New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 8
6274 East Avon-Lima Road, Avon, New York 14414-9519
Phone: (585) 226-2466 • **FAX:** (585) 226-8696
Website: www.dec.state.ny.us

Alexander B. Grannis
Commissioner

February 26, 2009

Mr. Antonio Gabrielle
1214 Lake Road
Webster, New York 14580

Mr. Joseph Ognibene
5875 North Byron Road
Byron, New York 14422

Dear Messrs. Gabriele and Ognibene:

Re: Churchville Ford Site # V00658-8
Remedial Action Work Plan, December 2008
Village of Churchville, Monroe County

The New York State Department of Environmental Conservation (NYSDEC) has completed its review of the December 2008 Remedial Action Work Plan (RAWP) prepared by Lu Engineers for the Former Churchville Ford site. Based upon the information and representations given in the RAWP and the July 2008 Remedial Investigation Report, the RAWP is hereby approved as modified below:

Remediation projects that utilize injection wells as part of the site cleanup activity are regulated by the USEPA's underground injection control (UIC) program. Please provide USEPA with the notification required by the UIC program using the inventory form referenced in 40CFR144.26 (form OMB No. 2040-0042 [USEPA form 7520-16]) (Attached). The notification should be made by fax or mail and should include enough details for USEPA to understand the site and the proposed process and should indicate that NYSDEC is overseeing and has approved the project. Notifications should be sent to:

Dennis J. McChesney, Chief,
Groundwater Compliance Section
U.S. EPA Region 2
290 Broadway
New York, NY 10007-1866
Voice (212) 637- 4232
Fax (212) 637- 4211
mcchesney.dennis@epa.gov

Copies of the notification package will also be sent to NYSDEC, the New York State Department of Health, and the Monroe County Health Department.

Once the injection activity has been completed the UIC must be closed in a manner which protects underground sources of drinking water. The UIC program must be notified of when and how the wells were closed.

Please submit five (5) CDs containing electronic copies of the RAWP (including this letter) by March 31, 2009. Please ensure that the electronic files are in pdf format and that the text is searchable.

Per the schedule in the RAWP, installation of the injection wells is expected to begin in April 2009. Please proceed with the USEPA notification and notify me when the field work has been scheduled. Prior to the start of field activities, NYSDEC will send a Fact Sheet to the community to notify them that field activities are about to begin.

Thank you for your cooperation in this matter and please contact me at (585) 226-5357 if you have any questions.

Sincerely,

Frank Sowers, P.E.
Project Manager

cc: w/attach
Benjamin Bonarigo - Bonarigo & McCutcheon
John Campbell - Oakar Equipment
Gregory Andrus - Lu Engineers
file

ec: w/attach

Bart Putzig	Katie Comerford
Bob Knizek	Jeff Kosmala
Joe Hausbeck	Geoff Laccetti
Mike Lesser	

Type or print all information. See reverse for instructions.

OMB No. 2040-0042 Approval Expires 4/30/07

INVENTORY OF INJECTION WELLS

EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF GROUND WATER AND DRINKING WATER

(This information is collected under the authority of the Safe Drinking Water Act)

1. DATE PREPARED *(Year, Month, Day)*

2. FACILITY ID NUMBER

PAPERWORK REDUCTION ACT NOTICE

The public reporting burden for this collection of information is estimated at about 0.5 hour per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, 2136, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, and to the Office of Management and Budget, Paperwork Reduction Project, Washington, DC 20503.

3. TRANSACTION TYPE *(Please mark one of the following)*

- ☐ Deletion
- ☐ First Time Entry
- ☐ Entry Change
- ☐ Replacement

4. FACILITY NAME AND LOCATION

A. NAME *(last, first, and middle initial)*

B. STREET ADDRESS/ROUTE NUMBER

C. LATITUDE — DEG | MIN | SEC

D. LONGITUDE — DEG | MIN | SEC

E. TOWNSHIP/RANGE — TOWNSHIP | RANGE | SECT | 1/4 SECT

F. CITY/TOWN

G. STATE

H. ZIP CODE

I. NUMERIC COUNTY CODE

J. INDIAN LAND *(mark "x")* ☐ Yes ☐ No

5. LEGAL CONTACT:

A. TYPE *(mark "x")* ☐ Owner ☐ Operator

B. NAME *(last, first, and middle initial)*

C. PHONE *(area code and number)*

D. ORGANIZATION

E. STREET/P.O. BOX

F. CITY/TOWN

G. STATE

H. ZIP CODE

I. OWNERSHIP *(mark "x")* ☐ PRIVATE ☐ PUBLIC ☐ SPECIFY OTHER ☐ STATE ☐ FEDERAL

6. WELL INFORMATION:

A. CLASS AND TYPE		B. NUMBER OF WELLS		C. TOTAL NUMBER OF WELLS	D. WELL OPERATION STATUS				
		COMM	NON-COMM		UC	AC	TA	PA	AN
				0					
				0					
				0					
				0					
				0					
				0					
				0					

COMMENTS *(Optional)*:

KEY:

DEG = Degree
MIN = Minute
SEC = Second

SECT = Section
1/4 SECT = Quarter Section

COMM = Commercial
NON-COMM = Non-Commercial

AC = Active
UC = Under Construction
TA = Temporarily Abandoned
PA = Permanently Abandoned and Approved by State
AN = Permanently Abandoned and not Approved by State

EPA Form 7520-16 (Rev. 8-01)

SECTION 1. DATE PREPARED: Enter date in order of year, month, and day.

SECTION 2. FACILITY ID NUMBER: In the first two spaces, insert the appropriate U.S. Postal Service State Code. In the third space, insert one of the following one letter alphabetic identifiers:

D - DUNS Number,
G - GSA Number, or
S - State Facility Number.

In the remaining spaces, insert the appropriate nine digit DUNS, GSA, or State Facility Number. For example, A Federal facility (GSA - 123456789) located in Virginia would be entered as : VAG123456789.

SECTION 3. TRANSACTION TYPE: Place an "x" in the applicable box. See below for further instructions.

Deletion. Fill in the Facility ID Number.
First Time Entry. Fill in all the appropriate information.
Entry Change. Fill in the Facility ID Number and the information that has changed.
Replacement.

SECTION 4. FACILITY NAME AND LOCATION:

A. Name. Fill in the facility's official or legal name.
B. Street Address. Self Explanatory.
C. Latitude. Enter the facility's latitude (all latitudes assume North Except for American Samoa).
D. Longitude. Enter the facility's longitude (all longitudes assume West except Guam).
E. Township/Range. Fill in the complete township and range. The first 3 spaces are numerical and the fourth is a letter (N,S,E,W) specifying a compass direction. A township is North or South of the baseline, and a range is East or West of the principal meridian (e.g., 132N, 343W).
F. City/Town. Self Explanatory.
G. State. Insert the U.S. Postal Service State abbreviation.
H. Zip Code. Insert the five digit zip code plus any extension.

SECTION 4. FACILITY NAME & LOCATION (CONT'D.):

I. Numeric County Code. Insert the numeric county code from the Federal Information Processing Standards Publication (FIPS Pub 6-1) June 15, 1970, U.S. Department of Commerce, National Bureau of Standards. For Alaska, use the Census Division Code developed by the U.S. Census Bureau.
J. Indian Land. Mark an "x" in the appropriate box (Yes or No) to indicate if the facility is located on Indian land.

SECTION 5. LEGAL CONTACT:

A. Type. Mark an "x" in the appropriate box to indicate the type of legal contact (Owner or Operator). For wells operated by lease, the operator is the legal contact.
B. Name. Self Explanatory.
C. Phone. Self Explanatory.
D. Organization. If the legal contact is an individual, give the name of the business organization to expedite mail distribution.
E. Street/P.O. Box. Self Explanatory.
F. City/Town. Self Explanatory.
G. State. Insert the U.S. Postal Service State abbreviation.
H. Zip Code. Insert the five digit zip code plus any extension.
I. Ownership. Place an "x" in the appropriate box to indicate ownership status.

SECTION 6. WELL INFORMATION:

A. Class and Type. Fill in the Class and Type of injection wells located at the listed facility. Use the most pertinent code (specified below) to accurately describe each type of injection well. For example, 2R for a Class II Enhanced Recovery Well, or 3M for a Class III Solution Mining Well, etc.
B. Number of Commercial and Non-Commercial Wells. Enter the total number of commercial and non-commercial wells for each Class/Type, as applicable.
C. Total Number of Wells. Enter the total number of injection wells for each specified Class/Type.
D. Well Operation Status. Enter the number of wells for each Class/Type under each operation status (see key on other side).

CLASS I Industrial, Municipal, and Radioactive Waste Disposal Wells used to inject waste below the lowermost Underground Source of Drinking Water (USDW).

TYPE	1I	Non-Hazardous Industrial Disposal Well.
	1M	Non-Hazardous Municipal Disposal Well.
	1H	Hazardous Waste Disposal Well injecting below the lowermost USDW.
	1R	Radioactive Waste Disposal Well.
	1X	Other Class I Wells.

CLASS II Oil and Gas Production and Storage Related Injection Wells.

TYPE	2A	Annular Disposal Well.
	2D	Produced Fluid Disposal Well.
	2H	Hydrocarbon Storage Well.
	2R	Enhanced Recovery Well.
	2X	Other Class II Wells.

CLASS III Special Process Injection Wells.

TYPE	3G	*In Situ* Gassification Well
	3M	Solution Mining Well.

CLASS III (CONT'D.)

TYPE	3S	Sulfur Mining Well by Frasch Process.
	3T	Geothermal Well.
	3U	Uranium Mining Well.
	3X	Other Class III Wells.

CLASS IV Wells that inject hazardous waste into/above USDWs.

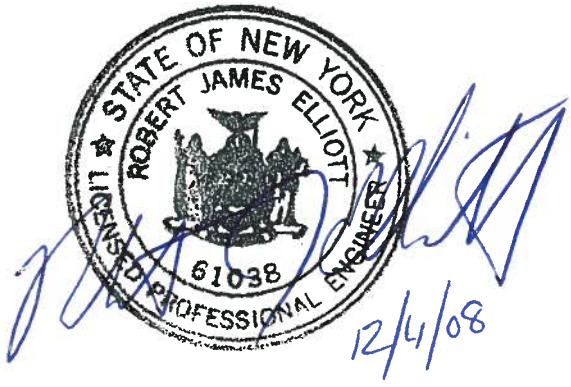
TYPE	4H	Hazardous Facility Injection Well.
	4R	Remediation Well at RCRA or CERCLA site.

CLASS V Any Underground Injection Well not included in Classes I through IV.

TYPE	5A	Industrial Well.
	5B	Beneficial Use Well.
	5C	Fluid Return Well.
	5D	Sewage Treatment Effluent Well.
	5E	Cesspools (non-domestic).
	5F	Septic Systems.
	5G	Experimental Technology Well.
	5H	Drainage Well.
	5I	Mine Backfill Well.
	5J	Waste Discharge Well.

Voluntary Cleanup Program
Former Churchville Ford Site (#V00658-8)
111 South Main Street
Village of Churchville
Monroe County, New York

Remedial Action Work Plan



Prepared For:

Okar Equipment Company, Inc.
754 Brooks Avenue
Rochester, New York 14619

Prepared By:

LU ENGINEERS
Civil and Environmental
2230 Penfield Road
Penfield, New York 14526

December 2008

Lu Project No. 5701-11

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Figures

Attachments

1.0 Introduction

This Remedial Action Work Plan (RAWP) was completed on behalf of Okar Equipment Company to specify the proposed remedial strategy for remediation of contamination found at the Former Churchville Ford Site #V00658-8. This RAWP has been developed in general accordance with New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) Voluntary Cleanup Program (VCP) Guide Draft, May 2002 for Site Investigation and Remediation.

This plan will identify Remedial Action Objectives (RAO) and cleanup levels to be attained. This RAWP will also describe the basis for concluding that the results of the remediation will be protective of public health and the environment.

The proposed Remedial Action (RA) activities for the Site include:

- Installation of injection wells in the western portion of the main building service area;
- The implementation of an in-situ chemical oxidation (ISCO) sodium permanganate ($NaMnO_4$) injection program;
- Creation of a Site Management Plan (SMP);
- Confirmatory groundwater and soil vapor testing in the area of concern; and
- Review of vapor mitigation issues and schematic sub-slab ventilation system design.

The objective of the proposed RA will be to mitigate potential exposures to environmental contaminants and contain further movement of contaminants associated with the presence of chlorinated solvents in saturated soils, groundwater, and soil vapor associated with former solvent storage.

1.1 Site Description

The Site is located at 111 South Main Street in the Village of Churchville, Town of Riga, Monroe County, New York (Figure 1). The original Site boundary was a 10.28-acre parcel (Tax ID # 143.17-1-001.121) owned by Antonio Gabriele and Joseph Ognibene (see Figure 2). The property was sold to the current owner, Meyers at Churchville, LLC, in April 2004. In 2006, the property was subdivided into two separate parcels to allow for realignment of Sanford Road North, which transects the original parcel (see Figure 3). The new parcels that comprise the original Site boundary are as follows:

- Tax ID # 143.17-1-50: A 6.083-acre parcel owned by Meyers at Churchville, LLC. This is the main portion of the Site that contains a 22,000-square foot truck and boat dealership with service bays, a small wooden shed, and parking lot.
- Tax ID # 143.17-1-51: A 1.808-acre parcel located south of Sanford Road; owned by Meyers at Churchville, LLC. This parcel consists of an undeveloped grassy area between I-490 and the new Sanford Road North.

- Sanford Road North Right of Way: This portion of the Site consists of Sanford Road North and a stormwater retention basin owned by the NYSDOT.

The Site is in the process of being re-defined to include only tax parcel 143.17-1-50, which contains the truck and boat dealership. The parcel is zoned "Highway Commercial Use District". The Site is serviced with public water, sewer, gas and electric. Floor drains within the building discharge to an oil/water separator, located in the north central portion of the building, prior to discharging to the municipal sanitary sewer system. Adjacent properties include Sanford Road North and a stormwater retention basin to the south; a party house to the north; Meyer's RV to the west; and South Main Street (NYS Route 36) and residential property to the east.

1.2 Site History

According to previous environmental reports, the Site was utilized as agricultural land until 1986, when it was developed as an automobile dealership. The facility began operations in 1987 as Gabriele Ford. According to information obtained from the Town of Riga Assessor's Office, the facility was taken over by the Ford Motor Company and operated as Churchville Ford from 1997-2001. The Site was vacant from approximately 2001 until Meyer's Campers purchased the property in 2004. The Site is currently owned by Meyer's at Churchville, LLC and utilized as Mark's Truck and Boat Center.

The main building was originally constructed in 1986, with two additions reportedly constructed between 1996 and 1999. Operations at the Site included sales and service of new and used vehicles as well as vehicle washing and detailing.

A 1,000-gallon aboveground storage tank (AST) was formerly located outside the southwest corner of the main building. This tank has since been removed (date unknown). Historically, the tank contained gasoline, virgin oil, and/or waste oil. A 275-gallon virgin oil AST was located in the service area, and a 200-gallon waste oil AST was formerly located outside the service area. Other vehicle maintenance products including antifreeze, used antifreeze, parts washing solvents, lubricants, automotive fluids, cleaners, and waxes were reportedly used onsite and stored in containers of 55 gallons or less.

Contamination was discovered at the Site in 2002 during an environmental investigation conducted for Meyer's Campers, as part of a property transfer. A Remedial Investigation (RI) was conducted by Entrix Environmental and Lu Engineers between 2004 and 2008. Results of previous investigations are discussed in the following section.

1.3 Previous Investigations

The Site has undergone a series of environmental investigations. These investigations include:

- Preliminary Phase I ESA, *Entrix, Inc.*, November 1997
- Preliminary Phase I ESA, *Entrix, Inc.*, August 2001
- Phase I ESA, *The Sear-Brown Group*, July 2002
- Phase II ESA, *The Sear-Brown Group*, August 2002
- Remedial Investigation, *Entrix Environmental* (2004) and *Lu Engineers* (2006-2008)

The Phase II ESA performed by Sear-Brown in August 2002 identified petroleum products and degreasing solvents in saturated soils and groundwater at the Site. Volatile organic compounds (VOCs) were detected in soil and groundwater at levels above NYSDEC soil cleanup objectives (TAGM 4046) and NYS groundwater standards. The impacted soils appeared to be limited to the western portion of the service area, where solvents were formerly stored. Semi-volatile organic compounds (SVOCs) were detected in soils above cleanup objectives near the former used oil AST, adjacent to the southwest corner of the building.

Additional investigation work at the Site was conducted under the Voluntary Cleanup Program (VCP). A Voluntary Cleanup Agreement was signed in September 2003 by Antonio Gabriele and Joseph Ognibene (the "volunteers") and the NYSDEC. An Investigation Work Plan was originally prepared by Entrix, Inc. (Entrix), the 'volunteer's' consultant. This work plan was approved by the NYSDEC and investigation activities were conducted by Entrix in 2004. Prior to completion of the RI, the 'volunteers' changed consultants from Entrix to Okar Equipment Company, Inc. (Okar). Lu Engineers was contracted by Okar to complete the RI. Lu Engineers prepared a NYSDEC-approved *Voluntary Cleanup Program Work Plan* in August 2006. The remainder of the RI activities were conducted by Lu Engineers between September 2006 and February 2008.

The RI conducted by Lu Engineers and Entrix included the following primary tasks:

- Completion of 20 soil borings;
- Installation of nine (9) groundwater monitoring wells;
- Three rounds of groundwater sampling;
- Collection of 16 surface soil samples;
- Collection of three (3) catch basin sediment samples;
- Two rounds of soil vapor intrusion sampling; and
- Cleaning and evaluation of the oil/water separator.

Results of the RI were presented in a Remedial Investigation Report, prepared by Lu Engineers (July 2008), and are summarized in the following section.

1.4 Summary of Environmental Conditions

Subsurface soil analytical results did not reveal VOCs, SVOCs, or metals above the Restricted Commercial Use (RCU) Guidance Values (6 NYCRR Part 375-6). Therefore, no soil remediation is warranted.

A source area containing elevated levels of trichloroethene (TCE), tetrachloroethene (PCE), and cis-1,2-dichloroethene (cis-1,2-DCE) has been found in groundwater beneath the southwestern portion of the building. This area was formerly utilized for solvent and used oil storage. Figure 4 identifies the extent of total VOCs identified in groundwater at the Site.

Elevated levels of TCE, PCE, and associated breakdown compounds were also detected in sub-slab soil vapor and/or indoor air samples located near the southwest corner of the building. Volatilization to indoor air is a potential exposure route, as elevated levels of TCE were identified in two of the three Lu Engineers' indoor air sampling locations.

Analytical results indicate that polynuclear aromatic hydrocarbons (PAHs) are present in storm sewer sediments and surface soils in the stormwater retention basin located on the southeast corner of the Site. The PAHs do not appear to be associated with a release or spill at the Site, but rather from non-point source origins (i.e., vehicle emissions, fluids, and/or asphaltic debris from adjacent roadways). Given the Site's current status and intended future use as commercial property, dermal contact with surface soils within the stormwater retention basin is not likely.

Based on the findings of the RI, remedial action was recommended to address chlorinated solvents detected in groundwater at levels exceeding NYS Groundwater Standards and NYSDEC guidance (TOGS 1.1.1).

1.5 Summary of Remedy

The elements of the remedy are as follows:

- Groundwater and subsurface soils will be treated via in-situ chemical oxidation (ISCO). Several chemical oxidants are commercially available for use with this technology. For the purpose of this discussion, sodium permanganate ($NaMnO_4$), will be the oxidant selected. When this chemical oxidant comes into contact with organic compounds such at TCE, PCE, and associated breakdown products, a reaction occurs oxidizing the organic contaminants to relatively benign compounds, such as carbon dioxide (CO_2) and water (H_2O).

  The chemical oxidant will be applied through injection wells (4 to 20 feet deep) to treat saturated soils as well as groundwater. This is to target groundwater with

chlorinated solvent concentrations in excess of 5 parts per billion (ppb) and 2 ppb for vinyl chloride.

It is estimated that five new shallow injection points will be installed. Three existing wells (MW-01, MW-03, and MW-06) will also be used as injection wells. The chemical oxidant will be injected during approximately six separate events over several months. During implementation, groundwater concentrations will be monitored and colorimetric testing will be conducted to evaluate oxidant distribution.

- Additional vapor intrusion sampling will be conducted after the oxidant injection is completed to determine if additional vapor intrusion mitigation or long-term monitoring measures are needed. If long-term vapor intrusion monitoring is appropriate, the monitoring plan will be included in the Site Management Plan (SMP). If mitigation is needed, a Remedial Design Plan (RDP) for the mitigation system will be prepared and submitted for NYSDEC review and approval.

- Imposition of an institutional control in the form of a deed restriction that requires a) limiting the use and development of the property to commercial use, which will also permit industrial use; b) compliance with an approved SMP; c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and d) the property owner to complete and submit an annual certification of institutional and engineering controls.

- Development of a SMP, which will include the following institutional and engineering controls: a) continued evaluation of the potential for vapor intrusion for any buildings developed on the Site, including provision for mitigation of impacts identified; b) monitoring of sub-slab soil vapor, indoor air, ambient air and groundwater; c) management of the existing cover system to restrict excavation below the existing cover system including pavement and buildings. Excavated soil will be tested, properly handled to protect the health and safety of workers and the nearby community, and will be properly managed in a manner acceptable to NYSDEC; d) identification of any use restrictions on the Site; e) provisions for the continued proper operation and maintenance of the components of the remedy; f) provisions for reporting on activities associated with implementation of the SMP and progress toward achieving the RAOs; and g) provisions to implement the NYSDEC approved corrective actions or optimization strategies, as necessary, if any portion of the remedy is not achieving the RAOs.

- The property owner will provide an annual certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to NYSDEC, until NYSDEC notifies the property owner in writing that this certification is no longer needed. This submittal will: (a) contain certification that the institutional controls and engineering controls put in

place are still in place and are either unchanged from the previous certification or are compliant with NYSDEC-approved modifications; (b) allow NYSDEC access to the Site; (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by NYSDEC.

Since the remedy could result in untreated hazardous waste remaining at the Site, a long term monitoring program will be instituted. This program may include semi-annual groundwater sampling and analysis for VOCs and metals to monitor the long-term effectiveness of the chemical oxidation.

1.6 Contemplated Use

The contemplated use of the Site, as listed in the VCA, is 'Restricted Commercial' use excluding day-care, child care, and medical care facilities. Mark's Truck and Boat Center will continue to operate at the Site for the foreseeable future. The property is zoned as Highway Commercial and no plans exist for alternative future use.

