate, ClO_4^-			99.4	8	12.33		
Hexavalent Chromium, Cr[VI]			52.0	3	17.20		
User added	Freon 113	1.667	187.4	6	30.99	0.13873997	Avg. of wells MW-02,
User added	Freon 123a	1.309	152	4	37.70	0.08848321	MW-03 & MW-06 (7/04)
User added	Freon 1113	0.029	116.5	2	57.79	0.00127881	" "

Generation (Potential Amount Formed)		GW Conc. (mg/L)	MW (g/mole)	e⁻ equiv./ mole	Stoichmetry Contaminant/H2 (wt/wt H_2)	Flux (g H_2/ day)	DOC Flux (moles/day)
Estimated Amount of Fe^{2+} Formed	10 to 100	38	55.8	1	55.41	1.74784994	
Estimated Amount of Manganese (Mn^{2+}) Formed		1.6	54.9	2	27.25	0.14961736	
Estimated Amount of CH_4 Formed	5 to 20	0.96	16.0	8	1.99	1.22967773	
Target Amount of DOC to Release	60 to 100	100	12.0				21.22

Note:

Calculations assume:
1.) that all reactions go to completion during passage through emulsified edible oil treated zone; and,
2.) perfect reaction stoichiometry.

Stoichiometric Hydrogen Demand	31	pounds
DOC Released	1,330	pounds
EOS® Concentrate Requirement	4	drums
	1,688	lbs.

(Note: drum size is 55-gal. and s.g. of EOS® is 0.92)

Emulsion Makeup

Concentrate : Water Ratio	1 Part EOS® Concentrate to	4	water	Minimum Value = 4; typical values 4 to 10
Approximate Quantity of Emulsified edible oil substrate formed		8,400	pounds	1100 gallons
Number of Injection Points and Dose:				
Spacing between injection points		10	ft on center spacing within rows between injection points (typical values 5 to 15)	
Overlap between injections, percent		25%	typical values 25 to 50%	
Number of injection points		10	points	
Emulsified edible oils injected per point		840	pounds	110.0 gallons
Cost of EOS®	Call for price quote			

Injection zone diameter	12.5	feet
Pore volume per injection point	4,590	gallons
Displacement flush pore volumes	1	typical values 1 to 1.25
Displacement flush volume per point	4,480	gallons
Total injection volume per injection point	4,590	gallons

9/18

EOS Remediation, Inc.

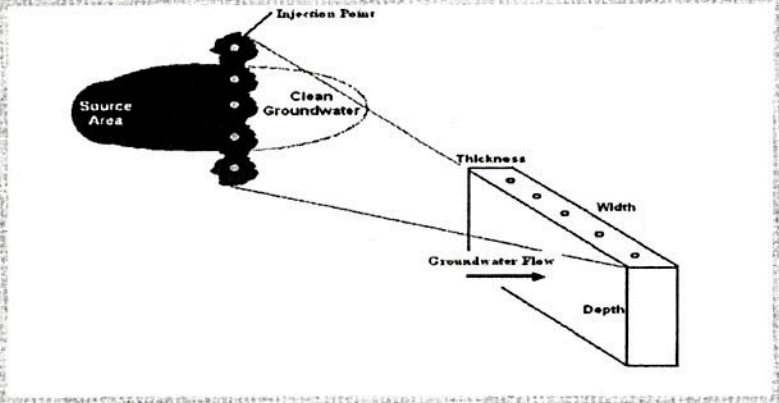
Emulsified Edible Oil Residual Saturation

www.eosremediation.com

Site Name:	Rohm and Haas Former EMCA Site
Location:	Mamaroneck, New York
Project No.:	11173570

Design Inputs

Width of proposed barrier perpendicular to groundwater flow	30	ft	9.1	m
Thickness of proposed barrier	5	ft	1.5	m
Depth of proposed barrier from minimum depth of contaminant	20	ft	6.1	m
Volume of treatment zone	3,000	ft3	85.0	m3



Soil Characteristics

Nominal soil type (enter silt, silty sand, or sand)	sand	
Density of soil (accept default or enter site specific value)	110	lbs / ft3
Soil to be treated	330,000	lbs
Aquifer "Sorption" Capacity (accept default or enter site specific value)	0.001	lbs EOS® / lbs soil

Aquifer "Sorption" Capacity[1]

- Fine sand with some clay 0.001 to 0.002 lbs EOS® / lbs soil
- Sand with higher silt/clay content 0..002 to 0.004 lbs EOS® / lbs soil

[1]Default values provided based on laboratory studies completed by NCSU

EOS® Concentrate Requirement

EOS® Residual Saturation Demand	330	lb

EOS® Concentrate Requirement	1	Drums

[†]Exclusive license agreement with Solutions-IES

[††]U.S. Patent # 6,398,960 and several international patents pending

[†††]EOS® is a registered trademark of Solutions-IES

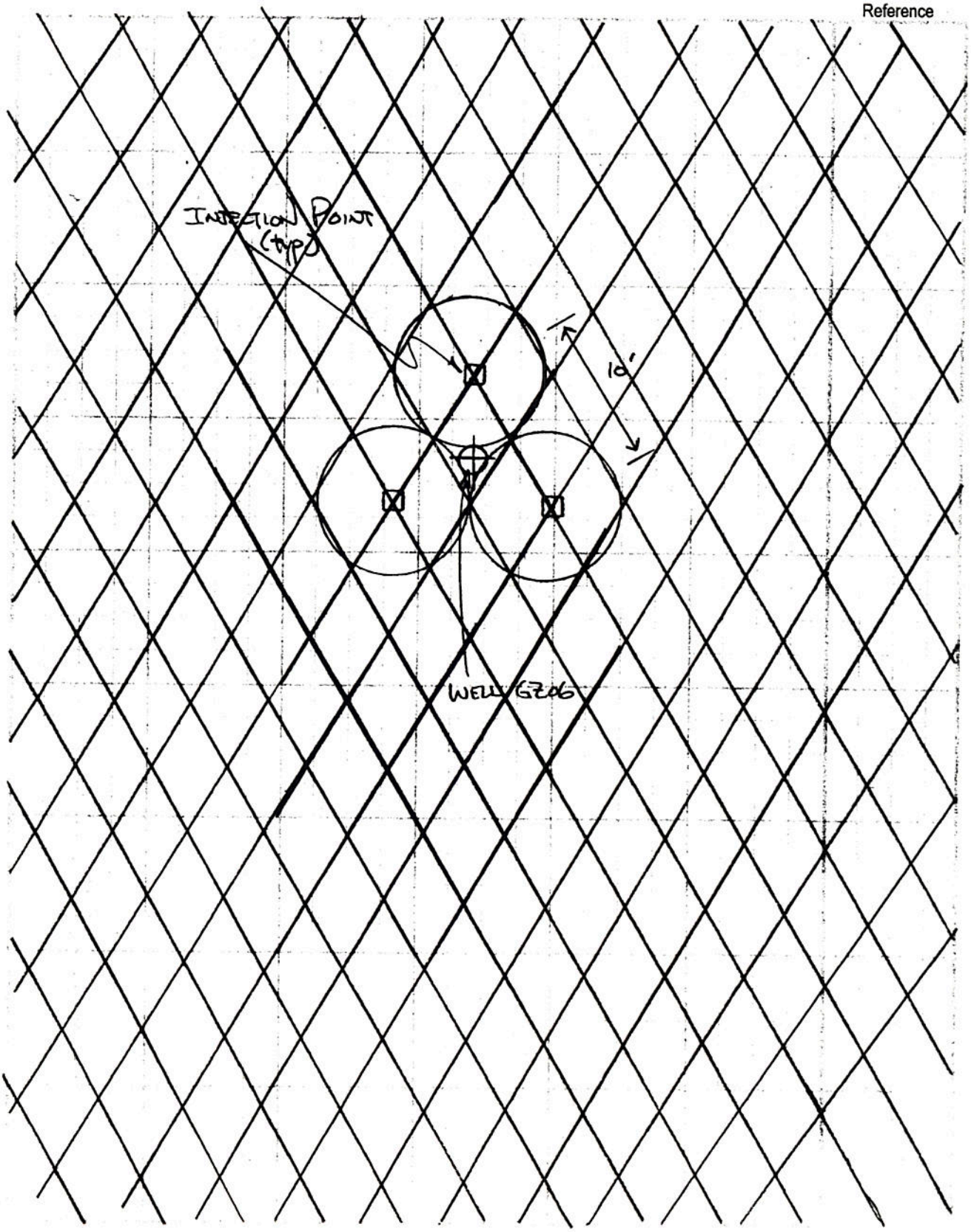
URS

Job ROHM & HAAS - FORMER EMCA
Project No. 11173570.00000
Page 10 of 18

Description INJECTION POINT LAYOUT
GZ-06 AREA
Computed by JRS
Date 9/20/04

Checked by MO
Date 9/27/04

Reference



URS

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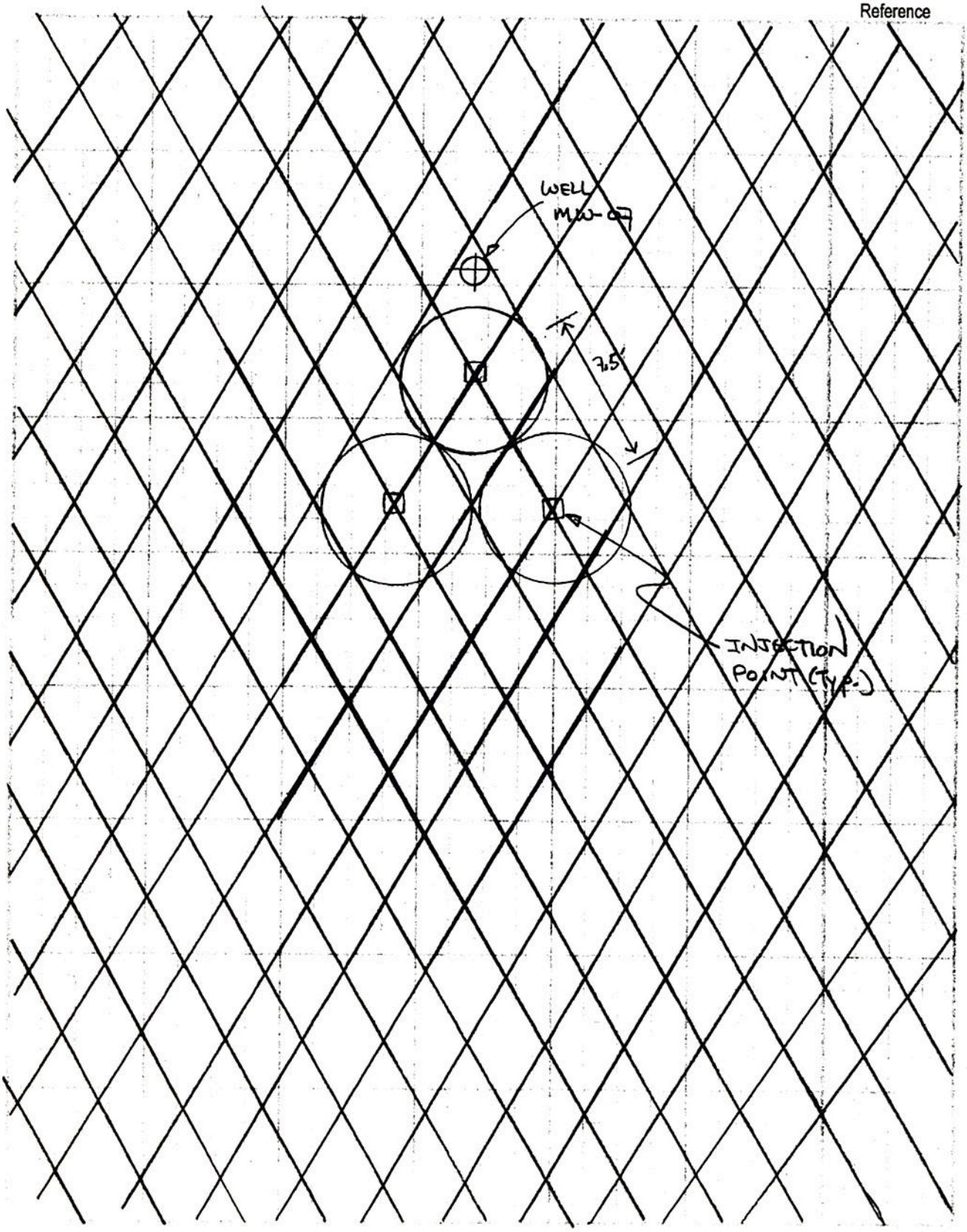
Job ROHM & HAAS - FORMER EMCA | Project No. 11173570.00000 | Sheet ___ of ___