2.0 Engineering Evaluation of the Remedy / Remedial Action Selection

The following Remedial Action Objectives (RAOs) have been established for the Site.

1. To remove contaminants from the media of concern (groundwater and soil vapor) and establish pre-release conditions if possible. If pre-release conditions cannot be achieved, the above listed SCGs for soil and groundwater will be utilized.
2. To minimize the generation of wastes during the remedial action that require off-site disposal in land disposal units. *(TAGM 4030).*
3. Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
4. Prevent contact with, or inhalation of, volatiles from contaminated groundwater.
5. Remove the source of groundwater contamination.
6. Prevent ingestion/direct contact with contaminated soil and sediment.
7. Prevent inhalation of, or exposure from, contaminants volatilizing from contaminants in soil.
8. Prevent migration of contaminants that would result in groundwater or surface water contamination.

Lu Engineers conducted a detailed review of Site conditions and available remedial strategies for the removal of chlorinated solvent contamination at the Site. The majority of conventional remedial methods transfer contamination from one media to another such as soil vapor extraction, which involves removing petroleum products entrained in soils

by venting contaminants to the atmosphere. Effluent treatment may also be used, but may add costs and require additional tracking and regulatory requirements.

Based on the nature of the Site and distribution of contaminants in the subsurface, Lu Engineers evaluated in-situ chemical oxidation (ISCO) as a way of streamlining the cleanup process. The presence of primarily chlorinated ethene contamination in groundwater at the Site, lack of potential groundwater receptors, and developed nature of the property were key considerations for the selection of ISCO as the primary remedial strategy for this project.

In-situ chemical oxidation destroys site contaminants in place through simple chemical reactions rather than transferring contaminants out of the subsurface for discharge or regulated disposal. When sodium permanganate is used as the oxidant, this process eliminates the contaminant and typically results in the production of small volumes of non-regulated chemical by-products such as carbon dioxide (CO_2), manganese oxide (MnO_2), ionic sodium (Na^+), hydrogen (H^+) and chlorine (Cl^-) by the following reaction:

$$4NaMnO_4 + C_2HCl_3\,(TCE) \longrightarrow 2CO_2 + 2MnO_2 + 2Na^+ + H^+ + 3Cl^-$$

The use of ISCO for remediation of chlorinated solvents in groundwater is an evolving, but well proven technology. Available government and industry research on the subject, including recent publications by the United States Environmental Protection Agency (USEPA)[1], Naval Facilities Engineering Command (NAVFAC)[2] and Interstate Technology Regulatory Council (ITRC)[3] has helped to clarify the nature of the ISCO process for several commercially available oxidants. These oxidants include Fenton's Reagent (hydrogen peroxide and iron), persulfate, ozone, and potassium/sodium permanganate. Based on a review of available literature with respect to the nature and extent of contamination at the Site, $NaMnO_4$ injection is considered the most appropriate compound for elimination of chlorinated VOCs.

As an alternative, RegenOx™, which works very similarly to Fenton's Reagent, may be used after the sodium permanganate injection process has been completed, if deemed appropriate based on results of sampling and testing. RegenOx™ is a form of activated percarbonate designed to degrade a wide variety of contaminants. It is a two-part product composed of an oxidizer/catalyst complex (Part A) and an activator complex (Part B). The oxidizer (Part A) contains sodium percarbonate $(Na_2CO_3)_2(H_2O_2)_3$ and a surface catalyst as the principal ingredients. The two parts are combined and injected into the subsurface via injection wells. Once in the subsurface, the combined product produces an oxidation reaction comparable to that of Fenton's Reagent without a violent exothermic reaction, as described below.

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[1] USEPA Engineering Issue, In-Situ Chemical Oxidation, Scott G. Huling and Bruce E. Pivetz

[2] NAVFAC Southern Division, Systematic Approach to Optimization of a Permanganate In Situ Chemical Oxidation System, June 2004

[3] Technical and Regulatory Guidance for In-Situ Chemical Oxidation of Contaminated Soils and Groundwater, 2nd Edition, June 2005

First, the RegenOx activator complex coats the surface of the contaminant molecule. Then, the oxidizer complex and contaminant react with the activator complex surface destroying the contaminant. Direct oxidation is achieved through the following reaction.

$$C_2Cl_4 + 2Na_2CO_3 \cdot 3H_2O_2 + 2H_2O \longleftrightarrow 2CO_2 + 4\ NaCl + 4\ H_2O + 2\ H_2CO_3$$

2.1 Protection of Human Health and the Environment

The proposed $NaMnO_4$ injection program will achieve the RAOs by destroying the primary source contaminants, TCE and PCE, and other organic contaminants in the subsurface. ISCO using $NaMnO_4$ will typically result in the production of non-hazardous byproducts, therefore, no waste products will be generated or disposed of.

In-situ treatment is also preferred because it prevents human contact with contaminated groundwater or subsurface soils during the remediation process.

2.2 Standards, Criteria, and Guidance (SCGs)

The NYSDEC list of potential SCGs has been used to evaluate applicable or relevant and appropriate requirements for the Former Churchville Ford Site. The following SCGs are applicable to this Site.

1. NYSDEC Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values, dated June 1998. These standards are based on groundwater as a drinking water source.
2. NYS Class GA Groundwater Quality Standards, 6 NYCRR Part 703.5.
3. Soil cleanup objectives provided in 6 NYCRR Part 375-6 for Restricted Commercial Use will be used as soil guidance values for the Site.
4. NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006, sub-slab soil vapor / indoor air decision matrices.

Specific remedial objectives for Site-related constituents are shown in the following tables.

Table 1. Remedial Objectives for Soil and Groundwater

Parameter	Groundwater Standard[1]	Soil Cleanup Objective[2]
Trichloroethene (TCE)	5 ppb	200 ppm
Tetrachloroethene (PCE)	5 ppb	150 ppm
cis-1,2-dichloroethene	5 ppb	500 ppm

1- NYS Class GA Groundwater Quality Standards (6 NYCRR Part 703.5)
2- Restricted Commercial Use soil clean-up objectives (6 NYCRR Part 375-6)

Table 2. NYSDOH Soil Vapor/Indoor Air Matrix 1
(TCE, Carbon Tetrachloride, and Vinyl Chloride Guidance Values)

Sub-slab Vapor Concentration of Compound (ug/m^3)	Indoor Air Concentration of Compound (ug/m^3)			
	< 0.25	0.25 to <1	1 to < 5.0	5.0 and above
< 5	1. No further action	2. Take reasonable and practical actions to identify source and reduce exposures	3. Take reasonable and practical actions to identify source and reduce exposures	4. Take reasonable and practical actions to identify source and reduce exposures
5 to < 50	5. No further action	6. MONITOR	7. MONITOR	8. MITIGATE
50 to < 250	9. MONITOR	10. MONITOR/MITIGATE	11. MITIGATE	12. MITIGATE
250 and above	13. MITIGATE	14. MITIGATE	15. MITIGATE	16. MITIGATE

Table 3. NYSDOH Soil Vapor/Indoor Air Matrix 2
(PCE, 1,1,1-TCA, cis-1,2-DCE, and 1,1-DCE Guidance Values)

Sub-slab Vapor Concentration of Compound (ug/m^3)	Indoor Air Concentration of Compound (ug/m^3)			
	< 3	3 to <30	30 to < 100	100 and above
< 100	1. No further action	2. Take reasonable and practical actions to identify source and reduce exposures	3. Take reasonable and practical actions to identify source and reduce exposures	4. Take reasonable and practical actions to identify source and reduce exposures
100 to < 1,000	5. MONITOR	6. MONITOR/ MITIGATE	7. MITIGATE	8. MITIGATE
1,000 and above	9. MITIGATE	10. MITIGATE	11. MITIGATE	12. MITIGATE

Additional factors that may be considered when evaluating the results are found in the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

2.3 Short-term Effectiveness and Impacts

The short-term effectiveness, oxidant persistence and radial influence of the injection program will be evaluated as work progresses by means of field and laboratory analytical testing. Colorimetric testing will be conducted on wells located in the injection area not being used for oxidant injection. One month after the last injection, samples will be obtained from nearby wells for laboratory analysis of VOCs (EPA Method 8260). It is anticipated that the RAOs can be achieved in less than one year.

Safety risks to Lu Engineers' staff, subcontractors, and other Site workers during handling of the $NaMnO_4$ solution will be taken into account during all site activities. $NaMnO_4$ is a strong oxidizer and can, if contacted with clothing or paper products, result in fire. This risk can be minimized by wearing protective equipment (i.e., face shield, plastic apron, gloves) during handling and transferring the solution in a well-ventilated, open area away from combustibles materials. These preventive measures are

incorporated into the site-specific Health and Safety Plan (Attachment B) and will be strictly enforced.

2.4 Long-term Effectiveness and Permanence

The proposed $NaMnO_4$ injection program is designed to be a permanent remedy by destroying the contaminant source in Site groundwater and saturated soils. Once the source area has been remediated, it is anticipated that residual impacts to unsaturated soils and/or soil vapor will diminish due to the natural process of reductive dechlorination in the subsurface.

The potential exists for rebound in post-oxidation groundwater contaminant concentrations. This may occur via (1) mass transfer from adsorbed and dense non-aqueous phase liquid (DNAPL) into the groundwater, and (2) contaminant mass transport in groundwater to monitoring well sample locations. To evaluate the potential for rebound, semi-annual groundwater sampling will be conducted. The results of this sampling will be used to determine the long-term effectiveness and permanence of the selected remedy.

Upon completion of the ISCO, another round of soil vapor intrusion sampling is proposed to determine if soil vapor and indoor air contaminant concentrations have decreased as a result of the groundwater mitigation. This will be followed by appropriate action per the NYSDOH guidance. Additional sampling may be necessary to monitor long-term soil vapor impacts.

2.5 Reduction of Toxicity, Mobility, or Volume

The proposed remedy is designed to treat a 3,600 ft^2 source area near the southwest corner of the building (see Figure 3). Additional area should be influenced by dissolved phase transport of the $NaMnO_4$ solution and dispersion via groundwater flow. MW-06 will also be utilized as an injection point to treat contaminated groundwater west of the source area.

The complete removal of chlorinated VOCs will be achieved through chemical oxidation reactions. This is an irreversible treatment process that eliminates the toxicity, mobility, and volume of groundwater contamination at the source via chemical processes in the subsurface. The process will prevent the potential for further migration of groundwater contamination at the Site and eliminate the source of volatile soil vapor contaminants.

2.6 Implementability

The proposed ISCO injection program is fairly simple to implement, however, there is the possibility of difficulties due to precipitation of MnO_2. This compound can interfere with the establishment of conditions suitable for beneficial bioremediation following chemical oxidation. To avoid fouling due to MnO_2 buildup, the $NaMnO_4$ solution will be diluted to a relatively low concentration (3%) prior to injection.

Lu Engineers and approved subcontractors are readily available to provide the necessary resources for installation of the injection wells, chemical injection, and short-term and long-term operation and maintenance (O&M) activities.

No permits are necessary for the proposed ISCO program.

3.0 Project Plans and Specifications

This Section describes the tasks necessary to construct and implement the proposed remedy. All remedial activities will be performed under the supervision of Lu Engineers and the NYSDEC, as appropriate.

3.1 Injection Well Installation

It is anticipated that five (5) new injection wells will be installed on the western portion of the main building, near the source area (see Figure 4). Three (3) existing shallow wells will also be used as oxidant injection points (MW-01, MW-03, and MW-06).

Prior to installation of the new injection wells, the Underground Facilities Protection Organization (UFPO) will be contacted for location of underground utilities. The location of privately-owned subsurface structures, including floor drains, will be coordinated with the current owner.

The injection wells will be installed by Trec Environmental,Inc. utilizing a Geoprobe© style rig equipped with hollow stem augers to a total depth of 11.5 feet below ground surface (bgs). The wells will consist of 7.5-feet of one-inch diameter Schedule 40 PVC well screen with a one-inch PVC riser connected to a PVC ball valve and cam lock fitting at the well head. An Injection Well Detail drawing is provided as Figure 5. All injection wells will be installed flush-mounted with bolted well covers.

Limited well development may be performed, as necessary. Development water shall be containerized and disposed of, as appropriate.

The locations and elevations of the newly installed injection wells will be surveyed by a Lu Engineers' licensed surveyor. Coordinates for all injection wells will be provided in meters using the NAD 83 UTM Zone 18 (NYTM) coordinate system. Injection well elevations will be provided in feet using the NAVD 88 coordinate system.

3.2 $NaMnO_4$ Injection

Prior to injection and after the final injection, Lu Engineers will notify the USEPA of the planned oxidant injections. No permits are necessary for the proposed injection system as the injection process is "authorized by rule".

Lu Engineers' subcontractor will utilize a Geoprobe, Incorporated GS-2000 cart-mounted injection system for the subsurface injection of $NaMnO_4$ directly into the contaminated zone(s) of the saturated soils and groundwater underlying the Site. The contaminated area to be directly affected by the injection process is approximately 80 feet by 80 feet (3,600 square feet) and is an average of five feet thick. Surrounding areas will be influenced by the cross and down-gradient movement of $NaMnO_4$ through the saturated zone.

The amount of oxidant required for contaminant removal has been determined based in part on a spreadsheet provided by Carus Corporation, the manufacturer of RemOx® ISCO Reagent, which is the oxidant planned for use at this Site. This spreadsheet is provided as Attachment A. Site data specifying contaminant levels, saturated soil porosity, and other factors are input to calculate the amount of permanganate needed to destroy the Site contaminants. The RemOx® Reagent comes as a 40% solution of $NaMnO_4$. To avoid fouling due to MnO_2 buildup, the $NaMnO_4$ solution will be diluted to a 3% concentration prior to injection. At this concentration, it will be necessary to deliver a total of 136 gallons of solution into each of the 8 injection locations over the course of the 6 planned injection events.

3.2.1 Dilution of RemOx®

The 40% $NaMnO_4$ solution will be mixed in a corrosion resistant drum in measured proportions with water to achieve the desired 3% dilution. A total of 1.3 gallons of 40% RemOx solution will be added to 21.4 gallons of water measured in the mixing drum. Minimal mixing will be necessary due to the high miscibility of the permanganate solution with water.

Personnel handling the $NaMnO_4$ solution will don protective equipment including chemically resistant gloves, aprons, and face shields. RemOx® should be stored in a closed container in a cool, dry area, as recommended on the Material Safety Data Sheet (MSDS). Additional health and safety considerations are addressed in the Health and Safety Plan (Attachment B). The injection process will continue at each injection point until a total of 22.7 gallons of solution is injected during each event.

3.2.2 Injection System

Figures 5 and 6 indicate the conceptual design of the injection system. As described above, the diluted 3% solution will be mixed in a chemically resistant 55-gallon drum. A subcontracted Geoprobe® GS-2000 injection system will be used for oxidant injection. The solution will then be transferred via chemical-resistant hand pump and hose (or equivalent methods) to the 9.5-gallon capacity hopper located on the GS-2000 unit. The GS-2000's hose will be attached to injection wells using a one-inch diameter cam lock connector (see Figure 6).

The injection system will manually be moved to each of the 8 injection wells inside and outside of the building. Exhaust from the GS-2000 will be vented to the building exterior using flexible, heat-resistant hose and/or ventilation fans.

The 3% solution will be injected at approximately 50 pounds per square inch (psi), allowing for a flow rate of approximately 0.45-gallon per minute, or 27 gallons per hour. Actual injection pressure will be measured using a gage located on the GS-2000 injection line. Oxidant flow rate will be determined based on timing the injection process.

Approximately 23 gallons of solution will be injected into each of the wells once every two weeks. A total of six injection events are anticipated in order to achieve the desired 136 gallons of solution for each injection location. Adjustments to the frequency and volume of injections as well as the oxidant concentration may be necessary based on the observed effectiveness of the program.

The injection process will be documented in the site log book during each injection event. The amount of oxidant injected, injection pressures and related information will be documented for future reference.

3.3 Groundwater Monitoring & Sampling

Groundwater levels will be collected from all of the on-site wells prior to each injection, or at least once a month, to evaluate any changes in groundwater flow patterns resulting from implementation of the remedy.

Existing monitoring wells in the area that are not used for injection will be tested by field and laboratory methods to evaluate the effectiveness of the $NaMnO_4$ injection program. These wells include MW-JCL-01, MW-JCL-02, and MW-JCL-03. Colorimetric testing will be used to determine relative concentrations of $NaMnO_4$ in the source area and to evaluate the oxidant distribution (radius of influence) and persistence.

It is estimated that three to four groundwater samples will be collected from existing wells MW-JCL-02, MW-JCL-03, and MW-13 during the injection program to evaluate the effectiveness of the $NaMnO_4$. The samples will be collected using disposable polyethylene bailers and submitted to Paradigm Environmental Services for analysis of VOCs and TAL metals. Metals shall be monitored as part of the analytical program since in situ chemical oxidation can result in increased concentrations and mobilization of metals in groundwater. Category B deliverables are not anticipated for this portion of the sampling program.

One month after the final injection, groundwater samples will be collected from monitoring wells MW-JCL-02, MW-JCL-03, and MW-13 to evaluate the short-term effectiveness of the ISCO. Groundwater sampling procedures are detailed in the attached QAPP (Attachment C). These post-injection samples will be submitted to Paradigm Environmental Services for analysis of VOCs (EPA Method 8260) and TAL metals (EPA Method 6010).

To evaluate the long-term effectiveness of the ISCO, monitoring wells MW-JCL-01, -02, -03, MW-01, MW-03, MW-06, and MW-13 will be sampled for VOCs and metals semi-annually. The sampling results will be submitted to the NYSDEC for review and evaluated to determine if the groundwater monitoring can be terminated. Monitoring for metals may be eliminated based on preliminary sampling results and approval from the NYSDEC. A groundwater monitoring plan will be included in the Site Management Plan, submitted as part of the final report.

3.4 Site Control and Signage

All of the new injection wells to be installed are located within the Site building, except for one located adjacent to the south wall of the paint shop (see Figure 3). During drilling, this outside area will be cleared and coned off as necessary to keep employees and customers away from the work area. Indoor injection well locations will be coordinated with Mark's Truck and Boat staff so that the work area will be cleared of obstructions and coned off.

During the injections, all combustible materials in the immediate area of the injection wells will be removed. Cones shall be placed around the wells and associated equipment. This work will be coordinated with the building owner to minimize disruption of business activities. Additional site control and safety measures are included in the Health and Safety Plan (Attachment B).

If necessary, a "Transform the Past....Build for the Future" sign will be displayed on-site during remediation activities. Sign requirements are as follows.

- Size: 96" wide x 48" high
- Construction: aluminum or wood sign board with vinyl sheeting
- Text Color: PMS 301 Blue, PMS 355 Green
- Type: Caslon 540

A draft layout of the proposed sign is included in Attachment D.

3.5 Vapor Mitigation Plan

Another round of vapor intrusion sampling is proposed after the final injection is complete to determine the impact on soil vapor from the ISCO of VOCs in the source area. Sampling will be conducted at the two locations where mitigation was recommended based on results of the remedial investigation vapor intrusion sampling:

- SVS-JCL-02 / IA-JCL-02
- SVS-JCL-03 / IA-JCL-03

A sub-slab vapor sample and an indoor air sample will be collected at each location. An outdoor ambient air sample will also be collected upwind of the building. The vapor intrusion sampling procedure is detailed in the QAPP (Attachment C).

Based on the results of the post-injection sampling, the appropriate action shall be taken following the NYSDOH *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006, as shown on the decision matrices listed in Section 2.2 above. If long-term vapor intrusion monitoring is deemed appropriate, a monitoring plan will be created for inclusion in the Site Management Plan. If vapor intrusion mitigation is warranted, a Remedial Design Plan for the mitigation system will be prepared and submitted for NYSDEC review and approval.

3.6 Site Management Plan

If necessary, a Site Management Plan (SMP) will be created for submission to the NYSDEC. The SMP will include:

- An Operation, Maintenance, and Monitoring (OM&M) Plan;
- Institutional and Engineering Control Plan;
- Soil Management Plan;
- Reporting provisions;
- Provisions for implementing corrective actions, if necessary; and
- Provisions for site closure and well decommissioning.

The SMP will be signed and stamped by a licensed professional engineer and submitted with the Final Engineering Report.

4.0 Institutional Controls

Long-term institutional controls, in the form of deed restrictions, will be necessary for this project. Deed restrictions may include:

- Limiting the use and development of the property to commercial use, which also permits industrial use;
- Compliance with the approved SMP;
- Restricting the use of groundwater as a source of potable or process water (Note: public water is supplied to the Site); and
- The property owner to complete and submit an annual certification of institutional and engineering controls.

The current owners have agreed to file and comply with the necessary deed restrictions, and a certified copy of such restrictions will be included in the Final Engineering Report.

5.0 Health and Safety Plans

A site-specific Health and Safety Plan (HASP) has been prepared for this project and is included as Attachment B. The HASP also includes a Community Air Monitoring Plan

(CAMP). The HASP and CAMP will be reviewed by all employees before starting Site work. Monitoring of the work area and screening of soil and groundwater will be conducted throughout the duration of RA activities using a MiniRAE 2000 PID, or equivalent.

Lu Engineers' employees and subcontracted personnel will have completed the OSHA 40-hour HAZWOPER training with current refresher courses. A copy of the HASP will be available onsite at all times during remedial activities.

6.0 Quality Assurance/Quality Control

Lu Engineers is responsible for the project management, coordination and scheduling, subcontracting, and quality assurance/quality control (QA/QC) of RA activities. General QA/QC procedures, including sample preparation and holding times, are described in the Quality Assurance Project Plan (Attachment C).

Except as noted, analytical work will be performed by an appropriately qualified ELAP/CLP certified subcontracted laboratory. Analytical methods reflect the requirements of the NYSDEC Analytical Services Protocol (ASP), Revised June 2000.

7.0 Reporting and Schedule

Upon receipt and review of all necessary data, a Final Engineering Report (FER) will be prepared including:

- A description of the remedy, as constructed, pursuant to the RAWP;
- A summary of all remedial actions completed;
- A list of cleanup levels/RAOs applied to the remedial actions;
- An evaluation of the effectiveness of the remedy;
- Tables and figures containing all pre-and post-remedial data keyed appropriately so that completion of the remedial action will be documented. The figures will clearly indicate the volume of contaminated media (groundwater and soil vapor), which was remediated;
- A detailed description of any Site restoration activities (if any);
- A description of institutional controls employed at the Site;
- A Site Plan with "as-built" drawings that include all changes made to the final design during construction, permanent structures, injections wells, monitoring wells, or other remedial structures, as well as documented areas of changed conditions or removals;
- Site Management Plan (SMP), as a separate document, signed and stamped by a licensed P.E.;
- Certification that the RAWP was implemented;

- Declaration of Covenants and Restrictions (the deed restrictions) recorded with the County Clerk and certified by the County Clerk to be a true and faithful copy;
- Fully executed manifests documenting any off-Site transport of waste material;
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables in PDF format;
- Coordinates for all injection wells in meters, using the NAD 83 UTM Zone 18 (NYTM) coordinate system. Injection well elevations will be provided in feet using the NAVD 88 coordinate system;
- Summary tables of all field measurements including water level elevations, results of colorimetric tests, and air monitoring results;
- Permits or registrations that were obtained to implement the remedy;
- Sample collection logs;
- Photographs of the remedial system;
- Data usability summary reports (DUSR); and
- Any other information requested from the NYSDEC;

A project schedule, including all anticipated fieldwork and report submission, is included in Attachment D.

Periodic progress reports will be submitted to NYSDEC and include a description of work completed during the reporting period, problems encountered, sampling results, and any changes to the scope of work. These reports will be submitted electronically in portable document format (PDF) with searchable text, by the 10th day of each month, until the FER is approved.

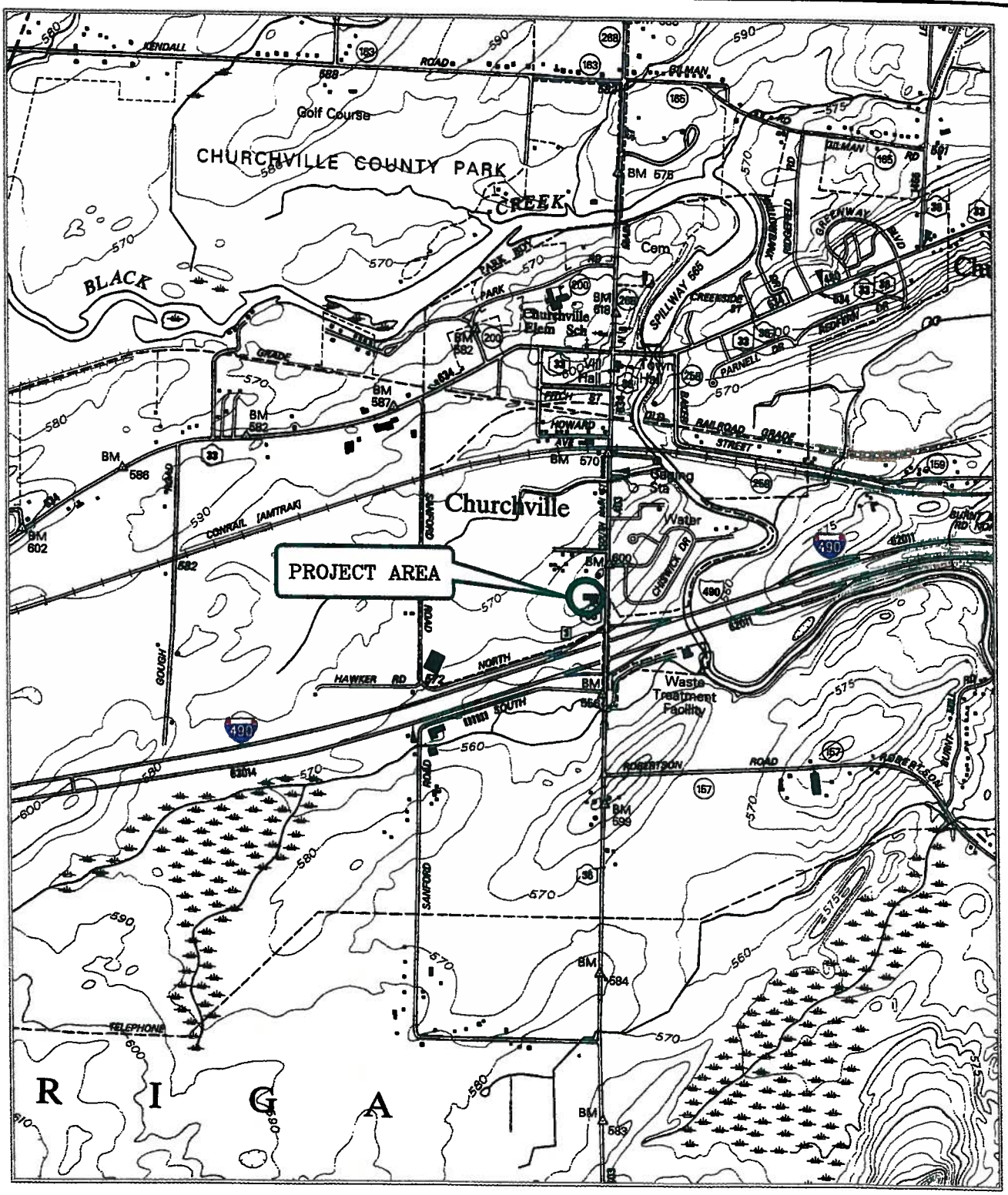
8.0 Project Organization

The project team is anticipated to be as follows:

Robert Elliott, P.E.	Project Director
Greg Andrus, CHMM	Project Manager
Steve Campbell, CHMM	Quality Assurance Officer
Eric Detweiler	Field Geologist
Laura Smith	Field Technician
Subcontractors	
Paradigm Laboratories	Analytical Laboratory
Centek Laboratories, Inc,	Analytical Laboratory- soil vapor
Upstate Laboratory	ASP Analytical Laboratory
Trec Environmental	Geoprobe Contractor
MECX, Inc.	Data Validation (as necessary)

Qualifications for Lu Engineers' personnel are included in Attachment D. Lu Engineers has experienced success with permanganate and Regenox® for cleanup of trichloroethylene and dichlorobenzene in soil and groundwater under contract for the United States Air Force. Trec Environmental, Inc. has performed oxidant injection on numerous sites in New York State and will employ the most current methods and equipment to assure successful completion of this project.

Figures



LU ENGINEERS
Civil and Environmental
JOSEPH C. LU ENGINEERING AND LAND SURVEYING, P.C.
2230 PENFIELD ROAD PENFIELD, NEW YORK 14526
PHONE: 585.377.1450 FAX: 585.377.1266

FIGURE 1. SITE LOCATION MAP

TOWN OF CHURCHVILLE – FORMER CHURCHVILLE FORD
OKAR EQUIPMENT
111 SOUTH MAIN STREET
CHURCHVILLE, NY MONROE COUNTY

DATE:	DECEMBER 2007
SCALE:	1:24,000
DRAWN BY:	DLS

MAP SOURCE: NYS DOT RASTER QUADRANGLE, CHURCHVILLE & CLIFTON / NEW YORK, MONROE COUNTY DOT EDITION DATE: 1997 / USGS CONTOUR DATA: 1950

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N/F
COMIDA
Realty income corp.
TA# 143.17-1-49

HORIZONTAL DATUM NAD 83/96
VERTICAL DATUM NAVD 88

FMR
JOSEPH J. OGNIBENE
and
ANTONIO M. GABRIELE
TA# 143.17-1-1.21
±10.28 acres

CHURCHVILLE-RIGA ROAD N.Y.S. RTE. 36

approx. r.o.w.

I-490

HOUSE
VILLAGE OF CHURCHVILLE
NO PARKING
ROUTE 36
T.P. RTC 30
WOOD SIGN WELCOME TO CHURCHVILLE
TELE BOX
ADOPT A HIGHWAY SIGN
P.P. 31
P.P. RTC 31
P.P. RTC 32
P.P. 39
ELEC. BOX
CONC. MON.
STOP
1-490 SIGN
Bush 3'x2' elec. box
parking lot
gravel parking lot

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

DATE	REVISIONS	BY

DRAWING ALTERATION

WARNING: It is a violation of the New York State Education Law, Article 145, Section 7209, Special Provision 2, for any person unless he is acting under the direction of a Licensed Professional Engineer or Land Surveyor to alter an item in any way. If an item bearing the seal of an engineer or land surveyor is altered, the altering engineer or land surveyor shall affix to the item his seal and notation "altered by" followed by his signature and date of such alteration, and a specific description of the alteration.

BY: _____
DATE: _____

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PROJECT:

FORMER
CHURCHVILLE FORD

CLIENT:

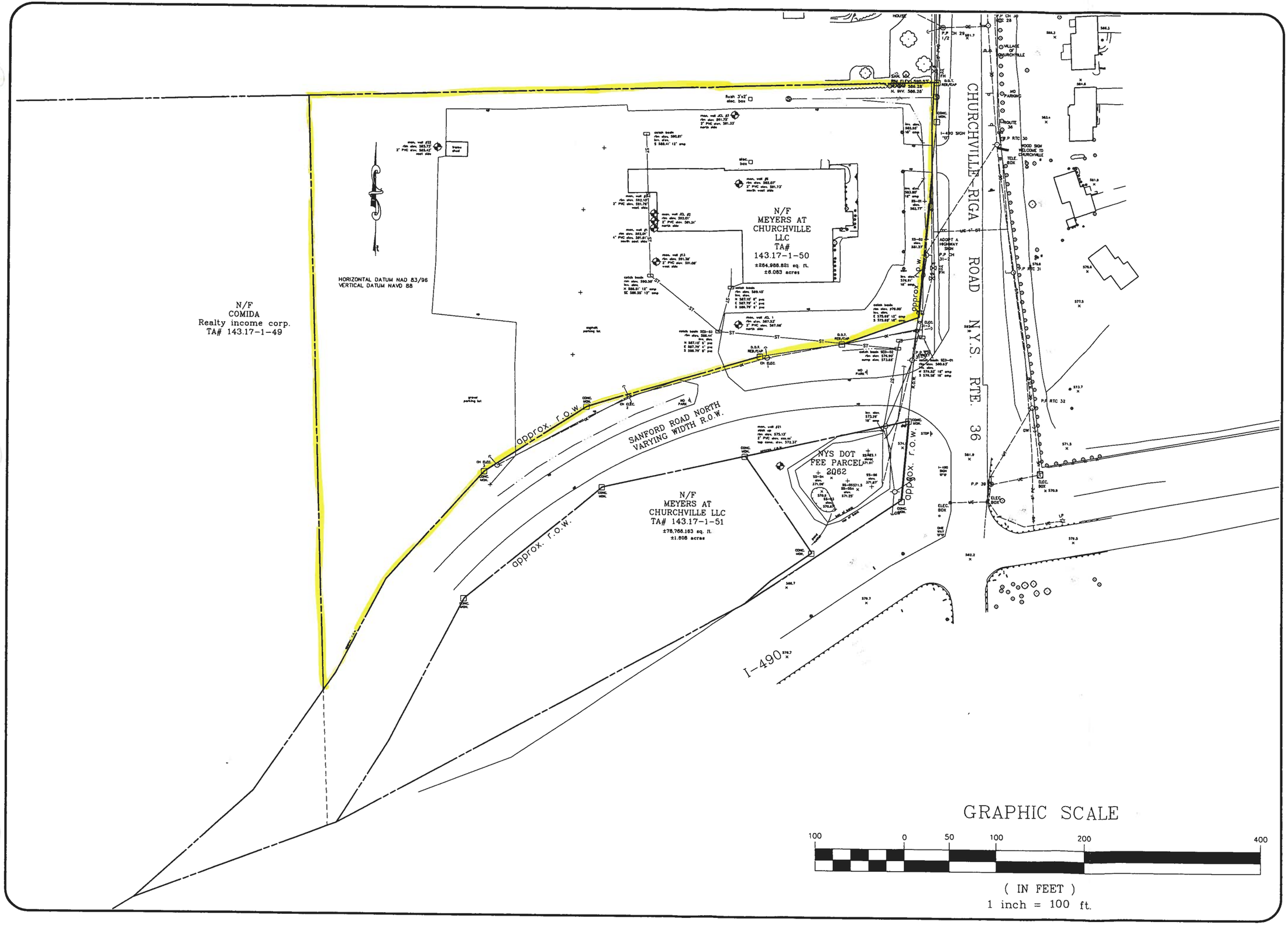
OKAR EQUIPMENT
COMPANY, INC.

DRAWING TITLE:

FIG. 2
ORIGINAL
SITE PLAN

DESIGNED BY: EO/LS	SCALE: 1" = 100'
DRAWN BY: CJR	DATE: May 2008
CHECKED BY: GA	PROJECT No. 57D1-11
SHEET OF	DRAWING No.

J:\PROJECTS\5701 OKA ...PORT\5701-11 OKAR\CADD\RI_REPORT\FIG 2&3_SITE PLANS.DWG, 8/25/2008 1:51:24 PM, DIANE



DATE	REVISIONS	BY

DRAWING ALTERATION

WARNING: It is a violation of the New York State Education Law, Article 145, Section 7209, Special Provision 2, for any person unless he is acting under the direction of a Licensed Professional Engineer or Land Surveyor to alter an item in any way. If an item bearing the seal of an engineer or land surveyor is altered, the altering engineer or land surveyor shall affix to the item his seal and notation "altered by" followed by his signature and date of such alteration, and a specific description of the alteration.

BY: _____

DATE: _____

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PROJECT:

FORMER
CHURCHVILLE FORD

CLIENT:

OKAR EQUIPMENT
COMPANY, INC.

DRAWING TITLE:

FIG. 3
NEW SITE PLAN
(SUB-DIVISION)

DESIGNED BY: ED/LS	SCALE: 1" = 100'
DRAWN BY: CJR	DATE: May 2008
CHECKED BY: GA	PROJECT No. 5701-11
SHEET OF	DRAWING No.

J:\PROJECTS\5701 OKAP 'PORT\5701-11 OKAR\CADD\RI_REPORT\FIG 2&3_SITE PLANS.DWG, 8/25/2008 1:52:27 PM, DIANE

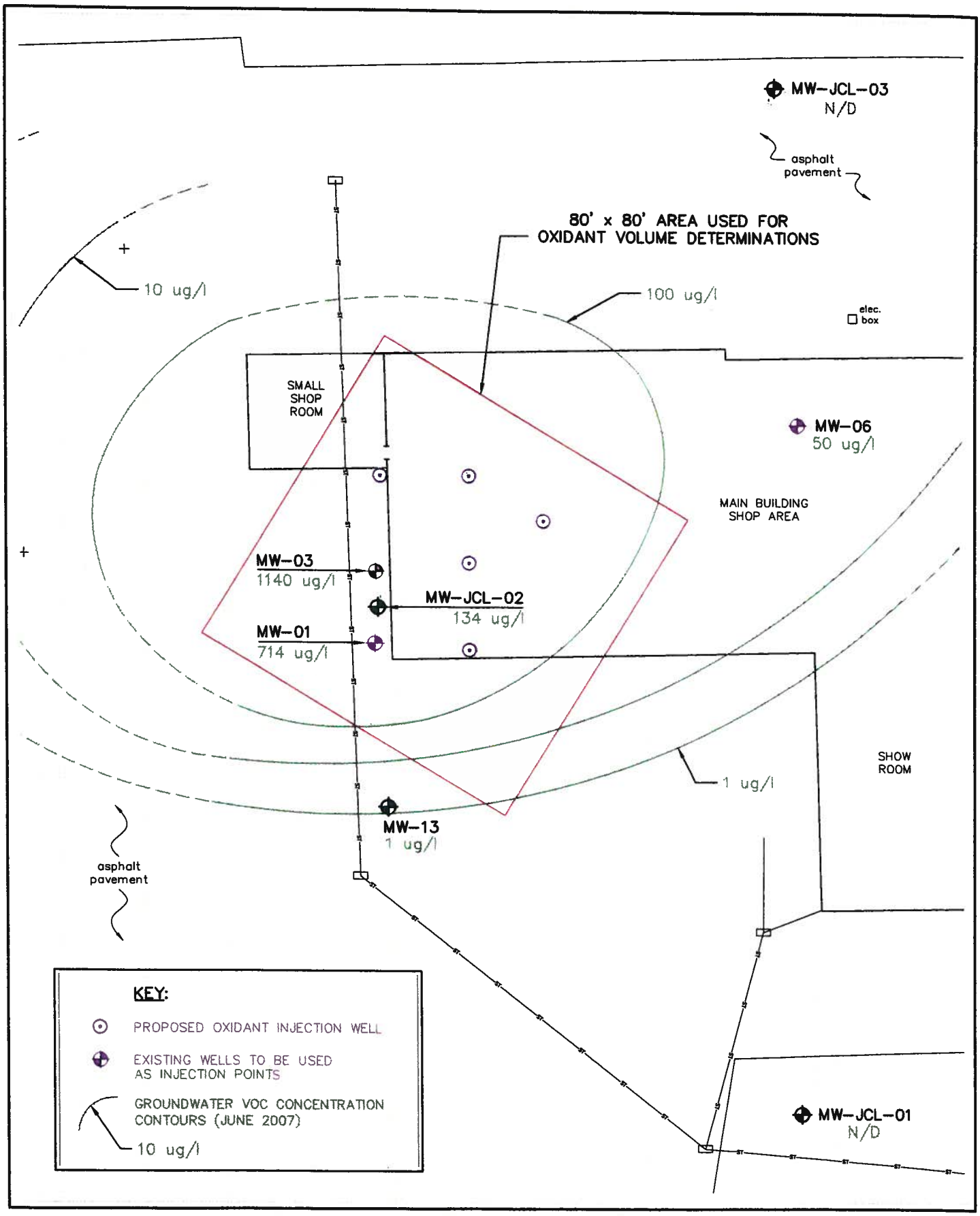

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FIGURE 4.

PROPOSED INJECTION WELL LOCATIONS

CHURCHVILLE FORD
REMEDIAL ACTION WORK PLAN

DATE:	DECEMBER 2007
SCALE:	1" = 30'
DESIGNED/DRAWN/CHECKED	GA/DS/JB
P.N.	5701-11

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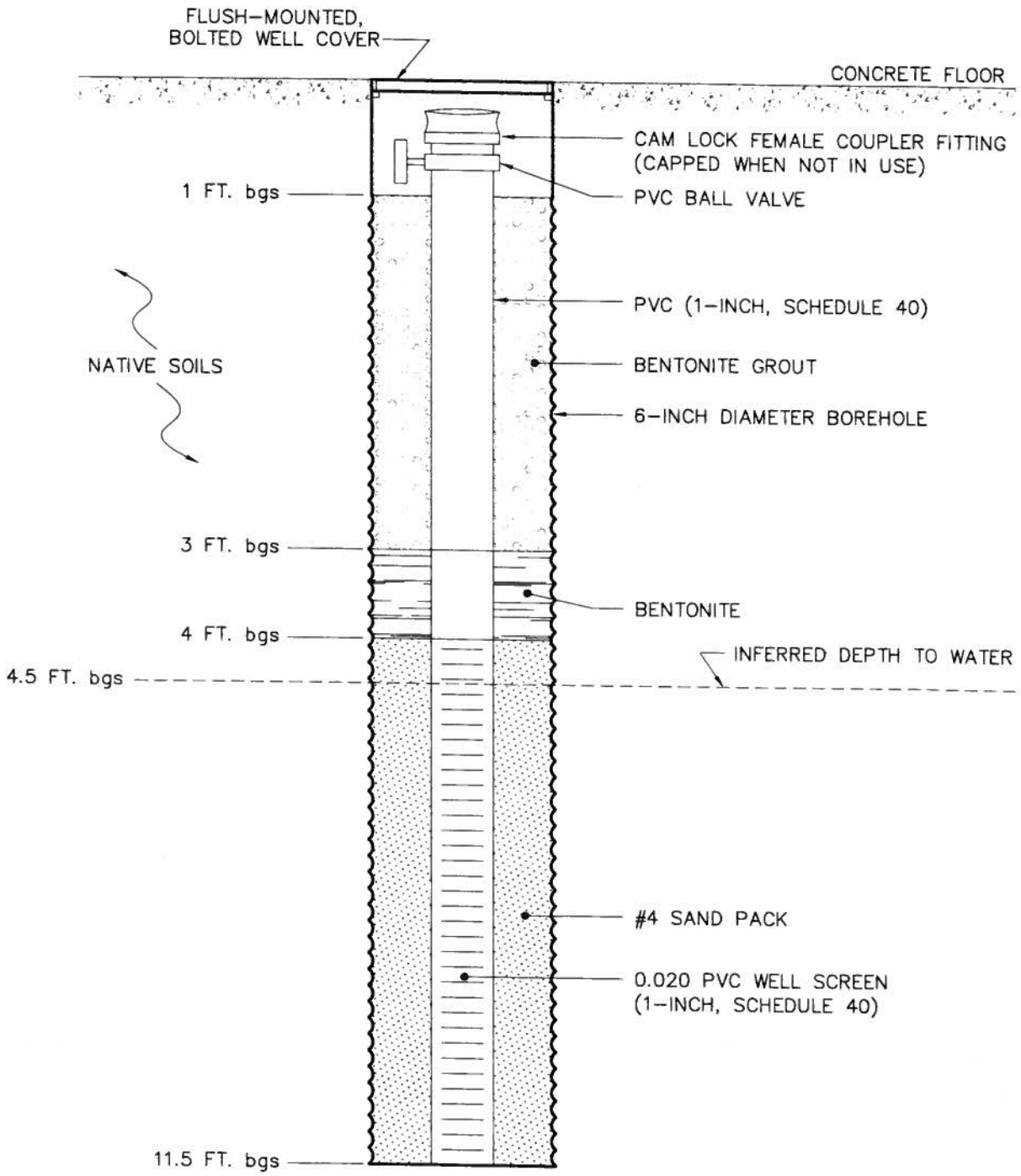

INJECTION WELL DETAIL

NOT TO SCALE

bgs = Below Ground Surface

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FIGURE 5.