Description INJECTION POINT LAYOUT MW07 AREA | Computed by JRS | Date 10/6/04

Checked by ___ | Date ___

Reference



Sodium Lactate Design for Plume Area/Grid Treatment

Site Name: Rohm & Haas Former EMCA Site
Location: Mamaroneck, New York

GZ06 Area

Sodium Lactate ($C_3H_5NaO_3$) — Ref.

Pure H_2 Yield	22.4 lb pure Sodium Lactate/lb H	
Sodium Lactate % (by weight)	60	WILCLEAR™ Sodium Lactate
Capacity to supply H_2	37.3 lb Sodium Lactate solution/lb H	
Density of Sodium Lactate	11.05 lb/gal	WILCLEAR™ Sodium Lactate

Site Conceptual Model

Width of Treatment Area	30.0 ft	
Length of Treatment Area	45.0 ft	
Depth to Water Table	5 ft	
Thickness of Contaminated Zone	20 ft	
Aquifer Material	sand	
Porosity	0.4	
Treatment Zone Pore Volume	10,800 ft^3	80,795 gal.

Dissolved Phase Electron Donor Demand

	Contaminant Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) contaminant/H_2	H Req (lb)
cis-1,2-dichloroethene (DCE)	0.0000	0.0	24.2	0.0000
Vinyl Chloride (VC)	0.0000	0.0	31.2	0.0000
Carbon tetrachloride	0.0000	0.0	19.2	0.0000
Chloroform	0.0000	0.0	19.9	0.0000
Freon 113	0.1000	0.1	31.2	0.0022
Freon 123a	0.0360	0.0	38.0	0.0006
Freon 1113	0.0240	0.02	52.5	0.0003

Sorbed Phase Electron Donor Demand

Soil bulk density	110	lb/cf
Fraction of organic carbon: foc	0.01	range: 0.0001 to 0.01

	Koc (L/kg)	Contaminant Conc (mg/kg)	Mass (lb)	Stoich. (wt/wt) contaminant/H_2	H_2 Req. (lb)
cis-1,2-dichloroethene (DCE)	80	0.0000	0.00	24.2	0.0000
Vinyl Chloride (VC)	2.5	0.0000	0.00	31.2	0.0000
Carbon tetrachloride	110	0.0000	0.00	19.2	0.0000
Chloroform	34	0.0000	0.00	19.9	0.0000
Freon 113	372	0.3720	1.10	31.2	0.0354
Freon 123a		0.0000	0.00	38.0	0.0000
Freon 1113		0.0000	0.00	52.5	0.0000

Competing Electron Acceptors

	Electron Acceptor Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) elec. acceptor/H_2	H_2 Req. (lb)
Oxygen	1.15	0.78	8.0	0.10
Nitrate	0.10	0.07	12.4	0.01
Est. Mn reduction demand (potential amt. of Mn+2 formed)	1.00	0.67	27.5	0.02
Est. Fe reduction demand (potential amt. of Fe+2 formed)	10.00	6.74	55.9	0.12
Estimated sulfate reduction demand	32.00	21.58	12.0	1.80

Microbial Demand Factor	4
Safety Factor (SF)	4

Mass Requirements

	H_2 (lb)	Sodium Lactate (lb)	(gal)	
Dissolved Phase Contamination	0.0	0.1	0.0	
Adsorbed Phase Contamination	0.0	1.3	0.1	
Competing Electron Acceptors	2.0	76.4	6.9	
Competing Microbial Processes	0.2	5.7	0.5	
Subtotal	2.2	83.6	7.6	
Total (with SF)		334.3	30.3	concentrated solution