INJECTION WELL DETAIL

CHURCHVILLE FORD
REMEDIAL ACTION WORK PLAN

DATE:	DECEMBER 2007
SCALE:	NONE
DESIGNED/DRAWN/CHECKED	GA/DS/JB
P.N.	5701-11

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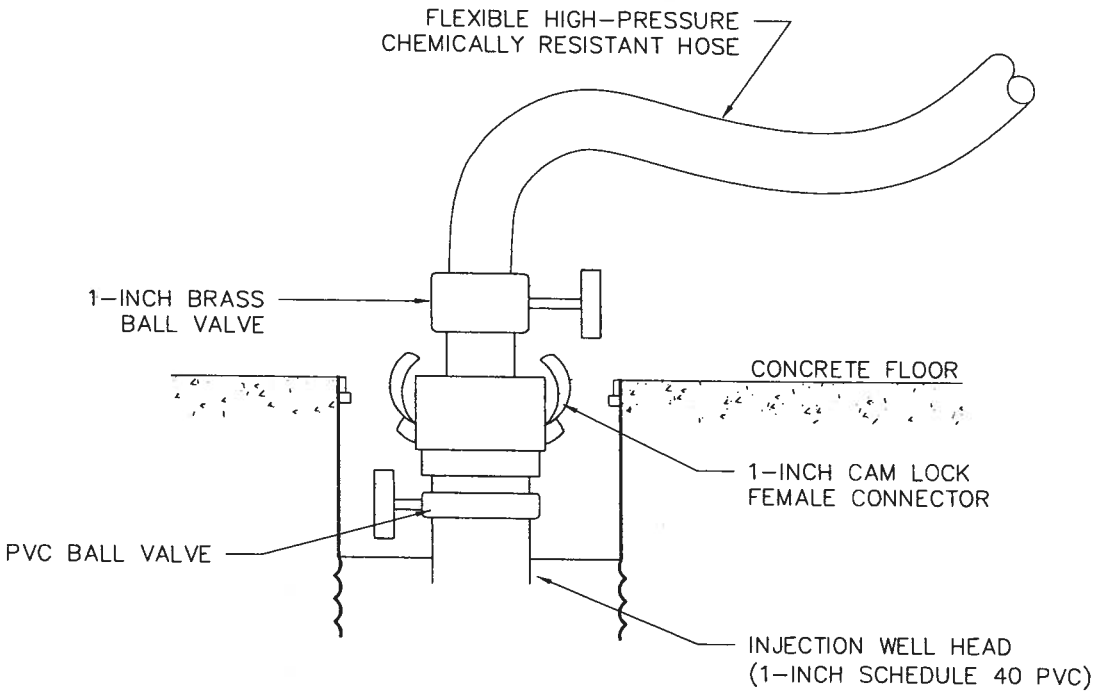

INJECTION WELL HEAD ASSEMBLY

NOT TO SCALE

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FIGURE 6.

INJECTION WELL HEAD ASSEMBLY

CHURCHVILLE FORD
REMEDIAL ACTION WORK PLAN

DATE:	DECEMBER 2007
SCALE:	NONE
DESIGNED/DRAWN/CHECKED	GA/DS/JB
P.N.	5701–11

Attachment A

ISCO Calculation Spreadsheets

Version 3.0 0104

Parameters	Units	Estimates	
*** Site Description ***			
Length	Ft.	80	
Width	Ft.	80	
Area	Sq. Ft.	6400	
Thickness	Ft.	5	
Total Volume	Cu. Yd.	1185	
Porosity	%	25	
Plume Total Pore Volume	Gal.	59844	
Avg. Contaminant Conc.	ppm	0.4	
Mass of Contaminant	lb.	0.199768863	
PSOD	g/kg	1	
Effective PSOD %	10	0.1	
PSOD	lb/yd3	0.297	
PSOD Oxidant Demand	lb	352.00	
Avg. Stoichiometric Demand	lb/lb	2.4	
Contaminant Oxidant Demand	lb.	0.479445271	
Theoritical Oxidant Demand	lb.	352.48	
Confidence Factor		1	
Calculated Oxidant Demand		352.48	
*** Injection Design ***		KMnO4	NaMnO4
Radius of Influence	Ft.	15.00	15
Number of Injection Points		8.00	8.00
Injection Concentration	% wt/wt	3.00%	3.00%
Flow Rate - Per Injection Point	GPM	0.45	0
Number of Wells per Phase		8	8
Total Injection Flow Rate	GPM	3.60	4
Estimated Injection Pressure	PSIG	50.00	50
Injection Volume/Hole	Gal	170.82	153.57
*** Injection Schedule ***			
Hours per Day	Hrs	1.00	1
Days Per Week	Days	1.00	1
Number of Inj. Days	Days	6.33	5.69
Number of Inj. Weeks	Weeks	6.33	5.69

40% NaMnO4 Injection Options

Pounds of 40% NaMnO4 Solution	Gallons of 40% Solution	Number of Pails	Number of Drums	Number of IBC's	Price per Lb of Solution	Total Cost of Chemical
784	68.80	13.76	1.43	0.26	$ -	$ -

Total Gallons of Dilution Water Required	Dilution Water Flow Rate - GPM	NaMnO4 40% Solution Flow Rate - GPM
1,159.79	3.40	0.20

OR

Dilution Water Gals per Pail	Dilution Water Gals per Drum	Dilution Water Gals per Tote
84.29	809.21	3,708.87

Dry KMnO4 Injection Options

Pounds of KMnO4 (Dry Crystals)	Number of Pails	Number of Drums	Number of SS**	Price per Lb (Dry)	Total Cost of Chemical
352	6.39	1.07	0.18		$0.00

Total Gallons of Dilution Water Required	Dilution Water Flow Rate - GPM
1,366.53	3.60

OR

Dilution Water Gals per Pail	Dilution Water Gals per Drum	Dilution Water Gals per Tote
213.23	1,279.38	12,793.76

**Call Carus for Details on larger packages

Instructions: Fill in all white colored blanks. Leave all shaded cells - these calculate themselves.
Please call Carus at 800/435-6856 for current chemical pricing.

				assumed density		Result
g KMnO4 / kg soil	lb KMnO4 / 454 g KMnO4	kg soil / 1000 g soil	454 g soil / lb soil	110 lb soil / ft^3	27 ft^3 soil / yd^3 soil	2.97

CARUS®

RegenOx Design Software for Grid Applications

Aug 2006

Regenesis Technical Support: USA (949) 366-8000 www.regenesis.com

Site Name: Revision 2 8/26/08
Location: Churchville Ford
Consultant: LU

Number of RegenOx application (first, second, third, fourth . . .)	first			
Is NAPL present? (yes or no)	no			
Estimated Plume Requiring Treatment				
Width of plume (intersecting gw flow direction)	40	ft		
Length of plume (parallel to gw flow direction)	80	ft	3,200	ft²
Depth to contaminated zone	10	ft		
Thickness of contaminated zone	5	ft		
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)	silty sand			
Total porosity	0.3	Effective porosity:	0.2	
Hydraulic conductivity	0.1778	ft/day	6.3E-05	cm/sec
Hydraulic gradient	0.005	ft/ft		
Seepage velocity	1.6	ft/yr	0.004	ft/day
Total Pore Volume	4,800	ft³	35,909	gallons

Dissolved Phase Oxygen Demand:

Individual species that represent oxygen demand:	Contaminant Conc. (mg/L)	Contaminant Mass (lb)	Stoichiometry (wt/wt) Oxidant/contaminant	RegenOx Oxidant Dose (lb)
Benzene	0.00	0.0	12.7	0
Toluene	0.00	0.0	11.9	0
Ethylbenzene	0.00	0.0	15.7	0
Xylenes	0.00	0.0	15.7	0
Tetrachloroethene (PCE)	0.47	0.1	1.3	0
Trichloroethene (TCE)	0.38	0.1	2.4	0
cis-1,2-dichloroethene (DCE)	0.62	0.2	4.3	1
Vinyl Chloride (VC)	0.00	0.0	8.4	0
tph	0.00	0.0	12.0	0
User added, add stoich. demand and Koc (see pull-down)	0.00	0.0	0.0	0
373				

* stoichiometries listed for petroleum hydrocarbons assume partial oxidation to biodegradable intermediates

Measures of total oxygen demand					
Estimated total oxidant demand	10.00	g oxidant/kg soil	total oxidant demand =	17,579	lbs
Known total oxidant demand (from bench test)	9.00	g oxidant/kg soil	total oxidant demand =	15,822	lbs

Parameters for Sorbed Phase Oxygen Demand:

Soil bulk density	1.76	g/cm³ =	110	lb/cf
Fraction of organic carbon (foc)	0.01	range: 0.0001 to 0.01		
(Estimated using sorbed phase = foc*Koc*Cgw)				
(Adjust Koc as necessary to provide realistic estimates)				

Individual species that represent oxygen demand:	Koc (L/kg)	Contaminant Conc. (mg/kg)	Contaminant Mass (lb)	Stoichiometry (wt/wt) Oxidant/contaminant	RegenOx Oxidan Dose (lb)
Benzene	123	0.00	0.0	12.7	0
Toluene	267	0.00	0.0	11.9	0
Ethylbenzene	327	0.00	0.0	15.7	0
Xylenes	298	0.00	0.0	15.7	0
Tetrachloroethene (PCE)	371	1.74	3.1	1.3	5
Trichloroethene (TCE)	122	0.44	0.8	2.4	2
cis-1,2-dichloroethene (DCE)	80	0.50	0.9	4.3	5
Vinyl Chloride (VC)	2.5	0.00	0.0	8.4	0
tph	373	0.00	0.0	12.0	0
User added, add stoich. demand and Koc (see pull-down)	0	0.00	0.0	0.0	0

Summary of Estimated RegenOx Requirements

	Dissolved Phase Oxidant Dose (lbs)	Sorbed Phase Oxidant Dose (lbs)	RegenOx Safety Factor	Total RegenOx Oxidant Dose (lbs)	RegenOx Oxidan Cost
Stoichiometric Oxidant Dose	2	12	5.0	70	$139
Known Total Oxidant Demand	Percentage of TOD accounted for:		100%	15,822	$30,061
Oxidant material requirement	Percentage of TOD accounted for:		2%	387	$766

Required RegenOx oxidant quantity (in 30 lb increments) ----------> 390 lbs RegenOx oxidant

Delivery Design for RegenOx

Spacing within rows (ft)	Consider tighter spacing	20.0	ft
# points per row		2	points/row
Spacing between rows (f	Consider tighter spacing	20.0	ft
# of rows		4	rows
Advective travel time bet. rows (days)		4499	days
Number of points in grid		8	points
Oxidant application rate (lbs/ft)		9.8	
Total RegenOx oxidant required		390	lbs of RegenOx oxidant
Total RegenOx activator required		390	lbs of RegenOx activator

Mixing Volume for Injections

Volume of pore space (effective)	3200	ft³
Percent of pore space occupied by RegenOx solution	4%	
Amount of RegenOx activator required for injection	390	lbs
Amount of water required for injection	924	gallons
Percent oxidant in solution	4.60%	
Volume of water required per foot of injection	23.1	gallons
Amount of oxidant required per foot of injection	9.8	lbs
Amount of activator required per foot of injection	9.8	lbs
Total volume of solution injected per foot of injection	25.0	gallons
Radial influence (assuming 100% pore volume displacement)	2.3	feet
Estimated efficiency factor	0.75	
grams of oxidant per kg of soil	0.22	g/kg
oxidant concentration	1301	mg/L
price per cubic yard of soil treated	$3.29	

Project Summary

Number of RegenOx delivery points (adjust as necessary for site)	8	
RegenOx oxidant application rate in lbs/ft (adjust as necessary for site)	9.8	lbs/foot
RegenOx oxidant material requirement (lbs)	390	lbs
Number of 30 lb RegenOx oxidant buckets	13.0	buckets
RegenOx activator application rate in lbs/ft (adjust as necessary for site)	9.8	lbs/foot
RegenOx activator material requirement	390	lbs
Number of 30 lb RegenOx activator buckets	13.0	buckets
Bulk RegenOx material requirement for single injection	780	lbs
Unit cost of RegenOx (per pound)	$ 2.50	
Total RegenOx material cost for single injection	$ 1,950	
Shipping and Tax Estimates		
Sales Tax rate: 0.00%	$ -	
Total Material Cost	$ 1,950	
Shipping (call for amount)	$ -	
Total Regenesis Material Cost	$ 1,950	

RegenOx Injection Cost Estimate (responsibility of customer to contract work)

Footage for each point = uncontaminated interval ÷ RegenOx injection interval (ft)	15	
Total length for direct push for project (ft)	120	
Estimated daily installation rate (ft per day: 200 for push, 100 for drilling)	150	
Estimated points per day (7 to 20 is typical for direct push)	10.0	
Required number of days	1	
Mob/demob cost for injection subcontractor	$ -	
Daily rate for injection subcontractor	$ -	
Total injection subcontrator cost for application	$ -	
Total Install Cost (not including consultant, lab, etc.)	$ 1,950	

Other Project Cost Estimates

Design	$	-
Permitting and reporting	$	-
Construction management	$	-
Groundwater monitoring and rpts	$	-
Other	$	-
Other	$	-
Other	$	-
Other	$	-
Total Project Cost	$	1,950

Attachment B

Health and Safety Plan

Former Churchville Ford
NYSDEC Site # V00658-8
111 South Main Street
Village of Churchville
Monroe County, New York

Health and Safety Plan

Remedial Action Work Plan

Prepared For:

Okar Equipment Company, Inc.
754 Brooks Avenue
Rochester, New York 14619

Prepared By:

LU ENGINEERS
Civil and Environmental
2230 Penfield Road
Penfield, New York 14526

Project No. 5701-11

Table of Contents

Attachments

Lu Engineers
Health & Safety Plan

A. GENERAL INFORMATION

Project Title:	Churchville Ford Remedial Action Work Plan	Project No.	5701-11
Project Manager:	Greg Andrus	Project Director:	Robert Elliott, P.E.
Location:	111 South Main Street Village of Churchville, Monroe County, New York		
Prepared by:	Staff	Date Prepared:	August 2006
Revised by:	Janet M. Bissi, CHMM	Date Revised:	December 2007
	Laura M. Smith		August 2008
Approved by:	Greg Andrus, CHMM	Date Approved:	August 2008

Scope/Objective of Work: Installation of five injection wells, injection of aqueous sodium permanganate into the subsurface, and associated sampling and testing.

Proposed Date of Field Activities: Summer/Fall 2008

Background Information: [X] Complete [ ] Preliminary

Overall Chemical Hazard: [ ] Serious [ ] Moderate
[X] Low [ ] Unknown

Overall Physical Hazard: [ ] Serious [ ] Moderate
[X]Low [ ] Unknown

B. SITE/WASTE CHARACTERISTICS

Waste Type(s):

[X] Liquid [X] Solid [ ] Sludge [X] Gas/Vapor

Characteristic(s):

[ ] Flammable/Ignitable [X] Volatile [X] Corrosive [ ] Acutely Toxic

[ ] Explosive (moderate) [X] Reactive [X] Carcinogen [ ] Radioactive

Physical Hazards:

[X] Overhead [ ] Confined Space [ ] Below Grade [X] Trip/Fall

[X] Puncture [ ] Burn [X] Cut [ ] Splash

[X] Noise [X] Other: Heat Stress/Cold Stress

Site History/Description and Unusual Features:
The Churchville Ford Site is located at 111 South Main Street in the Village of Churchville, Town of Riga, Monroe County, New York (see Work Plan, Figure 1). The Site consists of three parcels totaling 10.28 acres that contain a truck and boat dealership building, a wooden storage shed, paved parking areas, an access road (Sanford Road North), and a stormwater retention basin.

Mark's Truck and Boat Center currently operates a truck and boat sales and service center on property. The facility was previously utilized as Churchville Ford. Concentrations of chlorinated solvents (trichloroethene (TCE), tetrachloroethene (PERC), and cis-1,2-dichloroethene) were detected in subsurface soils and groundwater at the Site. The source area of contaminated groundwater is located near the southwestern portion of the building, where solvents and fuels were previously stored.

Locations of Chemicals/Wastes: Saturated soil and groundwater.

Estimated Volume of Chemicals/Wastes: The proposed remedy is designed to treat a source area of 3,600 ft^2 over a seven-foot depth interval.

Site Currently in Operation: Yes

C. HAZARD EVALUATION

Physical Hazards	Hazard Control Measures
Biological (flora, fauna, etc.)	• Establish site-specific procedures for working around identified hazards.
Cold Stress/Heat Stress	• Provide warm/cool break areas and adequate breaks. • Provide warm/cool non-caffeinated beverages. • Promote cold/heat stress awareness. • See Attachment B-1.
Drilling	• Hard hats, eye protection, steel-toed boots, ear protection. • Keep safe distance from equipment.
Fire and Explosion	• Inform personnel of the location(s) of potential fire/explosion hazards. • Establish site-specific procedures for working around flammables. • Ensure that appropriate fire suppression equipment and systems are available and in good working order. • Define requirements for intrinsically safe equipment. • Identify special monitoring needs. • Remove ignition sources from flammable atmospheres. • Coordinate with local fire-fighting groups regarding potential fire/explosion situations. • Establish contingency plans and review daily with team members.
Heavy Equipment Operation	• Define equipment routes, traffic patterns, and site-specific safety measures. • Ensure that operators are properly trained and equipment has been properly inspected and maintained. Verify back-up alarms. • Ensure that ground spotters are assigned and informed of proper hand signals and communication protocols. • Identify special PPE and monitoring needs. • Ensure that field personnel do not work in close proximity to operating equipment. • Ensure that lifting capacities, load limits, etc., are not exceeded. • Other: Overhead obstructions and falling objects.
Noise	• Establish noise level standards for on-site equipment/operations. • Inform personnel of hearing protection requirements. • Areas of potentially high sound levels (>85dBA) will be restricted to authorized personnel only.
Overhead Hazards/ Falling Objects	• Wear hard hat. • Identify overhead hazards prior to each task.
Power Tools	• Ensure compliance with 29 CFR 1910 Subpart P.
Sunburn	• Apply sunscreen. • Wear hats/caps and long sleeves.
Utility Lines	• Identify/locate existing utilities prior to work. • Ensure overhead utility lines are at least 25 feet away from project activities. • Contact utilities to confirm locations, as necessary.
Weather Extremes	• Potential hazards: High wind or Heavy rains. • Establish site-specific contingencies for severe weather situations. • Provide for frequent weather broadcasts. • Weatherize safety gear, as necessary (e.g., ensure eye wash units cannot freeze, etc.) • Identify special PPE needs. • Discontinue work during severe weather. • Drink plenty of fluids. • Other: Take frequent breaks on high humidity days.

CHEMICAL HAZARD EVALUATION

	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	PID	
		PEL	REL	TLV					Correction Factor **	Ioniz. Poten (eV)
	Cis-1,2-Dichloroethene	260 ppm	---	262 ppm	Y	Inh, Abs, Ing, Con	Irritation to eyes, skin, mucous membranes and GI, headache, vertigo, fatigue, giddiness, tremors, vomiting, nausea, may burn skin, visual disturbance, paresthesia, cardiac arrhythmias	Colorless liquid, aromatic odor	0.5	9.25
	Tetrachloroethylene (PCE)	50 ppm	---	25 ppm	Y	Inh, Abs, Ing, Con	Irritation to eyes, nose, upper respiratory tract, throat; skin, flush face, dizziness, giddiness, headache, intoxication, nausea, vomiting, abdominal pain, diarrhea, systemic effects	Colorless liquid, mild chloroform odor	---	9.32
	Trichloroethene (TCE)	100 ppm (per 6/97 NIOSH Pocket Guide)			Y	Inh, Abs, Ing, Con	Irritation to eyes, skin, mucous membranes and GI, headache, vertigo, fatigue, giddiness, tremors, vomiting, nausea, may burn skin, visual disturbance, paresthesia, cardiac arrhythmias	Colorless liquid, sometimes dyed blue, chloroform odor	---	9.45
	Sodium Permanganate	5 mg Mn per m^3 of air	---	0.2 Mn per m^3 of air	Y	Inh, Ing, Abs, Con	Damaging to eye tissue, irritating to skin, respiratory tract, and may cause burns to mucous membranes of the mouth, throat, esophagus and stomach if swallowed.	Dark purple solution, odorless (boiling point 105^{o}C	-----	-----

KEY:

PEL = Permissible Exposure Limit (OSHA)
REL = Recommended Exposure Limit (NIOSH)
TLV = Threshold Limit Value (ACGIH)
ppm = Parts per million

Inh = Inhalation
Ing = Ingestion
^{sk} = Skin Notation
GI = Gastrointestinal

Abs = Skin Absorption
Con = Skin and/or eye Contact
mg/m^3 = Milligrams per cubic meter

--- = Information not available

NR = No Response

N/A = Not Available, Not Listed

* = Chemical is a known or suspected carcinogen
** = Correction factors applicable only to MiniRAE^{2000} PID using 10.6 eV lamp. (8/22/00)

D. SITE SAFETY PLAN

Perimeter Identified?	**[Y]**	**Site Secured?**	**[N]**
Work Areas Designated?	**[Y]**	**Zone(s) of contamination identified?**	**[Y]**

Site Control: Specific work areas will be delineated relative to the location of the work activity. Designated work areas will be set up inside the main building during well installation and injections. Exclusion Zones will be established surrounding each of the injection and monitoring well locations where work will be performed. The Exclusion Zone will be designated by the use of cones and warning tape, as necessary to prevent building personnel from entering the work area, especially during injections.

The work areas will be discussed and coordinated with employees of Mark's Truck and Boat Center prior to commencement of work. Vehicles, equipment, and combustible materials will be cleared from the designated work areas by Mark's personnel prior to the well installations and injections. Employees will be instructed to stay out of the delineated areas during the oxidant injections. Remedial activities shall be scheduled so as to avoid disruption of normal site activities to the extent possible.

Anticipated Level of Protection: D / D^+

Level D	Level D^+
Safety glasses	Face shield
Hard hat	Tyvek (optional)
Work clothes or coveralls	Inner gloves of latex or vinyl
Work gloves	Outer gloves of neoprene or nitrile
Steel-toe work boots	Chemical-resistant outer boots

Most site work will be performed at Level D protection unless monitoring indicates otherwise. Level D^+ will be used when handling sodium permanganate solution to provide additional protection against splashing and skin or eye contact. A copy of the MSDS is included as Attachment B-3.

Air Monitoring:

Contaminant	Monitoring Device	Frequency
Organic Vapors	MiniRAE 2000 PID	As Necessary

Action Level:
PID readings of **>5 ppm to 10 ppm** above background in the breathing zone, sustained for greater than 1 minute.
Action: Halt work activities and move away from the vapor source. Consider vapor suppression actions. If PID readings drop to within 5 ppm above background, work may resume with continuous air monitoring.

PID readings of **10 ppm to <25 ppm** above background at breathing zone, sustained for greater than 1 minute.
Action: Stop work and consider upgrade to Level C protection.

PID readings of **>25 ppm** above background at breathing zone, sustained for greater than 1 minute.
Action: Stop work.

All air monitoring results as well as wind direction and speed (estimates) will be documented in the site-specific log book. A NYSDOH Community Air Monitoring Plan is included as Attachment B-1.

Decontamination Solutions and Procedures for Equipment, Sampling Gear, etc.
Specified in work plan.