Dose Requirements

No. Injection Points	3		
Injection Interval	20 ft.		
Sodium Lactate Required	111.42 lbs/hole	5.57 lbs/ft.	
	10.08 gal/hole	0.50 gal/ft	
Water/Sodium Lactate Dilution (vol/vol)	10 :1		
Dilute Sodium Lactate Required	110.9 gal/hole	5.5 gal/ft	332.8 gal. dilute solution
Injection Point Spacing	10 ft.		
Injection Point Pore Vol.	628 ft^3	4,700 gal	
Sodium Lactate/Pore Vol. Ratio	2.36 %		
Injection Distance (from borehole)	0.77 ft (radius)	1.54 ft (diameter)	

Sodium Lactate Design for Plume Area/Grid Treatment

Site Name: Rohm & Haas Former EMCA Site
Location: Mamaroneck, New York

MW07 Area

Sodium Lactate ($C_3H_5NaO_3$) — Ref.

Pure H_2 Yield	22.4	lb pure Sodium Lactate/lb H	
Sodium Lactate % (by weight)	60		WILCLEAR™ Sodium Lactate
Capacity to supply H_2	37.3	lb Sodium Lactate solution/lb H	
Density of Sodium Lactate	11.05	lb/gal	WILCLEAR™ Sodium Lactate

Site Conceptual Model

Width of Treatment Area	30.0	ft	
Length of Treatment Area	20.0	ft	
Depth to Water Table	5	ft	
Thickness of Contaminated Zone	20	ft	
Aquifer Material	sand		
Porosity	0.4		
Treatment Zone Pore Volume	4,800	ft^3	35,909 gal.

Dissolved Phase Electron Donor Demand

	Contaminant Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) contaminant/H_2	H Req (lb)	
cis-1,2-dichloroethene (DCE)	0.0000	0.0	24.2	0.0000	
Vinyl Chloride (VC)	0.0000	0.0	31.2	0.0000	
Carbon tetrachloride	0.0000	0.0	19.2	0.0000	
Chloroform	0.0000	0.0	19.9	0.0000	
Freon 113	2.5050	0.8	31.2	0.0240	Avg. of wells MW-03
Freon 123a	1.9750	0.6	38.0	0.0156	& MW-07 (7/04)
Freon 1113	0.1240	0.04	52.5	0.0007	

Sorbed Phase Electron Donor Demand

Soil bulk density	110	lb/cf
Fraction of organic carbon: foc	0.01	range: 0.0001 to 0.01

	Koc (L/kg)	Contaminant Conc (mg/kg)	Mass (lb)	Stoich. (wt/wt) contaminant/H_2	H_2 Req. (lb)
cis-1,2-dichloroethene (DCE)	80	0.0000	0.00	24.2	0.0000
Vinyl Chloride (VC)	2.5	0.0000	0.00	31.2	0.0000
Carbon tetrachloride	110	0.0000	0.00	19.2	0.0000
Chloroform	34	0.0000	0.00	19.9	0.0000
Freon 113	372	9.3186	12.30	31.2	0.3939
Freon 123a		0.0000	0.00	38.0	0.0000
Freon 1113		0.0000	0.00	52.5	0.0000

Competing Electron Acceptors

	Electron Acceptor Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) elec. acceptor/H_2	H_2 Req. (lb)
Oxygen	1.00	0.30	8.0	0.04
Nitrate	1.00	0.30	12.4	0.02
Est. Mn reduction demand (potential amt. of Mn+2 formed)	1.00	0.30	27.5	0.01
Est. Fe reduction demand (potential amt. of Fe+2 formed)	10.00	3.00	55.9	0.05
Estimated sulfate reduction demand	32.00	9.59	12.0	0.80

Microbial Demand Factor	4
Safety Factor (SF)	4

Mass Requirements

	H_2 (lb)	Sodium Lactate (lb)	(gal)	
Dissolved Phase Contamination	0.0	1.5	0.1	
Adsorbed Phase Contamination	0.4	14.7	1.3	
Competing Electron Acceptors	0.9	34.6	3.1	
Competing Microbial Processes	1.7	64.8	5.9	
Subtotal	3.1	115.6	10.5	
Total (with SF)		462.4	41.8	concentrated solution