Personnel Decon Protocol: Soap, water, and paper towels or baby wipes will be available for all personnel and will be used before eating, drinking or leaving the site. Personnel will shower upon return to home or hotel. Disposable PPE will be rendered unusable and disposed of as stated in work plan.

Decon Solution Monitoring Procedures, if Applicable: Contractor's controlled/ decon waste container.

Special Site Equipment, Facilities or Procedures (Sanitary Facilities and Lighting Must Meet 29CFR 1910.120):
Restrooms and potable water are available for use in Mark's Truck and Boat Center.

Site Entry Procedures and Special Considerations: Level D/D^{+} will be used based on the results of previous investigations.

Work Limitations (time of day, weather conditions, etc.) and Heat/Cold Stress Requirements:
All work will be completed during daylights hours. Heavy equipment will not be used during electrical storms.

General Spill Control, if Applicable: RemOx solution will be stored in a 55-gallon drum affixed to a spill pallet to contain any minor spills incurred during product transfer.

Investigation Derived Material (i.e., Expendables, Decon Waste, Cuttings) Disposal:
Specified in work plan.

Sampling Handling Procedures Including Protective Wear: All sample handling will be performed while wearing chemically-resistant gloves. To minimize hazards to lab personnel, sample volumes will be no larger than necessary, and the outside of all sample containers will be wiped clean prior to shipment.

Accident and Injury Reporting: Any work-related incident, accident, injury, illness, exposure, or property loss must be reported to the Lu Engineers project manager. This includes:

- Accident, injury, illness, or exposure of an employee;
- Injury of a subcontractor;
- Damage, loss, or theft of property, and/or
- Any motor vehicle accident regardless of fault, which involves a company vehicle, rental vehicle, or personal vehicle while employee is acting in the course of employment.

E. TRAINING REQUIREMENTS

All personnel conducting field activities on site are required to have completed training sessions in accordance with Occupational Safety and Health Administration (OSHA) for Parts 1926 and 1910 (Title 29 Code of Federal Regulations [CFR] Part 1926.65 and Part 1910.120 - Hazardous Waste Operations and Emergency Response- 'HazWOPER'). This training shall consist of a minimum of 40 hours of instruction off-site and three days of actual field experience under the direct supervision of a trained, experienced supervisor. Each employer will maintain documentation stating that its on-site personnel have complied with this regulation.

In addition, all personnel will have reviewed this HASP and received a site-specific health and safety briefing prior to participating in field work.

All visitors entering the work area must review the HASP and be equipped with the proper PPE. All site personnel and visitors shall sign the last page of the HASP as an acknowledgement that they have read and understand the Site health and safety requirements.

Medical Surveillance Requirements: All Lu Engineers field staff who engage in onsite activities for 30 days or more per year participate in a medical monitoring program and have completed applicable training per 29CFR 1910.120. Respiratory protection program meets requirements of 29CFR 1910.134.

F. EMERGENCY INFORMATION

LOCAL RESOURCES

Ambulance	911
Hospital Emergency Room	Lakeside Memorial Hospital (585) 637-3131 156 West Avenue Brockport, New York 14420
Poison Control Center	911 or 1-800-222-1222
Police (include local, county sheriff, state)	911
Fire Department	911
Airport	N/A
Local Laboratory	Paradigm Environmental Services (585) 647-2530 Upstate Laboratories (716) 472-2071
UPS/Federal Express	Fed Ex Express 2580 Manitou Rd. Rochester, NY 14624 Hours: Mon – Fri. 8:30am-8:30pm

SITE RESOURCES

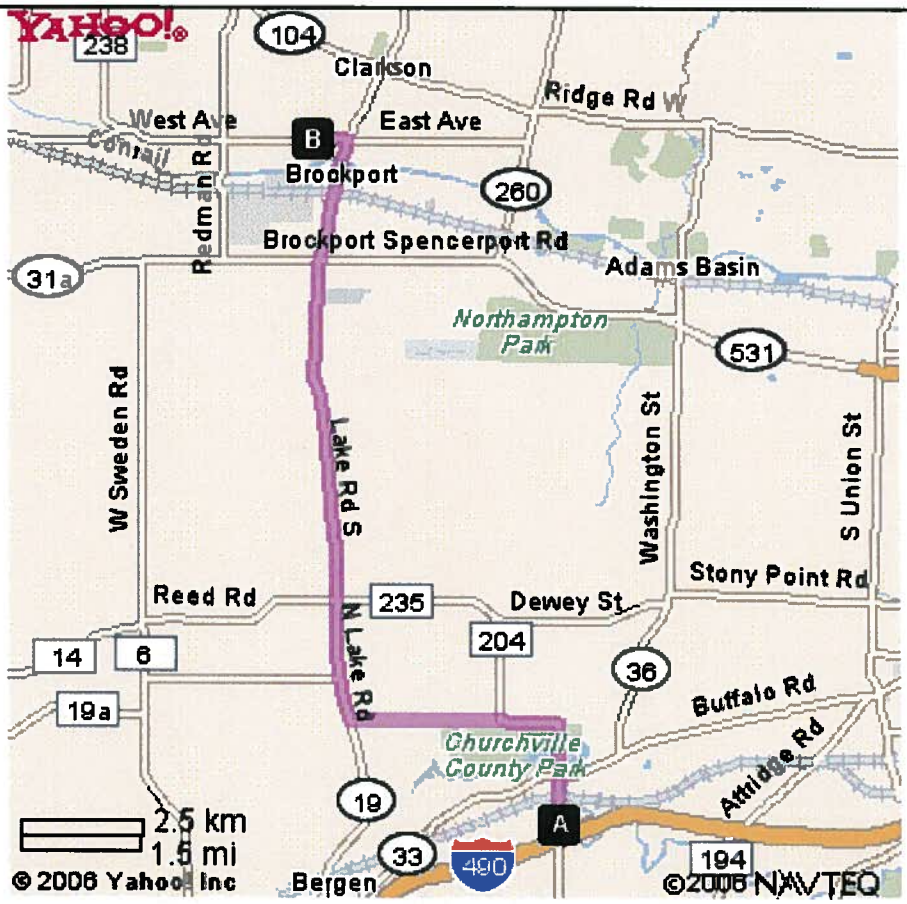
Site Emergency Evaluation Alarm Method	• One long blast: Evacuate the area by nearest emergency exit. • Two short blasts: Localized problem (not dangerous to workers. • Two long blasts: All clear
Water Supply Source	Located in Mark's Truck & Boat Center
Telephone Location, Number	TBD
Cellular Phone, if Available	TBD
Radio	N/A

EMERGENCY ROUTES

(Note: Field team must know route(s) prior to start of work.)

Directions from the site to LAKESIDE MEMORIAL HOSPITAL:

Go north on Main St. 1.3 miles; turn left on Kendall Rd., go 2.6 miles; turn right on Lake Rd. (Rte. 19), go 7.3 miles; turn left on West Ave., go 0.4 miles, hospital is on right



Attachment B-1

Community Air Monitoring Plan

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

Source: DRAFT DER-10 Technical Guidance for Site Investigation and Remediation, December 2002- Appendix 1A

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m_3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m_3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m_3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m_3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

Source: DRAFT DER-10 Technical Guidance for Site Investigation and Remediation, December 2002- Appendix 1A

Attachment B-2

Heat Stress and Cold Exposure Information

furnished by National Weather Service Gray, ME

Relative Humidity (%)

Air Temperature °F

°F	40	45	50	55	60	65	70	75	80	85	90	95	100
110	136												
108	130	137											
106	124	130	137										
104	119	124	131	137									
102	114	119	124	130	137								
100	109	114	118	124	129	136							
98	105	109	113	117	123	128	134						
96	101	104	108	112	116	121	126	132					
94	97	100	103	106	110	114	119	124	129	135			
92	94	96	99	101	105	108	112	116	121	126	131		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
88	88	89	91	93	95	98	100	103	106	110	113	117	121
86	85	87	88	89	91	93	95	97	100	102	105	108	112
84	83	84	85	86	88	89	90	92	94	96	98	100	103
82	81	82	83	84	84	85	86	88	89	90	91	93	95
80	80	80	81	81	82	82	83	84	84	85	86	86	87

Heat Index (Apparent Temperature)

With Prolonged Exposure and/or Physical Activity

Extreme Danger	
Heat stroke or sunstroke highly likely	
Danger	
Sunstroke, muscle cramps, and/or heat exhaustion likely	
Extreme Caution	
Sunstroke, muscle cramps, and/or heat exhaustion possible	
Caution	
Fatigue possible	

Wind Chill Chart

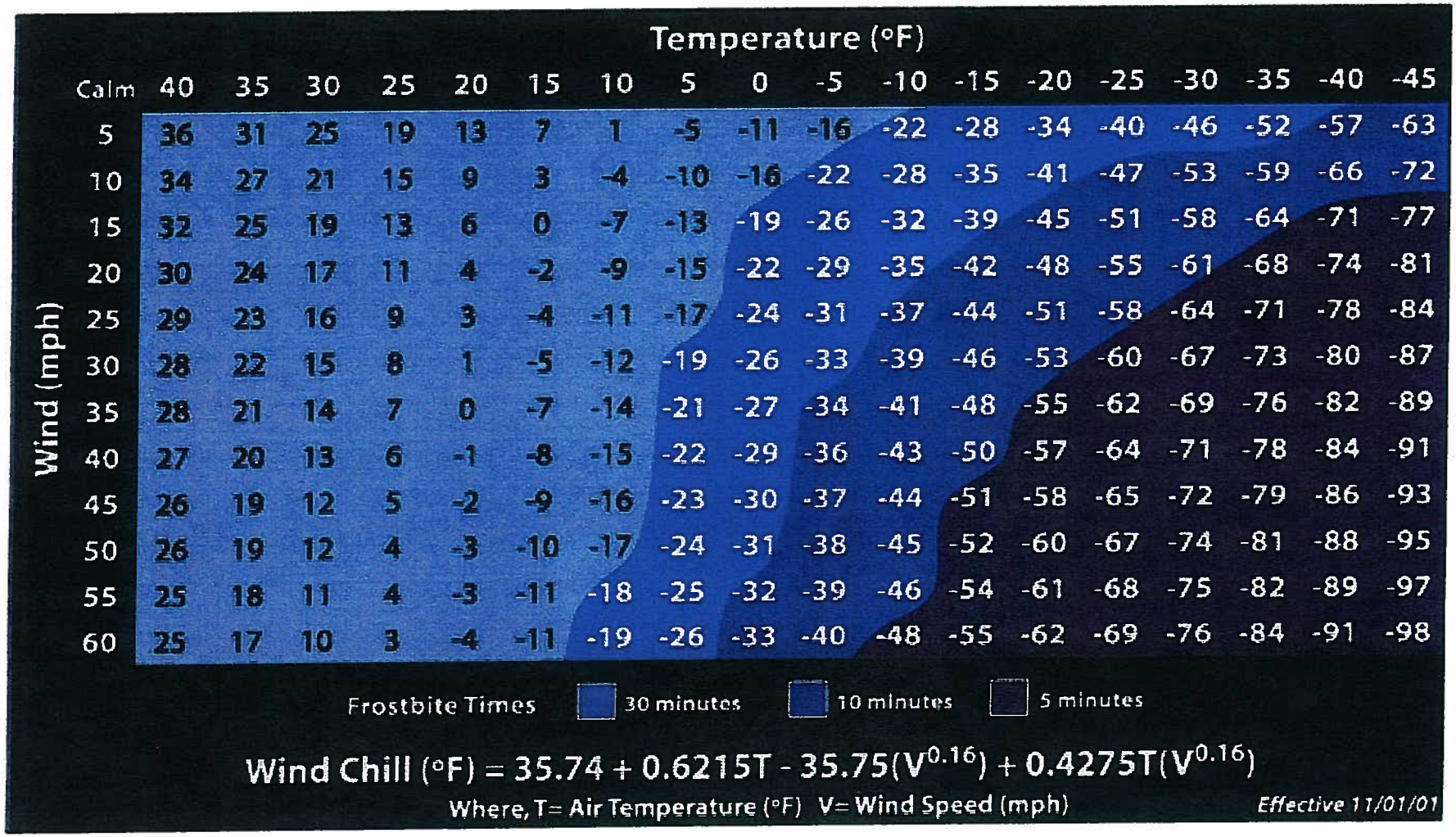


TABLE 4

WIND CHILL CHART

Wind speed	50°F	40°F	30°F	20°F	10°F	0°F	-10°F	-20°F	-30°F
5 mph	48°F	37°F	27°F	16°F	6°F	-5°F	-15°F	-26°F	-36°F
10 mph	40°F	28°F	16°F	4°F	-9°F	-24°F	-33°F	-46°F	-58°F
15 mph	36°F	22°F	9°F	-5°F	-18°F	-32°F	-45°F	-58°F	-72°F
20 mph	32°F	18°F	4°F	-10°F	-25°F	-39°F	-53°F	-67°F	-82°F
25 mph	30°F	16°F	0°F	-15°F	-29°F	-44°F	-59°F	-74°F	-88°F
30 mph	28°F	13°F	-2°F	-18°F	-33°F	-48°F	-63°F	-79°F	-94°F
35 mph	27°F	11°F	-4°F	-21°F	-35°F	-51°F	-67°F	-82°F	-98°F
40 mph	26°F	10°F	-6°F	-21°F	-37°F	-53°F	-69°F	-85°F	-100°F
over 40 mph adds little to the effect		LITTLE DANGER (properly clothed)			DANGER OF FREEZING OF EXPOSED FLESH			GREAT DANGER	
* TRENCH FOOT & IMMERSION FOOT can occur at any point on the chart!									

ADVERSE EFFECTS OF THE COLD

TRENCH FOOT: Caused by a combination of cold wet conditions at 50 and below. The symptoms include redness, swelling, numbness, blistering, bleeding or having swelling in severe cases.
IMMERSION FOOT: Caused by the restriction of blood circulation in the presence of moisture and cold starting at 50 and below. The symptoms are little or no pain, cold feeling, gradual paling, numbness, and the feet feel like blocks of wood.
CARBON MONOXIDE POISONING: Occurs when exhaust fumes from fuel burning equipment such as vehicles, oil heaters, etc., enter a closed space such as the inside of a vehicle or tent. The symptoms are extreme weakness and drowsiness. Death will result unless individual is moved to fresh air.
FROSTBITE: Is the crystallization of tissue fluid caused by exposure to cold below freezing. Most common areas of frostbite are the face, nose, ears, hands, and feet. The symptoms include redness and pain in the early stages, followed by a waxy white appearance, numbness and the skin may feel stiff and even brittle.

PREVENTION OF COLD INJURY

To Stay Warm Remember The Word C-O-L-D

C - Cleanliness and Care: Feet, socks, and clothing are warmer when clean. Constant foot care is imperative.
O - Overheating: Prevent overheating by adjusting your clothing to the job being performed.
L - Loose and Layered: Loose-fitting clothing insures good circulation and insulation. Clothing in layers assures air spaces which hold body heat. Again, allows an individual to adjust the number of layers to the temperature and activity being performed.
D - Dampness: Any wet garment is a cold garment, just as tight-fitting garments are cold producing garments. Wear a field jacket as a wind breaker and for its water-repellency. Keep clothing dry.

* Use the Buddy system, this is the best way to prevent cold injury. If you start feeling cold do some exercises until you start feeling warm again.

FIRST AID FOR COLD INJURIES

1. Get individual off their feet.
2. Get individual into warm dry clothing.
3. Get individual warm fluids to drink (NO ALCOHOLIC BEVERAGES)
4. Do not smoke.
5. Keep the effected area clean, warm and dry. Do not allow to REFREEZE. If you cannot keep area warm, leave it frozen.
6. Do not rub effected area.
7. Evacuate through medical channels ASAP.

HYPOTHERMIA

The condition of low internal body heat dropping steadily from a healthy 98.6, and if not reversed, can bring fatal consequences. Hypothermia can develop without much warning. Dress for the weather and avoid getting wet or damp.

Attachment B-3

Equipment Checklist

Equipment Checklist - Churchville Ford Site

Personal Protective Gear

Level D		**Level B**	
Steel-toe work boots	x	SCBA	
Hard Hat	x	Spare air tanks	
Work gloves	x	Protective coveralls (Tyvek, Saranax)	
Work clothes/ coveralls	x	Chemical-resistant outer gloves	
Safety glasses or goggles (as needed)	x	Chemical-resistant inner gloves	
Rain Suit (as needed)	x	Steel-toe boots, chemical-resistant	
Earplugs (as needed)	x	Disposable chemical-resistant booties (optional)	
Disposable boot covers (as needed)	x	Hard hat (as needed)	
Orange safety vest (as needed)		Face sheild (as needed)	
Level D+		**Level A**	
Chemical-resistant disposable booties	x	SCBA	
Face sheild	x	Spare air tanks	
Safety goggles	x	Encapsulating suit, chemical-protective	
Dust mask		Chemical-resistant inner gloves	
Cut-resistant gloves		Chemical-resistant outer gloves	
Tyvek w/hood		Chemical-resistant steel-toe boots	
Inner & outer chemical-resistant gloves	x	Hard hat (as needed)	
Splash shield (as needed)		Cooling vest (optional)	
Level C			
Air purifying respirator (full or half-face)			
Cartridges (type....)		**Misc.**	
5-minute escape mask (optional)		Insect repellant	x
Chemical-resistant coveralls (Tyvek, Saranax)		Mosquito net (as needed)	x
Chemical-resistant outer gloves		Suncreen	x
Inner gloves		Hand/Foot warmers	
Steel-toe work boots			
Disposable boot covers (as needed)			
Hard hat (as needed)			

Monitoring Equipment

MiniRAE PID	x
Explosimeter	x
4-Gas Meter	
Particulate Meter (Dust-Trak, etc)	x
ppbRAE PID	
Weather station	
Sound level meter	
Personal sampling pumps	
Draeger pump w/ tubes	
Radiation detector (Mini-RAD)	

First Aid Equipment

First-Aid kit	x
Portable eye wash	x
CPR mask	

Equipment Checklist - Churchville Ford Site

Sampling Equipment

Soil Sampling

4-oz. jars	
Stainless steel spoons	
Stainless steel bowl	
Soil auger	
Soil sampling (coring) tool	
Labels	
Permanent marking pens	
Packaging tape	
Ziploc bags	x
Water Sampling	
Polyethylene tubing	
Flex tubing	
Water level meter	
Bailers (disposable, SS, PVC)	
Bailer twine	
Stopwatch	
Peristaltic pump (Geopump)	
Well key/wrench	
Socket wrench (as needed)	
Air Sampling	
Beeswax	
Hot pot	
Purge pump	
Tedlar bags	
Summa canisters	
Digital camera	
Wrenches (as needed)	

Decon Equipment

Wash tub	
Buckets	
Scrub brushes	
Pressurized sprayer	
Detergent (Alconox, TSP)	
Solvent (hexane, 10% HNO3)	
Plastic sheeting	
Tarps and poles	
Trash bags	
Trash cans	
Paper towels	
Face mask sanitizer (as needed)	
Distilled water	
Deionized water	
Sanitizing wipes	

Shipping Equipment

Shipping labels	
Clear packing tape	
Chain-of-custody forms	
Custody seals	
Strapping tape	
Plastic baggies	
Bubble wrap (as needed)	

Miscellaneous Field Equipment

Basic tool kit	x	Tables	
Step ladder (as needed)		Folding chairs	
Surveyor's tape	x	Portable radios	
Marking paint	x	Wagon	
Nylon rope		Sled	
Surveyor's Flags		Digital camera	x
Bung wrench		Batteries & chargers	x
Pick		Flashlights	x
Shovel			
Propane torch			
Surveying meter stick			
Pop-up canopy			
Clipboard	x		

Attachment B-4

Material Safety Data Sheets

RemOx™ L
ISCO Reagent

EC- SAFETY DATA SHEET according to EC directive 2001/58/EC
MATERIAL SAFETY DATA SHEET

Section 1 Chemical Product and Company Identification

PRODUCT NAME: RemOx™ L ISCO Reagent **TRADE NAME:** RemOx™ L ISCO Reagent	**Revision Date: February 2005**

USES OF SUBSTANCE: RemOx™ L ISCO Reagent is a liquid oxidant recommended for in-situ and ex-situ remediation of sites that require a strong oxidant.

COMPANY NAME (Europe): CARUS NALON S.L.	**COMPANY ADDRESS:**	Carus Nalon S.L. Barrio Nalon, s/n 33100 Trubia-Oviedo Espana, Spain
	INFORMATION:	(34) 985-785-513 (34) 985-785-513 www.caruseurope.com (Web) carus@carusnalon.com (Email)
COMPANY NAME (US): CARUS CHEMICAL COMPANY	**EMERGENCY TELEPHONE:**	(34) 985-785-513
	COMPANY ADDRESS:	315 Fifth Street Peru, IL 61354, USA
	INFORMATION:	(815)-223-1500 www.caruschem.com (Web) salesmkt@caruschem.com (Email)
	EMERGENCY TELEPHONE:	(800) 435 –6856 (USA) (800) 424-9300 (CHEMTREC, USA) (815-223-1500 (Other countries)

Section 2 Hazardous Ingredients

Material or Component	CAS No.	%	Hazard Data	
Sodium Permanganate	10101-50-5	40	**PEL/C**	5 mg Mn per cubic meter of air
			TLV-TWA	0.2 mg Mn per cubic meter of air

Section 3 Hazards Identification

1. Eye Contact
   RemOx™ L ISCO Reagent is damaging to eye tissue on contact. It may cause burns that result in damage to the eye.
2. Skin Contact
   Momentary contact of solution at room temperature may be irritating to the skin, leaving brown stains. Prolonged contact is damaging to the skin.
3. Inhalation
   Acute inhalation toxicity data are not available. However, airborne concentrations of RemOx™ L ISCO Reagent in the form of mist may cause irritation to the respiratory tract.
4. Ingestion
   RemOx™ L ISCO Reagent if swallowed, may cause burns to mucous membranes of the mouth, throat, esophagus, and stomach.

Section 4 First Aid Measures

1. Eyes
   Immediately flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface. Do not attempt to neutralize chemically. Seek medical attention immediately. Note to physician: Decomposition products are alkaline.
2. Skin
   Immediately wash contaminated areas with water. Remove contaminated clothing and footwear. (Caution: Solution may ignite certain textiles). Wash clothing and decontaminate footwear before reuse. Seek medical attention immediately if irritation is severe and persistent.
3. Inhalation
   Remove person from contaminated area to fresh air. If breathing has stopped, resuscitate and administer oxygen if readily available. Seek medical attention immediately.
4. Ingestion
   Never give anything by mouth to an unconscious or convulsing person. If person is conscious, give large quantities of water or milk. Seek medical attention immediately.