Dose Requirements

No. Injection Points	3			
Injection Interval	20	ft.		
Sodium Lactate Required	154.13	lbs/hole	7.71	lbs/ft.
	13.95	gal/hole	0.70	gal/ft
Water/Sodium Lactate Dilution (vol/vol)	10	:1		
Dilute Sodium Lactate Required	153.4	gal/hole	7.7	gal/ft — 460.3 gal. dilute solution
Injection Point Spacing	10	ft.		
Injection Point Pore Vol.	628	ft^3	4,700	gal
Sodium Lactate/Pore Vol. Ratio	3.26	%		
Injection Distance (from borehole)	0.90	ft (radius)	1.81	ft (diameter)

REFERENCES

Rohm & Haas EMCA Site - Well Construction Details & Depth of Contamination

Well	Installation Date	Diameter (in)	Screen (ft bgs)	Screen type	Riser (ft bgs)	Riser type	Water Table (ft bgs)	Maximum Depth of Contamination (ft bgs)	Rationale
GZ-1	2/5/88	2	3.5 - 13.5	#10 slot, sch 40 PVC	3.5 - ag	sch 40 PVC	± 4	13.5	groundwater
GZ-2	2/5/88	2	2 - 12	#10 slot, sch 40 PVC	2 - ag	sch 40 PVC	± 4	12	groundwater
GZ-3	2/5/88	2	3 - 13	#10 slot, sch 40 PVC	3 - ag	sch 40 PVC	7.18 - 9.66	13	groundwater
GZ-4	5/12/88	2	4 - 19	#10 slot, sch 40 PVC	4 - ag	sch 40 PVC	± 5	19	groundwater
GZ-5	5/12/88	2	3 - 13	#10 slot, sch 40 PVC	3 - 0	sch 40 PVC	± 8	***	below action levels
GZ-6	5/12/88	2	3 - 13	#10 slot, sch 40 PVC	3 - ag	sch 40 PVC	4.11 - 7.94	13	groundwater
GZ-7	5/13/88	2	6 - 16	#10 slot, sch 40 PVC	6 - 0	sch 40 PVC	± 9	16	groundwater
GZ-8	5/12/88	2	20 - 25	#10 slot, sch 40 PVC	20 - ag	sch 40 PVC	± 5	25	groundwater
GZ-9	5/13/88	2	4.5 - 14.5	#10 slot, sch 40 PVC	4.5 - ag	sch 40 PVC	± 10	14.5	groundwater
MW-01	10/5/99	1	4 - 16	#10 slot, sch 40 PVC	4 - 0	sch 40 PVC	4.39 - 5.91	16	groundwater
MW-02	10/5/99	1	3 - 16	#10 slot, sch 40 PVC	3 - 0	sch 40 PVC	4.61 - 6.18	16	groundwater
MW-03	10/5/99	1	4.5 - 14.5	#10 slot, sch 40 PVC	4.5 - 0	sch 40 PVC	5.06 - 6.62	14.5	groundwater
MW-04	10/5/99	1	4.5 - 14.5	#10 slot, sch 40 PVC	4.5 - 0	sch 40 PVC	4.31 - 5.86	14.5	groundwater
MW-05	7/11/00	1	3 - 16	#10 slot, sch 40 PVC	0	sch 40 PVC	5.47 - 5.57	16	groundwater

Notes:
ft bgs = feet below ground surface
ag = above grade

REF. 1

REF. 1

16/18

COLLOREN-ZOINO & ASSOCIATES, INC.
935 CONNECTICUT AVE., BRIDGEPORT, CT
GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS

PROJECT: U.A. Cablevision

REPORT OF BORING NO. GZ-6
SHEET 1 OF 1
FILE No. W-90196
CHKD. BY

BORING No. East Coast Drilling
FOREMAN
DRILLER

BORING LOCATION Adjacent to GZ-4
GROUND SURFACE ELEVATION
DATE START 5/12/96 DATE END 5/12/96

HAMMER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 LB. HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 LB. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER	CASING	STABILIZATION TIME
5/12	----	±9	OUT	0 hrs.
5/31	----	6.83		19 days

DEPTH	CASING BLOWS	SAMPLE No.	SAMPLE PEN./REC.	SAMPLE DEPTH (Ft.)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION Burmister CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	REMARKS
									11.7 PPM	
5						Refer to Boring GZ-4 for soil descriptions (0-21').				
10										
15		S-1	24/12	21-27	8/9/7/6	Brown fine to medium SAND, some silt, trace cobbles.	SAND		5.2 ppm	
		S-2	24/20	30-32	5/4/5/3	Brown-Grey fine-medium SAND.	±32' E.O.B.		2.0 ppm	

Soil samples field-screened for volatile organic compounds with HNU Model PI 101 11.7 EV Photoionization Detector.
Refer to GZ-4 boring log for sample descriptions to 25 feet.
Equipment Used: Screens: 5'-2" ID slot schedule 40 threaded flush joint PVC completed 25' 2" PVC riser; Setting: 23-30' below grade. Clean sand backfilled from 30-24 below grade. Bentonite seal from 24-22 feet below grade. Sand backfilled from 23-1 feet below grade. 5' locking steel protective sleeve cemented secure.

NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED. FLUCTUATIONS OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE

BORING No. GZ-6

REF. 2

17/18

Revision 0

11/11/95

TECHNICAL PROTOCOL FOR IMPLEMENTING INTRINSIC REMEDIATION WITH LONG-TERM MONITORING FOR NATURAL ATTENUATION OF FUEL CONTAMINATION DISSOLVED IN GROUNDWATER

VOLUME I

by

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for

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*This United States Air Force guidance was developed in cooperation with United States Environmental Protection Agency (USEPA) researchers but was not issued by the USEPA and does not represent USEPA guidance.

Effective porosity can be estimated using the results of a tracer test. Although this is potentially the most accurate method, time and monetary constraints can be prohibitive. For this reason, the most common technique is to use an accepted literature value for the types of materials making up the aquifer matrix, and then to calibrate a contaminant transport model by adjusting the value of effective porosity (in conjunction with other input parameters such as transmissivity) within the range of accepted literature values until the modeled and observed contaminant distribution patterns match. Because aquifer materials can have a range of effective porosity, sensitivity analyses should be performed to determine the effect of varying the effective porosity on numerical model results. Values of effective porosity chosen for the sensitivity analyses should vary over the accepted range for the aquifer matrix material. Table C.3.2 presents accepted literature values for total porosity and effective porosity. Contaminant transport model sensitivity analysis is discussed in Appendix D.

Table C.3.2

Representative Values of Dry Bulk Density, Total Porosity, and Effective Porosity for Common Aquifer Matrix Materials (After Walton, 1988 and Domenico and Schwartz, 1990))

Aquifer Matrix	Dry Bulk Density (gm/cm^3)	Total Porosity	Effective Porosity
Clay	1.00-2.40	0.34-0.60	0.01-0.2
Peat	—	—	0.3-0.5
Glacial Sediments	1.15-2.10	—	0.05-0.2
Sandy Clay	—	—	0.03-0.2
Silt	—	0.34-0.61	0.01-0.3
Loess	0.75-1.60	—	0.15-0.35
Fine Sand	1.37-1.81	0.26-0.53	0.1-0.3
Medium Sand	1.37-1.81	—	0.15-0.3
Coarse Sand	1.37-1.81	0.31-0.46	0.2-0.35
Gravelly Sand	1.37-1.81	—	0.2-0.35
Fine Gravel	1.36-2.19	0.25-0.38	0.2-0.35
Medium Gravel	1.36-2.19	—	0.15-0.25
Coarse Gravel	1.36-2.19	0.24-0.36	0.1-0.25
Sandstone	1.60-2.68	0.05-0.30	0.1-0.4
Siltstone	—	0.21-0.41	0.01-0.35
Shale	1.54-3.17	0.0-0.10	—
Limestone	1.74-2.79	0.0-50	0.01-0.24
Granite	2.24-2.46	—	—
Basalt	2.00-2.70	0.03-0.35	—
Volcanic Tuff	—	—	0.02-0.35