Section 5 Fire Fighting Measures

NFPA* HAZARD SIGNS:

Health Hazard	1 =	Materials which under fire conditions would give off irritating combustion products. (less than 1 hour exposure) Materials which on the skin could cause irritation.
Flammability Hazard	0 =	Materials that will not burn.
Reactivity Hazard	0 =	Materials which in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.
Special Hazard	OX =	Oxidizer

***National Fire Protection Association 704**

FIRST RESPONDERS:
Wear protective gloves, boots, goggles, and respirator. In case of fire, wear positive pressure breathing apparatus. Approach incident with caution. Use 2004 Emergency Response Guidebook (U.S. DOT RSPA, TC and STC). Guide No. 140. (http://hazmat.dot.gov/pubs/erg2004/erg2004.pdf).

FLASHPOINT	None
FLAMMABLE OR EXPLOSIVE LIMITS	Lower: Nonflammable Upper: Nonflammable
EXTINGUISHING MEDIA	Use large quantities of water. Water will turn pink to purple if in contact with RemOx™ L ISCO Reagent. Dike to contain. Do not use dry chemicals, CO_2Halon® or foams.
SPECIAL FIREFIGHTING PROCEDURES	If material is involved in fire, flood with water. Cool all affected containers with large quantities of water. Apply water from as far as a distance as possible. Wear self-contained breathing apparatus and full protective clothing.

UNUSUAL FIRE AND EXPLOSION	Powerful oxidizing material. May decompose spontaneously if exposed to heat (135°C/275°F). May be explosive in contact with certain other chemicals (Section 10). May react violently with finely divided and readily oxidizable substances. Increases burning rate of combustible material. May ignite wood and cloth.

Section 6 Accidental Release Measures

PERSONAL PRECAUTIONS

Personnel should wear protective clothing suitable for the task. Remove all ignition sources and incompatible materials before attempting clean up.

ENVIRONMENTAL PRECAUTIONS:

Do not flush into sanitary sewer system or surface water. If accidental release into the environment occurs, inform the responsible authorities. Keep the product away from drains, sewers, surface and ground water and soil.

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Contain spill by collecting the liquid in a pit or holding behind a dam (sand or soil). Dilute to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite or ferrous salt solution. The bisulfite or ferrous salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralize with sodium carbonate to neutral pH, if acid was used. Decant or filter and deposit sludge in approved landfill. Where permitted, the sludge may be drained into sewer with large quantities of water. To clean contaminated floors, flush with abundant quantities of water into sewer, if permitted by federal, state, and local regulations. If not, collect water and treat as above.

Section 7 Handling and Storage

WORK/HYGIENIC PRACTICES

Wash hands thoroughly with soap and water after handling RemOx™ L ISCO Reagent. Do not eat, drink or smoke when working with RemOx™ L ISCO Reagent . Wear proper protective equipment. Remove clothing, if it becomes contaminated.

VENTILATION REQUIREMETNS

Provide sufficient mechanical and/or local exhaust to maintain exposure below the TLV/TWA.

CONDITIONS FOR SAFE STORAGE

Store in accordance with NFPA 430 requirements for Class II oxidizers. Protect containers from physical damage. Store in a cool, dry area in closed containers. Segregate from acids, peroxides, formaldehyde, and all combustible, organic, or easily oxidizable materials including antifreeze and hydraulic fluid.

Section 8 Exposure Controls and Personal Protection

RESPIRATORY PROTECTION

In cases where overexposure to mist may occur, the use of an approved NIOSH-MSHA mist respirator or an air

supplied respirator is advised. Engineering or administrative controls should be implemented to control mist.
EYE Faceshield, goggles, or safety glasses with side shields should be worn. Provide eyewash in working area.
GLOVES Rubber or plastic gloves should be worn.
OTHER PROTECTIVE EQUIPMENT Normal work clothing covering arms and legs, and rubber, or plastic apron should be worn. Caution: If clothing becomes contaminated, wash off immediately. Spontaneous ignition may occur with cloth or paper.

Section 9 Physical and Chemical Properties

APPEARANCE AND ODOR	Dark purple solution, odorless
BOILING POINT, 760 mm Hg	105 °C
VAPOR PRESSURE (mm Hg)	760 mm at 105°C
SOLUBILITY IN WATER % BY SOLUTION	Miscible in all proportions
PERCENT VOLATILE BY VOLUME	61% (as water)
EVAPORATION RATE	Same as water
FREEZING POINT	-15.0 °C
SPECIFIC GRAVITY	1.36-1.39
pH	5-9
OXIDIZING PROPERTIES	Strong oxidizer. May ignite wood and cloth.
EXPLOSIVE PROPERTIES	Explosive in contact with sulfuric acid or peroxides, or readily oxidizable substances.

Section 10 Stability and Reactivity

STABILITY	Under normal conditions, the material is stable.
CONDITIONS TO AVOID could	Contact with incompatible materials or heat (135°C / 275°F) result in violent exothermic chemical reaction.
INCOMPATIBLE MATERIALS	Acids, peroxides, formaldehyde, antifreeze, hydraulic fluids, and all combustible organic or readily oxidizable materials, including metal powders. With hydrochloric acid, toxic chlorine gas is liberated.
HAZARDOUS DECOMPOSITION PRODUCTS	When involved in a fire, liquid permanganate may form corrosive fumes.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION	Material is not known to polymerize.

Section 11 Toxicological Information

SODIUM PERMANGANATE: Acute oral LD_{50} not known.

1. Acute toxicity

Irritating to body tissue with which it comes into contact. No acute toxicity data is available for sodium permanganate. Toxicity is expected to be similar to that of potassium permanganate. The toxicity data for potassium permanganate is given below:

Ingestion:
LD 50 oral rat: 780 mg/kg male (14 days); 525 mg/kg female (14 days).
Harmful if swallowed. ALD: 10g. Ingestion may cause nausea, vomiting, sore throat, stomach-ache and eventually lead to a perforation of the intestine. Liver and kidney injuries may occur.

Skin contact:
LD 50 dermal no data available.
The product may be absorbed into the body through the skin. Major effects of exposure: severe irritation, brown staining of skin.

Inhalation:
LC 50 inhal. no data available.
The product may be absorbed into the body by inhalation. Major effects of exposure: respiratory disorder, cough.

2. Chronic toxicity

No known cases of chronic poisoning due to permanganates have been reported. Prolonged exposure, usually over many years, to heavy concentrations of manganese oxides in the form of dust and fumes may lead to chronic manganese poisoning, chiefly involving the central nervous system.

3. Carcinogenicity

Sodium permanganate has not been classified as a carcinogen by ACGIH, NIOSH, OSHA, NTP, or IARC.

4. Medical Conditions Generally Aggravated by Exposure

Sodium permanganate solution will cause further irritation of tissue, open wounds, burns or mucous membranes.

Section 12 Ecological Information

Entry to the Environment
Permanganate has a low estimated lifetime in the environment, being readily converted by oxidizable materials to insoluble MnO_2.

Bioconcentration Potential
In non-reducing and non-acidic environments MnO_2 is insoluble and has a very low bioaccumulative potential.

Aquatic Toxicity
No data.

Section 13 Disposal Considerations

Waste Disposal

RemOx™ L ISCO Reagent, once it becomes a waste, is considered a D001 hazardous (ignitable) waste. For disposal of RemOx™ L ISCO Reagent solutions, follow procedures in Section 6 and deactivate the permanganate to insoluble manganese dioxide. Dispose of it in a permitted landfill. Contact Carus Chemical Company for additional recommendations.

Section 14 Transport Information

USA (land, D.O.T.)	**Proper Shipping Name:**	49 CFR172.101 Permanganates, inorganic, aqueous solution, n.o.s .(contains sodium permanganate
	Hazard Class:	49 CFR172.101....Oxidizer
	ID Number:	49 CFR172.101....UN 3214
	Packing Group:	49 CFR172.101....II
	Division:	49 CFR172.101....5.1
European Labeling in accordance Road/Rail Transport (ADR/RID)	**ID Number:**	UN 3214
	ADR/RID Class	5.1
	Description of Goods:	Permanganates, inorganic, aqueous solution, n.o.s (contains sodium permanganate)
	Hazard Identification No.	50
European Labeling in accordance with EC directive (Water, I.M.O.)	**Proper Shipping Name:**	Permanganates, inorganic, aqueous solution, n.o.s (contains sodium permanganate)
	Hazard Class:	Oxidizer
	ID Number:	UN 3214
	Packing Group:	II
	Division:	5.1
	Marine Pollutant:	No
European Labeling in accordance with EC directive (Air, I.C.A.O.)	**Proper Shipping Name:**	Permanganates, inorganic, aqueous solution, n.o.s (contains sodium permanganate)
	Hazard Class:	Oxidizer
	ID Number:	UN 3214
	Packing Group:	II
	Division:	5.1

Section 15 Regulatory Information (Sodium Permanganate)

TSCA	Listed in the Toxic Substances Control Act (TSCA) Chemical Substance Inventory.
CERCLA	Not listed.
RCRA	Oxidizers such as RemOx™ L ISCO Reagent solution meet the criteria of ignitable waste. 40 CFR 261.21.

SARA TITLE III Information
Section 302/303 Extremely hazardous substance: Not listed

	Section 311/312	Hazard categories: Fire, acute and chronic toxicity.
	Section 313	RemOx™ L ISCO Reagent contains 40% manganese compounds as part of the chemical and is subject to the reporting requirements of Section 313 of Title III, Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.
FOREIGN LIST	Canadian Non-Domestic Substance List, EINECS	

Section 16 Other Information

NIOSH	National Institute for Occupational Safety and Health
MSHA	Mine Safety and Health Administration
OSHA	Occupational Safety and Health Administration
NTP	National Toxicology Program
IARC	International Agency for Research on Cancer
PEL	Permissible Exposure Limit
C	Ceiling Exposure Limit
TLV-TWA	Threshold Limit Value-Time Weighted Average
CAS	Chemical Abstract Service
EINECS	Inventory of Existing Chemical Substances (European)

Chithambarathanu Pillai (S.O.F.)
June 2005

RemOx® L
ISCO Reagent

CAS Registry No. 10101-50-5
EINECS No. 233-251-1

Fact Sheet

RemOx® L ISCO Reagent has been specifically manufactured for environmental applications such as remediation of soils and associated groundwater. This product can be used to degrade a variety of contaminants such as chlorinated solvents, polyaromatic hydrocarbons, phenolics, organo-pesticides and substituted aromatics. RemOx® L ISCO Reagent is shipped with a Certificate of Analysis (COA).

Product Specifications

Assay, %	39.5 - 41.0 as $NaMnO_4$
pH	5.0 - 8.0
Trace Metals	(See Table 1)

Chemical/Physical Data

Formula	$NaMnO_4$
Appearance	Dark Purple Solution
Specific Gravity	1.365-1.385
Shelf Life	18 months
Freezing Point	4° F
Solubility in Water	Miscible with water in all proportions.

Material will pass through a 10 micron filter

Applications

RemOx® L ISCO Reagent is used for soil and groundwater remediation by in-situ or ex-situ chemical oxidation and as active agent in subsurface reactive barriers for treatment of:

- Chlorinated Ethenes -PCE, TCE, Vinyl Chloride, etc.
- Phenolics-PCP, p-Cresol, 2,3 Dichlorophenol, etc.
- Polyaromatic Hydrocarbons-Naphthalene, Phenanthrene, Benzo(a)Pyrene, etc.
- TNT, RDX, HMX, etc.
- Various Pesticides

Benefits

- Concentrated liquid form
- More precise dosing of chemical
- Feed equipment is simplified
- Consistent concentration
- High stability

Shipping Containers

5-gallon (20-L) HDPE Jerrican
(UN Specification: UN3H1/Y1.8/100) Made of high-density polyethylene (HDPE). Weighs 3.5 lb (1.6 kg). The net weight is 57 lbs (25.7 kg). The jerrican stands approximately 13.4 in. tall, 9.4 in. wide, and 13.0 in. deep (33.9 cm high, 23.8 cm wide, and 33.0 cm deep).

55-gallon (208.2L) HDPE Tighthead Drum
(UN Specification: UN1H1/Y1.9/150) Made of high-density polyethylene (HDPE). Weighs 22 lbs (10 kg). The net weight is 550 lbs (249.5 kg). The drum stands approximately 34.5 in. tall, has an outside diameter of 23.4 in. (89.1 cm tall, OD 59.4 cm).

275-gallon (1041L) IBC (Intermediate Bulk Container)
(UN Specification: UN31HA1/Y1.9/100) They are also marked "MX" for multi-trip IBC Weighs 139 lbs (65 kg). The net weight is 3000 lb (1161 kg). The IBC contains 263 gallons or 995 liters of product. The IBC dimensions are 45.4 in. high, 48 in. long, and 40 in. wide. The IBC has a 2" butterfly valve with NPT threads in bottom sump. (Domestic)

Bulk Shipping - Quantities up to 4000 gallons are available.

Handling and Storage

Like any strong oxidant RemOx® L ISCO Reagent should be handled with care. Protective equipment during handling should include face shields and/or goggles, rubber or plastic loves, and rubber or plastic apron. If clothing becomes spotted, wash off immediately; spontaneous ignition can occur with cloth or paper. In cases where significant exposure exists use the appropriate NIOSH-MSHA dust or mist respirator is recommended.

Store in accordance with NFPA (National Fire Protection Association) Code 430 requirements for Class II Oxidizers. The product should be stored in a cool, dry area in closed containers. Concrete floors are preferred. Avoid wooden decks. Spillage should be collected and disposed of properly. Contain and dilute spillage to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite, or ferrous salt solution. The bisulfite or ferrous salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralize with sodium carbonate to neutral pH, if acid was used. Deposit sludge in an approved landfill or, where permitted, drain into sewer with large quantities of water.

As an oxidant, the product itself is non-combustible, but will accelerate the burning of combustible materials. Therefore, contact with all combustible materials and/or chemicals must be avoided. These include but are not limited to: wood, cloth, organic chemicals, and charcoal. Fires may be controlled and extinguished by using large quantities of water. Refer to the *MSDS* for more information. Avoid contact with acids, peroxides, sulfites, oxalates, and all other oxidizable inorganic chemicals. During contact with hydrochloric acid, chlorine is liberated.

Shipping

RemOx® L ISCO Reagent is classified as an oxidizer for both domestic and international transportation. Liquid permanganate is shipped domestically as Freight Class 70.

Harmonized Code for export: 2841.69.0010

Proper Shipping Name: Permanganates, inorganic, aqueous solution n.o.s (contains permanganate).
Hazard Class: 5.1
Identification Number: UN 3214
Packaging Group: II
Label Requirements: Oxidizer, 5.1

Packaging Requirements: 49 CFR Parts 171 to 180 Sections: 173.152, 173.202, 173.242.

Quantity Limitations: 1 liter net for passenger aircraft or railcar; 5 liters net for cargo aircraft.

Vessel Stowage: D-material must be stowed "on-deck" on a cargo vessel, but is prohibited on a passenger vessel. Other provisions: stow separately from ammonium compounds, hydrogen peroxide, peroxides, super-oxides, cyanide compounds and powdered metal.

Compatibility Information

RemOx® L ISCO Reagent is compatible with many metals and synthetic materials. Natural rubbers and fibers are often incompatible. Solution pH and temperature are also important factors. The material selected for use with liquid permanganate must also be compatible with any kind of acid or alkali being used.

In neutral and alkaline solutions, sodium permanganate is not corrosive to carbon steel and 316 stainless steel. However, chloride corrosion of metals may be accelerated when an oxidant such as liquid permanganate is present in solution. Plastics such as Teflon, polypropylene, HDPE and EPDM are also compatible with liquid permanganate.

Aluminum, zinc, copper, lead, and alloys containing these metals maybe be slightly affected by sodium permanganate. Actual corrosion or compatibility studies should be made under the conditions in which RemOx® L ISCO Reagent will be used prior to use.

Table 1: Trace Metal Content and Specifications

	Typical Analysis (mg/kg)	Specification (mg/kg)	DL* (mg/kg)	Element	Typical Analysis (mg/kg)	Specification (mg/kg)	DL* (mg/kg)
Ag	0.036	0.15	0.034	Fe	BDL	2.00	0.053
Al	0.33	2.00	0.24	Hg	BDL	0.03	0.003
As	0.005	4.00	0.006	Ni	BDL	0.10	0.030
Ba	2.26	5.00	0.016	Pb	BDL	0.70	0.16
Be	BDL	0.50	0.08	Sb	BDL	0.70	0.16
Cd	BDL	0.10	0.016	Se	0.0066	0.50	0.0003
Cr	1.99	5.00	0.031	Tl	BDL	3.50	0.8
Cu	0.024	0.10	0.022	Zn	0.024	0.40	0.011

*DL=Detection Limit

Carus Chemical Company

During its 90-year history, Carus' ongoing emphasis on research and development, technical support, and customer service has enabled the company to become the world leader in permanganate, manganese, oxidation, and base-metal catalyst technologies.

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ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TETRACHLOROETHYLENE
CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethyl-

ene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Material Safety Data Sheet

Tetrachloroethylene

ACC# 01602

Section 1 - Chemical Product and Company Identification

MSDS Name: Tetrachloroethylene
Catalog Numbers: AC138010000, AC138010010, AC138010025, AC138015000, AC167890010, AC167891000, AC167895000, AC420210000, AC420211000, AC423020000, AC423020040, 16789-0000, 16789-0025, C182-20, C182-4, NC9472508, O4586-4
Synonyms: Ethylene tetrachloride; Perchloroethylene; Tetrachloroethene.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
127-18-4	Tetrachloroethylene	99	204-825-9

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid.
Warning! Causes eye, skin, and respiratory tract irritation. Harmful if inhaled. May cause central nervous system depression. May cause cancer based on animal studies. Marine pollutant.
Target Organs: Kidneys, central nervous system, liver, respiratory system, eyes, skin.

Potential Health Effects
Eye: Contact may cause transient eye irritation. Vapors cause eye irritation.

Skin: May cause severe irritation and possible burns. Excessive drying of the skin may result from repeated or prolonged contact. Not expected to cause an allergic skin reaction. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. A short single exposure may cause skin irritation. Prolonged or repeated exposure may cause severe skin irritation, even a burn. Did not cause allergic skin reactions when tested in guinea pigs.
Ingestion: May cause central nervous system depression, kidney damage, and liver damage. Symptoms may include: headache, excitement, fatigue, nausea, vomiting, stupor, and coma. Possible aspiration hazard.
Inhalation: Causes respiratory tract irritation. May cause central nervous system effects including vertigo, anxiety, depression, muscle incoordination, and emotional instability. A single brief (minutes) inhalation exposure to levels above 6000 ppm perchloroethylene may be immediately fatal. (Dow Chemical)
Chronic: Possible cancer hazard based on tests with laboratory animals. Prolonged or repeated skin contact may cause defatting and dermatitis. May cause adverse nervous system effects including muscle tremors and incoordination. May cause liver and kidney damage. May cause reproductive and fetal effects. There is debate on whether or not chronic exposure can cause subtle deficits to vision. Human data are limited and have not established an association between perchloroethylene exposure and cancer. Perchloroethylene is not believed to pose a measurable carcinogenic risk to man when handled as recommended. (Dow

Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If vomiting occurs naturally, have victim lean forward.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Not combustible, but if involved in a fire, decomposes to produce hydrogen chloride.
Extinguishing Media: Use extinguishing media most appropriate for the surrounding fire.

Flash Point: Not applicable.
Autoignition Temperature: Not applicable.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Clean up spills immediately, observing precautions in the Protective Equipment section. Provide ventilation. Control runoff and isolate discharged material for proper disposal.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Do not reuse this container. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid breathing vapor.
Storage: Store in a cool, dry place. Keep containers tightly closed. Do not store in aluminum containers.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Tetrachloroethylene	25 ppm TWA; 100 ppm STEL	150 ppm IDLH	100 ppm TWA; 200 ppm Ceiling

OSHA Vacated PELs: Tetrachloroethylene: 25 ppm TWA; 170 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical splash goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: sweetish odor - ethereal odor
pH: Not available.
Vapor Pressure: 18.6 mm Hg @ 25 deg C
Vapor Density: 5.8
Evaporation Rate:9 (ether=100)
Viscosity: 0.89 mPa s 20 deg C
Boiling Point: 121 deg C
Freezing/Melting Point:-22.3 deg C
Decomposition Temperature:126 deg C
Solubility: Insoluble.
Specific Gravity/Density:1.62
Molecular Formula:C2Cl4
Molecular Weight:165.83

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Excess heat, ultra violet light, open flame, direct sunlight..
Incompatibilities with Other Materials: Active metals, powdered aluminum, powdered magnesium, zinc powder, strong oxidizing agents, strong bases, aluminum.
Hazardous Decomposition Products: Hydrogen chloride, chlorine, phosgene, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 127-18-4: KX3850000
LD50/LC50:
CAS# 127-18-4:
Draize test, rabbit, eye: 162 mg Mild;

Draize test, rabbit, eye: 500 mg/24H Mild;
Draize test, rabbit, skin: 810 mg/24H Severe;
Draize test, rabbit, skin: 500 mg/24H Mild;
Inhalation, mouse: LC50 = 5200 ppm/4H;
Inhalation, mouse: LC50 = 35000 mg/m3/4H;
Inhalation, mouse: LC50 = 20200 mg/m3/6H;
Inhalation, rat: LC50 = 34200 mg/m3/8H;
Inhalation, rat: LC50 = 4100 ppm/6H;
Oral, mouse: LD50 = 8100 mg/kg;
Oral, mouse: LD50 = 6400 mg/kg;
Oral, rat: LD50 = 2629 mg/kg;

Carcinogenicity:
CAS# 127-18-4:

- **ACGIH:** A3 - Confirmed animal carcinogen with unknown relevance to humans
- **California:** carcinogen, initial date 4/1/88
- **NTP:** Suspect carcinogen
- **IARC:** Group 2A carcinogen

Epidemiology: Epidemiologic studies have given inconsistent results. Studies have shown that tetrachloroethylene has not caused cancer in exposed workers. The studies have serious weaknesses such as mixed exposures. In tests with rats and mice, it appeared that tissue destruction or peroxisome proliferation rather than genetic mechanisms were the cause of the observed increases in normally occurring cancers. The oral mouse TDLo that was tumorigenic was 195 gm/kg/50W-I.
Teratogenicity: Has caused musculoskeletal abnormalities. Has caused morphological transformation at a dose of 97mol/L in a study using rat embryos.
Reproductive Effects: Has caused behavioral, biochemical, and metabolic effects on newborn rats when the mother was exposed to the TCLo of 900 ppm/7H at 7-13 days after conception. A dose of 300 ppm/7H 6-15 days after conception caused post-implantation mortality.
Mutagenicity: Not mutagenic in Escherichia coli. No mutagenic effects were seen in rat liver after exposure at 200 ppm for 10 weeks. No chromosome changes were seen in the bone marrow cells of exposed mice.
Neurotoxicity: No information available.
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Rainbow trout: LC50 = 5.28 mg/L; 96 Hr.; Static Condition, 12 degrees CFish: Fathead Minnow: LC50 = 18.4 mg/L; 96 Hr.; Flow-through conditionFish: Bluegill/Sunfish: LC50 = 12.9 mg/L; 96 Hr.; Static ConditionBacteria: Phytobacterium phosphoreum: EC50 = 120.0 mg/L; 30 minutes; Microtox test No data available.
Environmental: In soil, substance will rapidly evaporate. In water, it will evaporate. In air, it can be expected to exist in the vapor phase.

Physical: No information available.
Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 127-18-4: waste number U210.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	TETRACHLOROETHYLENE	TETRACHLOROETHYLENE
Hazard Class:	6.1	6.1
UN Number:	UN1897	UN1897
Packing Group:	III	III

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 127-18-4 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 127-18-4: Effective 6/1/87, Sunset 6/1/97
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 127-18-4: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 127-18-4: immediate, delayed.

Section 313

This material contains Tetrachloroethylene (CAS# 127-18-4, 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

CAS# 127-18-4 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 127-18-4 is listed as a Priority Pollutant under the Clean Water Act. CAS# 127-18-4 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 127-18-4 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Tetrachloroethylene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 127-18-4: 14 æg/day NSRL

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN N

Risk Phrases:

R 40 Limited evidence of a carcinogenic effect.

R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 23 Do not inhale gas/fumes/vapour/spray.

S 36/37 Wear suitable protective clothing and gloves.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 127-18-4: 3

Canada - DSL/NDSL

CAS# 127-18-4 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D1B, D2A, D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List
CAS# 127-18-4 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 6/17/1999
Revision #8 Date: 12/12/2007

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ July 2003

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Material Safety Data Sheet

Trichloroethylene, stabilized

ACC# 23850

Section 1 - Chemical Product and Company Identification

MSDS Name: Trichloroethylene, stabilized
Catalog Numbers: AC158310000, AC158310010, AC158310025, AC421520000, AC421520040, AC421520200, AC421525000, S80327ACS-1, S80327ACS-2, NC9494591, T340-4, T341-20, T341-4, T341-500, T341J4, T403-4
Synonyms: Ethylene trichloride; Trichloroethene; 1,1,2-Trichloroethylene; TCE.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
79-01-6	Trichloroethylene	>99	201-167-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid.
Warning! Breathing vapors may cause drowsiness and dizziness. Causes eye and skin irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. May cause cancer based on animal studies. May cause liver damage.
Target Organs: Central nervous system, liver, eyes, skin.

Potential Health Effects
Eye: Causes moderate eye irritation. May result in corneal injury. Contact produces irritation, tearing, and burning pain. Contact with trichloroethylene causes pain but no permanent injury to the eyes. (Doc of TLV)
Skin: Causes mild skin irritation. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. May cause peripheral nervous system function impairment including persistent neuritis, and temporary loss of touch. Damage to the liver and other organs has been observed in

workers who have been overexposed.
Ingestion: May cause irritation of the digestive tract. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.
Inhalation: May cause respiratory tract irritation. May cause liver abnormalities. May cause cardiac abnormalities. May cause peripheral nervous system effects. Inhalation overexposure may lead to central nervous system depression, producing effects such as dizziness, headache, confusion, incoordination, nausea, weakness, and loss of consciousness. Extreme exposures may cause other CNS effects including death. The chief symptoms of TCE exposure were found to be abnormal fatigue, irritability, headache, gastric disturbances, and intolerance to alcohol. (Doc to TLV)
Chronic: Possible cancer hazard based on tests with laboratory animals. Chronic inhalation may cause effects similar to those of acute inhalation. Prolonged or repeated skin contact may cause defatting and dermatitis. May cause peripheral nervous system function impairment including persistent neuritis, and temporary loss of touch. Damage to the liver and other organs has been observed in workers who have been overexposed.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid imme diately.
Skin: Get medical aid if irritation develops or persists. Flush skin with plenty of soap and water.
Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Possible aspiration hazard. Get medical aid immediately.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool.
Extinguishing Media: Use extinguishing media most appropriate for the surrounding fire.
Flash Point: None
Autoignition Temperature: 420 deg C (788.00 deg F)
Explosion Limits, Lower:8
Upper: 10.5
NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Provide ventilation. Approach spill from upwind. Control runoff and isolate discharged material for proper disposal.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing. Avoid breathing vapor.
Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Trichloroethylene	50 ppm TWA; 100 ppm STEL	1000 ppm IDLH	100 ppm TWA; 200 ppm Ceiling

OSHA Vacated PELs: Trichloroethylene: 50 ppm TWA; 270 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical splash goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: chloroform-like
pH: Not available.
Vapor Pressure: 58 mm Hg @ 20 deg C
Vapor Density: 4.5 (air=1)
Evaporation Rate:0.69 (CCl4=1)
Viscosity: 0.0055 poise
Boiling Point: 87 deg C

Freezing/Melting Point:-86 deg C
Decomposition Temperature: Not available.
Solubility: Slightly soluble.
Specific Gravity/Density:1.46
Molecular Formula:C2HCl3
Molecular Weight:131.39

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Light, confined spaces.
Incompatibilities with Other Materials: Active metals.
Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.
Hazardous Polymerization: May occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 79-01-6: KX4550000
LD50/LC50:
CAS# 79-01-6:
Draize test, rabbit, eye: 20 mg/24H Moderate;
Draize test, rabbit, skin: 2 mg/24H Severe;
Inhalation, mouse: LC50 = 8450 ppm/4H;
Inhalation, mouse: LC50 = 220000 mg/m3/20M;
Inhalation, mouse: LC50 = 262000 mg/m3/30M;
Inhalation, mouse: LC50 = 40000 mg/m3/4H;
Inhalation, rat: LC50 = 140700 mg/m3/1H;
Oral, mouse: LD50 = 2402 mg/kg;
Oral, mouse: LD50 = 2400 mg/kg;
Oral, rat: LD50 = 4920 mg/kg;
Skin, rabbit: LD50 = >20 gm/kg;
Skin, rabbit: LD50 = 20 mL/kg;

Carcinogenicity:
CAS# 79-01-6:

- **ACGIH:** Not listed.
- **California:** carcinogen, initial date 4/1/88
- **NTP:** Suspect carcinogen
- **IARC:** Group 2A carcinogen

Epidemiology: In six epidemiological studies completed, there was no evidence to suggest that trichloroethylene has increased the incidence of cancer in humans. (Documentation of the TLV, 7th edition)

Teratogenicity: No information available.
Reproductive Effects: Experimental reproductive effects have been observed.
Mutagenicity: Human mutation data has been reported. IARC and the National Toxicology Program (NTP) stated that variability in the mutagencity test results with trichloroethylene may be due to the presence of various stabilizers used in TCEwhich are mutagens (e.g.epoxybutane, epichlorohydrin).See actual entry in RTECS for complete infomation.R68 Mutagen Category 3 (CHIP 2002, UK).
Neurotoxicity: No information available.
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: 41-67 mg/L; 96 hrs.; LC50Daphnia: Daphnia: 2.2-100 mg/L; 48 hrs.; LC50Mollusk Shrimp: 2 mg/L; 96 hrs.; LC50 Bluegill sunfish, LD50= 44,700 ug/L/96Hr. Fathead minnow, LC50=40.7 mg/L/96Hr.
Environmental: In air, substance is photooxidized and is reported to form phosgene, dichloroacetyl chloride, and formyl chloride. In water, it evaporates rapidly. Potential for mobility in soil is high.
Physical: No information available.
Other: Bioconcentration potential is low (BCF less than 100).

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 79-01-6: waste number U228.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	TRICHLOROETHYLENE	TRICHLOROETHYLENE
Hazard Class:	6.1	6.1
UN Number:	UN1710	UN1710
Packing Group:	III	III

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 79-01-6 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 79-01-6: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 79-01-6: immediate, delayed, reactive.
Section 313
This material contains Trichloroethylene (CAS# 79-01-6, >99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR
Clean Air Act:
CAS# 79-01-6 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 79-01-6 is listed as a Hazardous Substance under the CWA. CAS# 79-01-6 is listed as a Priority Pollutant under the Clean Water Act. CAS# 79-01-6 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 79-01-6 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Trichloroethylene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 79-01-6: 50 æg/day NSRL (oral); 80 æg/day NSRL (inhalation)

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
T
Risk Phrases:
R 36/38 Irritating to eyes and skin.
R 45 May cause cancer.
R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 67 Vapours may cause drowsiness and dizziness.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 79-01-6: 3

Canada - DSL/NDSL

CAS# 79-01-6 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D1B, D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 79-01-6 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 2/01/1999
Revision #7 Date: 12/27/2006

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Attachment C

Quality Assurance Project Plan

Voluntary Cleanup Program
Former Churchville Ford Site (#V00658-8)
111 South Main Street
Village of Churchville
Monroe County, New York

Quality Assurance Project Plan

Remedial Action Work Plan

Prepared For:

Okar Equipment Company, Inc.
754 Brooks Avenue
Rochester, New York 14619

Prepared By:

LU ENGINEERS
Civil and Environmental
2230 Penfield Road
Penfield, New York 14526

Project No: 5701-11

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1.0 Introduction

This Quality Assurance Project Plan (QAPP) was prepared as an integral part of the Remedial Action Work Plan (RAWP) for the Former Churchville Ford Site and is subject to the review and approval by the New York State Department of Environmental Conservation (NYSDEC). The project work will be performed by Lu Engineers, or conducted under their discretion by NYSDEC-approved contractors. Project-specific descriptions can be found in the RAWP.

This QAPP presents the policies, organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities that will be implemented by Lu Engineers for this project. This QAPP is designed to ensure that all technical data generated by Lu Engineers is accurate, representative, and will ultimately withstand legal scrutiny.

All QA/QC procedures are implemented in accordance with applicable professional technical standards, NYSDEC and Environmental Protection Agency (EPA) requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared in accordance with NYSDEC and EPA QAPP guidance documents.

This QAPP incorporates the following activities:

- Sample Management and chain of custody;
- Document control;
- Laboratory quality control; and
- Review of project deliverables.

Analytical samples will be collected in the field utilizing standard operating procedures (SOPs) and sent to the contracted New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) Contract Laboratory Program (CLP)-certified laboratory for analysis, as necessary. Non-ASP laboratory analysis will also be used during the implementation of the remedial program. All analysis will be completed by ELAP certified laboratories. Field data compilation, tabulation, and analysis will be checked for accuracy. Calculations and other post-field tasks will be reviewed by field personnel and the project manager.

Equipment used to take field measurements will be maintained and calibrated in accordance with established procedures. Records of calibration and maintenance will be kept in the field logbook, as necessary.

Document control procedures will be used to coordinate the distribution, coding, storage, retrieval, and review of all data collected during all sampling tasks. These include, but are not limited to, the sampling of groundwater and soil vapor.

In addition, the laboratory has developed SOPs for individual analytical methods and internal QC procedures. These documents are an important aspect of their QA program and are available for review upon request.

2.0 Project Objectives

The intent of this project is to implement an In-Situ Chemical Oxidation (ISCO) program to destroy chlorinated solvent contamination in saturated soils and groundwater beneath and surrounding the southwestern portion of the main building. Injection of sodium permanganate ($NaMnO_4$) solution via five newly installed injection wells and three existing monitoring wells has been proposed for the Site. Sampling of soil vapor and groundwater will be used to evaluate the short-term and long-term effectiveness of the injection program.

A complete project description, including Site history and background information, and the scope of work is described in the RAWP.

3.0 Project Organization

The personnel anticipated for this project are as follows:

Robert Elliott, P.E.	Project Director
Greg Andrus, CHMM	Project Manager
Steve Campbell, CHMM	Quality Assurance Officer
Eric Detweiler	Field Geologist
Laura Smith	Field Technician
Subcontractors	
Paradigm Laboratories	Analytical Laboratory
Centek Laboratories, Inc,	Analytical Laboratory- soil vapor
Upstate Laboratory	ASP Analytical Laboratory
Nothnagle Drilling Company	Injection Well Installation
Trec Environmental	Injection Well Installation (alternate)
MECX, Incorporated	Data Validation (as necessary)

Qualifications for Lu Engineers' personnel are included in Appendix A.

4.0 Sampling Procedures

4.1 Sampling Design

Sampling for this project is designed to evaluate the effectiveness of the oxidant injections. Groundwater samples will be collected from MW-JCL-02, MW-JCL-03, and MW-13 one month after the final injection to determine the short-term effectiveness of the remedy. To determine the long-term effectiveness, samples will be collected semi-annually from seven monitoring wells:

- MW-JCL-01
- MW-JCL-02
- MW-JCL-03
- MW-01
- MW-03
- MW-06
- MW-13

Groundwater samples will be analyzed for target compound list (TCL) volatile organic compounds (VOCs) and tentatively identified compounds (TICs) and target analyte list (TAL) metals following Analytical Services Protocol (ASP) 2000 methods.

A Site Plan showing the proposed injection and monitoring well locations is provided as Figure 3 in the RAWP.

Post-injection vapor intrusion samples will be collected at two locations (SVS-JCL-02/ IA-JCL-02 and SVS-JCL-03/ IA-JCL-03) where mitigation was recommended based on evaluation of the remedial investigation vapor intrusion results. A sub-slab and indoor air sample will be collected at each location. An ambient outdoor air sample will also be collected upwind of the building.

4.2 QC Samples

Various types of field QC samples are used to check the cleanliness and effectiveness of field handling methods. They are analyzed in the laboratory as samples, and their purpose is to assess the sampling and transport procedures as possible sources of sample contamination and document overall sampling and analytical precision. Rigorous documentation of all field QC samples in the Site logbooks is mandatory.

- **Trip Blanks** are similar to field blanks with the exception that they are not exposed to field conditions. Their analytical results help assess the potential for cross-contamination of volatile organics while samples are held in a cooler and transported. Trip blanks are prepared at the lab prior to the sampling event and shipped with the sample bottles. Trip blanks are prepared by adding organic-free water to a 40-ml VOA vial. One trip blank will be used with every batch of water samples shipped for volatile organic analysis. Each trip blank will be transported to the sampling location, handled like a sample, and returned to the laboratory for analysis without being opened in the field.
- **Field Equipment/Rinsate Blanks** are blank samples designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use and that cleaning procedures between samples are sufficient to minimize cross-contamination. Rinsate blanks are prepared by passing analyte-free water over sampling equipment and analyzing the samples for all applicable parameters. If a sampling team is familiar with a particular site, its members may be able to predict which areas or samples are likely to have the highest concentration of contaminants. Unless other constraints apply, these samples should be taken last to avoid excessive contamination of sampling equipment. Rinsate blanks are not required if dedicated sampling equipment is used for sample collection.
- **Field Duplicates** consist of a set of two (2) samples collected independently at a sampling location during a single sampling event. Field duplicates can be sent to the laboratory so that they are indistinguishable from other analytical samples and personnel performing the analysis are not able to determine which of the samples are field duplicates. Field duplicates are designed to assess the consistency of the overall sampling and analytical system.

- **Matrix Spike (MS) Samples** are used to assess matrix interference effects on the laboratory method, as well as to evaluate instrument performance. A sample spike is prepared by adding to an environmental sample (before extraction or digestion) a known amount of pure compound of the same type that is to be assayed for in the environmental sample. Spikes are added at one to 10 times the expected sample concentration or approximately 10 times the method detection limit. These spikes simulate the background and interferences found in the actual samples, and the calculated percent recovery of the spike is taken as a measure of the accuracy of the total analytical method.
- **Matrix Spike Duplicate (MSD) Samples** are aliquots of the same sample that are split prior to analysis and treated exactly the same throughout the analytical method. Spikes and duplicates for the batch are normally aliquots of the same sample. For organics, spikes are added at approximately 10 times the method detection limit. The relative percent difference (RPD) between the values of the matrix spike and matrix spike duplicate for organics or between the original and the duplicate for inorganics is taken as a measure of the precision of the analytical method. In general, the tolerance limit for RPDs between laboratory duplicates should not exceed 20% for validation in homogeneous samples.

Field QC samples and the frequency of analysis for this project are summarized in Table 1 of this QAPP.

4.3 Decontamination Procedures

All decontamination will be performed in accordance with NYSDEC approved procedures. Sampling methods and equipment have been chosen to minimize decontamination requirements and prevent the possibility of cross-contamination. Disposable sampling equipment (i.e., disposable bailers, HDPE tubing) will be used to the extent possible to minimize the need for equipment decontamination. Groundwater sampling will be performed using new dedicated, disposable bailers.

All drilling equipment will be decontaminated prior to drilling, after drilling each injection well, and prior to leaving the Site. Special attention will be given to the drilling assembly, augers, and polyvinyl chloride (PVC) casing.

Drill cuttings and water generated during drilling will remain onsite. Waters generated by decontamination or by developing, purging, or pumping the wells that exhibit elevated PID readings or other evidence of contamination will be stored in drums or an onsite holding tank.

If necessary, a temporary decontamination pad will be established in a secure area onsite using 6-mil polyethylene sheeting. The drill rig and associated tooling will be decontaminated using steam-cleaning methods at the designated location. Fluids generated during decontamination will be collected in the plastic-lined pad. All decontamination wastes will be transferred into drums or an onsite holding tank for appropriate staging and disposal. Okar Equipment Company will be responsible for proper staging and disposal of all investigation derived wastes (IDW).

Final disposal of soils and water will be dependent on the results of the groundwater analyses to be conducted during this RAWP.

4.4 Sampling Methods

4.4.1 Injection Well Installations

Bedrock drilling is not anticipated during the well installations for this remedial effort.

Drilling fluids, other than water from a NYSDEC approved source, will not be allowed without special consideration and agreement from NYSDEC. The use of lubricants is also not allowed unless approved by the NYSDEC representative.

Well Casing (Riser)
The well riser shall consist of one-inch diameter, threaded flush-joint PVC pipe. All well risers will conform to the requirements of American Society of Testing and Materials (ASTM) method D 1785 Schedule 40 pipe, and shall bear markings that will identify the material as that which is specified. All materials used to construct the wells will be NSF/ASTM approved.

Well Screen
Generally, wells will be constructed with a 7.5-foot section of 0.02-inch machine-slotted screen, unless otherwise specified in the RAWP or dictated by field conditions. Screen and riser sections shall be joined by flush-threaded coupling to form watertight unions that retain 100% of the strength of the casing. Solvent PVC glues shall not be used at any time in the construction of the wells. The bottom of the screen shall be sealed with a cap or plug.

Sand Pack
Granular backfill will be chemically and texturally clean, inert, 100% silica sand, and of appropriate grain size for the screen slot size and the host environment. The well screen and riser casing will be installed, and the sand pack placed around the screen and casing to a depth approximately one foot above the top of the well screen.

Bentonite Seal
A minimum 1-foot thick seal of bentonite pellets/chips and water slurry will be placed directly on top of the sand pack, and care will be taken to avoid bridging. The seal will be measured immediately after placement, without allowance for swelling.

Grout Mixture
Upon completion of the bentonite seal, the well will be grouted with a non-shrinking cement grout/bentonite mix to be placed from the top of the bentonite seal to one foot below ground surface. The cement grout shall consist of a mixture of Portland cement (ASTM C 150) and water, in the proportion of not more than 7-gallons of clean water per bag of cement (1 cubic foot or 94 pounds). Additionally, 3% by weight of bentonite powder shall be added.

Surface Protection
At all times during the progress of the work, precautions shall be used to prevent tampering with or the entrance of foreign material into the well. Upon completion of the well, a suitable vented cap shall be installed to prevent material from entering the well. The PVC well riser shall be flush mount and set into a concrete pad. The steel casing shall be provided with a cover and bolts. A concrete pad, sloped away from the well, shall be constructed around the well casing at ground level.

Well Development
After completion of the well, but not sooner than 48-hours after grouting is completed, development will be accomplished using air surging, surge blocking, pumping, or bailing. The air-lift surge method may be supplemented with a bottom-filling bailer if a well has an extremely low yield. No dispersing agents, acids, disinfectants, or other additives will be used during development nor be introduced into the well at any other time. During development, water will be removed throughout the entire water column by periodically lowering and raising the pump intake (or bailer stopping point).

Well development will include washing the entire well cap and the interior of the well casing above the water table, using only water from the well itself. As a result of the operation, the well casing will be free of extraneous materials (grout, bentonite, and sand) inside the riser, well cap, and blank casing between top of the well casing and water table. This washing will be conducted before and/or during development, not after development. Development water will be properly contained and treated as waste until the results of chemical analysis of samples are obtained.

4.4.2 Groundwater Sampling Procedures

Static water levels will be measured to within 0.01-foot prior to purging and sampling. Purging and sampling of each well will be accomplished using dedicated disposable PVC bailers on new polypropylene line. All wells will be purged a minimum of three volumes of water standing in the casing or to dryness. Temperature, pH, conductivity, and turbidity will be measured and recorded during purging.

Groundwater samples will be collected according to the following procedures.

- Water clarity will be quantified during sampling with a turbidity meter;
- When transferring water from the bailer to sample containers, care will be taken to avoid agitating the sample, since agitation promotes the loss of volatile constituents;
- Any observable physical characteristics of the groundwater (e.g., color, sheen, odor, turbidity) at the time of sampling will be recorded; and
- Weather conditions (i.e., air temperature, sky condition, recent heavy rainfall, drought conditions) at the time of sampling will be recorded.

All groundwater samples and their accompanying QA/QC samples will be analyzed as specified in the RAWP.

4.4.3 Vapor Intrusion Sampling

Sub-slab soil vapor samples will be obtained from beneath the concrete slab floor of the southwestern portion of the maintenance area of the building. Sub-slab samples will be collected in accordance with the NYSDOH *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006).* Samples shall be obtained using the following procedure:

- Prior to sampling, a NYSDOH Indoor Air Quality Questionnaire and Building Inventory including a product inventory, floor plan sketch, and background PID readings will be completed for the sampling area. The concrete floor will be inspected for cracks and penetrations. A floor plan sketch with locations of sumps, drains, penetrations, odors and PID readings will be noted.

- A one-inch diameter penetration will be made in the slab to a depth of approximately one inch, utilizing a hammer drill. A 3/8-inch diameter hole will be drilled to a depth of 1-2 inches below the slab.

- A temporary probe consisting of ¼-inch polyethylene tubing will be inserted approximately 1-inch below the slab. A rubber stopper may be used to hold the tubing in place.

- The surface will be sealed with 100% pure melted beeswax.

- One to three tubing volumes will be purged using a purge pump and collected in a Teflon bag. Flow rate of the purge pump will be < 0.2 liters per minute.

- Samples will be collected using 6-liter stainless steel Summa® canisters equipped with low-flow regulators. Canisters shall be pre-cleaned by the contract laboratory prior to sampling.

- Photographs of the sampling set-up and surrounding area will be taken. Beginning and ending air pressures of the Summa® canisters will be recorded on Summa® Can Data Sheets and the chain-of-custody.

- Eight hour samples will be collected. Upon completion of the sampling, the tubing will be removed and the penetration sealed with a concrete patch.

Field duplicates for sub-slab samples will be collected by attaching a T-fitting supplied by the laboratory to two Summa® canisters with attached regulators. The inlet for the T-fitting will then be attached to the sub-slab sample tubing. Both Summa® canister valves are opened and closed simultaneously for sampling.

Summa® canisters will be submitted to the contracted laboratory for analysis of VOCs via EPA Method TO-15. Analytical results will be provided in ASP Category B format and a Data Usability Summary Report (DUSR) will be prepared.

4.5 Sample Documentation

4.5.1 Logbooks

All field activities will be documented in a field logbook. This logbook will provide a record of activities conducted at the Site. All entries will be signed and dated at the end of each day of fieldwork. The field logbook will include the following: date and time of all entries; names of all personnel on Site; weather conditions (temperature, precipitation, etc.); location of activity; and description of activity.

In addition, Lu Engineers will complete the following standard field forms as necessary:

- Boring logs
- Well construction detail
- Groundwater elevations, development, and sampling logs
- Summa® canister data sheets
- Chain of custody for all analytical laboratory sampling

As with any data logbooks, no pages will be removed for any reason. If corrections are necessary, these must be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside it. The correction must be initialed and dated.

4.5.2 Sample Identification

All containers of samples collected by Lu Engineers from the project will be identified using a format identified in the field on a label affixed to the sample container (labels are to be covered with Mylar tape). Generally, the format will include the following:

- Two or three letters identifying the type of sample:
  - MW- groundwater sample
  - SVS- sub-slab soil vapor sample
  - IA- indoor air sample
  - OA- outdoor air sample
- Three letters identifying Lu Engineers: JCL
- Two numbers identifying a sample location;
- Additional letters identifying special parameters, if applicable:
  - D – Field Duplicate
  - MS – Matrix Spike
  - MD - Matrix Spike Duplicate

Example: SVS-JCL-03 a sub-slab soil vapor sample collected from location 03.

Each sample will be labeled and sealed immediately after collection. The sample label will be filled out using waterproof ink and will be firmly affixed to the sample containers and protected with Mylar tape. The sample label will give the sample number, the date of the collection, analysis required, and pH and preservation, if appropriate.

The laboratory sample number will appear on a barcode label affixed to each sample, extract, or digestate.

4.6 Field Instrumentation

All instruments and equipment used during sampling and analysis will be operated, calibrated and maintained according to manufacturer's guidelines and recommendations. Operation, calibration, and maintenance will be performed by personnel properly trained in these procedures. Documentation of calibration information will be maintained in the appropriate log book or reference file and will be available upon request. Instruments will be calibrated before each use.

5.0 Sample Handling and Custody

This section describes procedures for sample handling and chain-of-custody to be followed by Lu Engineers sampling personnel and the analytical laboratory. The purpose of these procedures is to ensure that the integrity of the samples is maintained during their collection, transportation, storage, and analysis. Chain-of-custody requirements are compliant with EPA sample-handling protocols.

Sample identification documents will be carefully prepared so that sample identification and chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include field notebooks, sample labels, custody seals, chain-of-custody records, and laboratory sample log-in and tracking forms.

The primary objective of the chain-of-custody procedures is to provide an accurate written record that can be used to trace the possession and handling of a sample from the moment of its collection through it analyses. A sample is in custody if it is:

- In someone's physical possession;
- In someone's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

5.1 Sample Containers and Preservation

For sampling performed by Lu Engineers, new sample containers obtained from a reliable supplier will be provided by the analytical laboratory. All containers provided by the laboratory are precleaned (Level 1), with certificates of analysis available for each bottle type. Certifications of Analysis provided by the vendor are kept on file by the laboratory.

All samples will be stored on ice pending delivery to the laboratory. In addition, all water samples for volatile analysis will be preserved with HCl to a pH of less than 2. A list of preservatives and holding times for each type of analysis is included on the attached Table 2.

Sample preservation will be verified at the lab prior to extraction, digestion, and/or analysis and the pH will be recorded in the extraction/digestion logbook. The pH may be checked upon arrival, if desired. If the samples are improperly preserved, a QA/QC discrepancy form will be submitted to the lab manager and QA coordinator for appropriate follow-up action (i.e., evaluation of the data during the data validation process and, if necessary, additional instruction of personnel regarding proper procedures).

5.2 Field Custody Procedures

- Sample bottles must be obtained precleaned from the laboratory or directly from an approved retail source. All containers will be prepared in a manner consistent with the NYSDEC ASP 1991 bottle-washing procedures. Coolers or boxes containing cleaned bottles should be sealed with a custody tape seal during transport to the field or while in storage prior to use.
- All containers will have assigned lot numbers to ensure traceability through the supplier.
- As few persons as possible should handle samples.
- The sample collector is personally responsible for the care and custody of samples collected until the samples are transferred to another person or dispatched properly under chain-of-custody rules.
- The sample collector will record sample data in the field notebook.
- The project manager will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

5.2.1 Custody Seals

Custody seals are preprinted adhesive-backed seals with security perforations designed to break if the seals are disturbed. A custody seal is placed over the cap of individual sample bottles by the sampling technician. Sample shipping containers (coolers, cardboard boxed, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. Strapping tape should be placed around the lid to ensure that seals are not accidentally broken during shipment and in a manner that allows easy removal by laboratory personnel. On receipt at the laboratory, the custodian must check (and certify, by completing logbook entries) that seals on boxes and bottles are intact.

5.2.2 Chain-of-Custody Record

The chain-of-custody record must be fully completed in duplicate, using black carbon paper where possible, by the field technician who has been designated by the project manager as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (i.e., extraction time or sample retention period limitations, etc.), the person completing the chain-of-custody record should note these constraints in the "Remarks" section of the custody record.

5.3 Sample Handling, Packaging and Shipping

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of the sample but also prevents any detrimental effects due to the possible hazardous nature of samples. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 through 177.

5.3.1 Sample Packaging

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

- Sample bottle lids must never be mixed. All sample lids must stay with the original containers.
- The sample bottle should never be completely filled except for VOA bottles. At a minimum, a 10% void space should be left in the bottle to allow for expansion.
- All sample bottles must be sealed around the neck or the jar lid with clear tape. Any custody seals should be affixed prior to sealing the bottle.
- All sample bottles shall be placed in plastic Zip-lock bags to minimize contact with inert packing material, unless foam inserts are used.
- Foam inserts should be used as inert packing material when shipping low hazard water samples via a common carrier to the laboratory.
- Low-hazard environmental samples are to be cooled. "Blue ice" or some other artificial icing material, or ice placed in plastic bags, may be used. Ice will not be used as a substitute for packing material.
- A duplicate custody record must be placed in a plastic bag and taped to the inside of the cooler lid. Custody seals are affixed to the sample cooler.
- The cooler will be labeled as containing a hazardous material if it contains medium or high-hazard samples. Labeling requirements differ depending on the type of material being shipped; the majority of soil samples may be shipped as a class "9" hazardous material with the proper shipping name "OTHER REGULATED SUBSTANCES (ENVIRONMENTAL SAMPLES)."
- A hazardous material shipping manifest will be completed for each cooler of medium to high-hazard samples and affixed to the lid of the cooler.
- Low-hazard environmental samples do not require a hazardous material shipping manifest. The words "LABORATORY SAMPLES" should be printed on the top of the cooler for low-hazard samples.
- Samples packaged and shipped as limited-quantity radioactive material must comply with DOT and shipper regulations for package contamination limits, surface exposure rate, and airbill completion.

5.3.2 Shipping Containers

Environmental samples will be properly packaged and labeled for transport and dispatched for analysis to the appropriate subcontracted laboratory for geotechnical analyses. A separate chain-of-custody record must be prepared for each container. The following requirements for marking and labeling of shipping containers will be observed:

- Use abbreviations only where specified;
- The words "This End Up" or "This Side Up" must be clearly printed on the top of the outer package. Upward-pointing arrows should be placed on the sides of the package. The words "Laboratory Samples" should also be printed on the top of the package; and
- After a container has been closed, two custody seals are placed on the container—one on the front and one on the back. The seals are protected from accidental damage by placing strapping tape over them.

Field personnel will make timely arrangements for transportation of samples to the laboratory. When custody is relinquished to a shipper, field personnel will telephone the laboratory custodian to inform him of the expected time of arrival of the sample shipment and to advise him of any time constraints on sample analysis.

5.3.3 Shipping Procedures

- The coolers in which the samples are packed must be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the record. This record documents sample custody transfer.
- Samples must be dispatched to the laboratory for analysis with a separate chain-of-custody record accompanying each shipment. Shipping containers must be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information are entered in the "Remarks" section of the chain-of-custody record.
- All shipments must be accompanied by the chain-of-custody record identifying their contents. The original record accompanies the shipment, and the yellow copy is retained by the site team leader.
- If sent by mail, the package is registered with return receipt requested. If sent by common carrier, a bill of lading is used. Freight bills, Postal Service receipts, and bills of lading are retained as part of the permanent documentation.
- Samples must be shipped to the analytical laboratory within 24 to 48 hours from the time of collection.

5.4 Laboratory Custody Procedures

The designated sample custodian at the laboratory will be responsible for maintaining the chain-of-custody for samples received at the lab. Among other things, the custodian must adhere to the following basic requirements:

- When the sample arrives at the lab, the custodian will complete a Cooler Receipt & Preservation Form for each cooler/package container.
- Upon receipt, the coolers are examined for the presence and condition of custody seals, locks, shipping papers, etc. Shipping labels are removed and placed on scrap paper and added to the receiving paper work. The custodian then completes the chain-of-custody record by signing and recording the date and time the package is opened.
- Acceptance criteria for cooler temperature is 0-6°C. If a cooler exhibits a temperature outside this range, the anomaly is noted on the Cooler Receipt & Preservation Form.
- The custodian will then unload the samples from the cooler(s)/container(s), assign an identification number to each sample container, and affix a barcode label to each sample container for logging in and out of the sample tracking system.

Adherence to this procedure will ensure that all samples can be referenced in the computer tracking system. All sample control and chain-of-custody procedures applicable to the analytical laboratory are presented in laboratory SOPs available for review.

6.0 Analytical Methods

Post-injection groundwater sample analysis will be performed by Paradigm Environmental Services, a NYSDOH ELAP-certified analytical laboratory. If ASP-B analysis is required (i.e., final groundwater sampling), Upstate Laboratories will be used for groundwater analysis. Soil vapor intrusion sample analysis will be preformed by Centek Laboratories, LLC. General analytical and organic methods to be performed by the laboratory for this project are listed in Table 1 of this QAPP.

6.1 Analytical Capabilities

The analytical laboratory is fully equipped for analysis of all types of water, air, and soil samples for chemical contaminants, bacteriological quality, and general characterization. Proven and approved analytical techniques are used, backed up by a rigorous system of QC and QA checks to ensure reliable and defensible data. All laboratory work is performed in accordance with guidelines established by EPA, the NYSDOH, and the NIOSH.

Organic analysis is accomplished by gas chromatography (GC), high performance liquid chromatography (HPLC), and or GC/mass spectrometry (MS). Liquid, soil, and air samples are analyzed routinely for pesticides, polychlorinated biphenyls (PCBs), volatile organics, extractable organics, and other groups of compounds, as necessary.

Laboratory procedures to be utilized for sample preparation and analysis are referenced in the NYSDEC ASP.

Method Detection Limits
Method detection limits are determined according to procedures outlined in 40 CFR Part 136, Appendix B or EPA CLP. General analytical detection limits are usually determined by the lowest point on the curve. Detection limits are determined at least annually for all appropriate analytical methods. A listing of the laboratory's method detection limits is available upon request.

Reporting limits for analysis of the soil vapor and indoor air samples via EPA Method TO-15 are included in Attachment C-1. The detection limit for most compounds is 1 ug/m^3. Indoor and outdoor air samples for Matrix 1 compounds have a lower detection limit of 0.25 ug/m^3.

6.2 Quality Control Samples

Laboratory QC consists of analysis of laboratory blanks, duplicates, spikes, standards, and QC check samples as appropriate to the methodology. These laboratory QC samples are described below.

6.2.1 Laboratory Blanks

Three types of laboratory blanks, one or more of which will be utilized depending on the analysis are described below:

- Method blanks consist of analyte-free water and are subjected to every step of the analytical procedure to determine possible contamination.
- Reagent blanks are similar to method blanks but incorporate only one of the preparation reagents in the analysis. When a method blank indicates significant contamination, one or more reagent blanks are analyzed to determine the source.
- Calibration blanks consist of pure reagent matrix and are used to zero an instrument's response, thus establishing the baseline.

6.2.2 Calibration Standards

A calibration standard may be prepared in the laboratory by dissolving a known amount of a pure compound in an appropriate matrix. The final concentration calculated from the known quantities is the true value of the standard. The results obtained from these standards are used to generate a standard curve and thereby identify the concentration of the compound in the environmental sample. A minimum of three calibration standards will be used to generate a standard curve for all analyses.

6.2.3 Reference Standard

A reference standard is prepared in the same manner as a calibration standard but from a different source. Reference standards may be obtained from the EPA. The final concentration calculated from the known quantities is the "true" value of the standard. The important difference in a reference standard is that it is not carried through the same process used for the

environmental samples, but is analyzed without digestion or extraction. A reference standard result is used to validate an existing concentration calibration standard file or calibration curve.

6.2.4 Spike Sample

A sample spike is prepared by adding to an environmental sample (before extraction or digestion) a known amount of pure compound of the same type that is to be assayed for in the environmental sample. Spikes are added at one to 10 times the expected sample concentration or approximately 10 times the method detection limit. These spikes simulate the background and interferences found in the actual samples, and the calculated percent recovery of the spike is taken as a measure of the accuracy of the analytical method.

A blank spike is the same as a spike sample except the spike is added to analyte-free water. The blank spike is used to determine whether the sample preparation and analysis are under control.

6.2.5 Surrogate Standard

A surrogate is prepared by adding a known amount of pure compound to the environmental sample; the compound selected is not one expected to be found in the sample, but is similar in nature to the compound of interest. Surrogate compounds are added to the sample prior to extraction or digestion. Surrogate spike concentrations indicate the percent recovery of the analytes and, therefore, the efficiency of the methodology.

6.2.6 Internal Standard

Internal standards are similar to surrogate standards in chemical composition but are used to quantify the concentration of analytes sampled based on the relative response factor. Internal standards are added to the environmental sample prior to instrumental analysis.

6.2.7 Laboratory Duplicate or Matrix Spike Duplicate

Laboratory duplicates are aliquots of the same sample that are split prior to analysis and treated exactly the same throughout the analytical method. Spikes and duplicates for the batch are normally aliquots of the same sample. For organics, spikes are added at approximately 10 times the method detection limit. The RPD between the values of the matrix spike and matrix spike duplicate for organics or between the original and the duplicate for inorganics is taken as a measure of the precision of the analytical method.

In general, the tolerance limit for RPDs between laboratory duplicates should not exceed 20% for validation in homogeneous samples.

6.2.8 Check Standard/Samples

Inorganic and organic check standards or samples are prepared with reference standards or are available from the EPA. They are used as a means of evaluating analytical techniques of the analyst. Check standards or samples are subjected to the entire sample procedure, including extraction, digestion, etc., as appropriate for the analytical method utilized. The check standard or sample can provide information on the accuracy of the analytical method independent of various sample matrices.

6.3 Laboratory Instrumentation

Laboratory capabilities will be demonstrated initially for instrument and reagent/ standards performance as well as accuracy and precision of analytical methodology. A discussion of reagent/standard procedures and brief descriptions of calibration procedures for major instrument types follow.

All standards are obtained directly from EPA or through a reliable commercial supplier with a proven record for quality standards. All commercially supplied standards will be traceable to EPA or NIST reference standards and appropriate documentation will be obtained from the supplier. In cases where documentation is not available, the laboratory will analyze the standard and compare the results to a known EPA-supplied or previous NIST-traceable standard.

All sections of the laboratory will have SOP for standard and reagent procedures to document specific standard receipt, documentation, and preparation activities. In general, the individual SOPs incorporate the following items:

- Documentation and labeling of date received, lot number, date opened, and expiration date;
- Documentation of traceability;
- Preparation, storage, and labeling of stock and working solutions; and
- Establishing and documenting expiration dates and disposal of unusable standards.

Each laboratory instrument will be labeled clearly with a unique identifier that relates to all laboratory calibration documentation. Laboratory SOPs and calibration procedures are detailed in the laboratory's Quality Assurance Manual, available upon request.

7.0 Data Reporting and Validation

7.1 Deliverables

Once the contract laboratories have provided all analytical data and sampling information has been evaluated, Lu Engineers will develop a Final Engineering Report for the remedy. The report will be prepared as indicated by the following general outline:

1.0 Introduction
2.0 General Site Information
3.0 Description of the Remedy
4.0 Summary of Remedial Actions
5.0 Results
6.0 Conclusions & Recommendations

The report will carefully document all remedial activities and will be supplemented with photographic documentation, maps, figures, tables, sample logs, DUSRs, and lab results.

A Site Management Plan (SMP) will be prepared and submitted along with the FER.

7.1.1 Category B Data Package

The final round of groundwater samples and all vapor intrusion samples will be reported by the laboratory with NYSDEC ASP Category B deliverables. The Category B data package includes:

- A detailed summary of the report contents and any quality control outliers or corrective actions taken.
- Chain of Custody documentation
- Sample Information including: date collected, date extracted, date analyzed, and analytical methods.
- Data (including raw data) for:
    - samples
    - laboratory duplicates
    - method blanks
    - spikes and spike duplicates
    - surrogate recoveries
    - internal standard recoveries
    - calibrations
    - any other applicable QC data
- Method detection limits and/or instrument detection limits
- Run logs, standard preparation logs, and sample preparation logs
- Percent solids (where applicable).

7.1.2 Quality Assurance Reports

For the laboratory, a general QA report summarizing problems encountered throughout the laboratory effort, including sample custody, analyses, and reporting, is provided to Lu Engineers by the QA coordinator. This report identifies areas of concern and possible resolutions in an effort to ensure data quality.

Upon completion of a project sampling effort, analytical and QC data will be included in a comprehensive report that summarizes the work and provides a data evaluation. A discussion of the validity of the results in the context of QA/QC procedures will be made, as well as a summation of all QA/QC activity.

Serious analytical or sampling problems will be reported to NYSDEC. Time and type of corrective action, if needed, will depend on the severity of the problem and relative overall project importance. Corrective actions may include altering procedures in the field, conducting an audit, or modifying laboratory protocol. All corrective actions will be implemented after notification and approval of NYSDEC.

In addition to the laboratory report narrative, QA data validation reports that include any contractual requirements will also be provided to NYSDEC. These QA reports will be submitted with the analytical data, on a monthly basis, or at the conclusion of the project.

7.2 Data Validation and Usability

Prior to the submission of the report to NYSDEC, all data will be evaluated for precision, accuracy, and completeness.

QA/QC requirements from both methodology and company protocols will be strictly adhered to during sampling and analytical work. All data generated will be reviewed by comparing and interpreting results from instrumental responses, retention time, determination of percent recovery of spiked samples or blanks, and reproducibility of duplicate sample results. All calculations and data manipulations are included in the appropriate methodology references. Control charts and calibration curves will be used to review the data and identify outlying results.

7.2.1 Data Validation

It is anticipated that a third-party validator (MECX, Inc.) will be responsible for an independent review of analytical work performed under the NYSDEC ASP-CLP protocol. The functions will be to assess and summarize the quality and reliability of the data for the purpose of determining its usability and to document for the historical record of each site any factors affecting data usability, such as discrepancies, poor laboratory practices, and site locations that are difficult to analyze. The data validator will be responsible for determining completeness and compliance. Lu Engineers' QA officer will be responsible for determining data usability and overseeing the work of the data validator.

Information available to the data validator and the QA officer for performance of these functions include the NYSDEC ASP Category B data package, information from the sampling team regarding field conditions and field QA samples, chain-of-custody and shipping forms. The data package is designed to provide all necessary documentation to verify compliance with NYSDEC ASP CLP protocol and the accuracy and reliability of the reported results.

The laboratory will deliver the data package to the project QA coordinator for processing prior to submission to the data validator. The project QA coordinator will review the report for immediate problems, summarize the data for in-house use, and process the work order for the third-party data-validation subcontract within five working days.

In order to effectively review the data package, the data validator will obtain a general overview of each case. This includes the exact number of samples, their assigned numbers, and their matrix. The data validator will deliver the data validation report within 30 days of receipt of the data package.

If a problem arises between the data validator and the laboratory, the data validator must submit written questions to the laboratory. The laboratory will be required to respond in writing within 10 working days to correct any deficiencies. If the data validator does not receive a written response from the laboratory within the specified time period, the data in question shall be considered noncompliant.

Sampling locations will be obtained from the sampling records, such as the chain-of-custody forms. This information is necessary for preparation of the data summary, evaluation of adherence to sample holding times, discussion of matrix problems, and discussion of contaminants detected in the samples.

The following is a brief outline of the data validation process:

- Compilation of all samples with the dates of sampling, laboratory receipt, and analysis;
- Compilation of all QC samples, such as field blanks, field duplicates, MS/MSD samples, laboratory blanks, and laboratory replicates;
- Review of chain-of-custody documents for completeness and correctness;
- Review of laboratory analytical procedure and instrument performance criteria;
- Qualification of data outside acceptable QC criteria ranges;
- Preparation of a memorandum summarizing any problems encountered and the potential effects on data usability;
- Preparation of a data summary, including validated results, with sample matrix, location, and identification; and
- Tabulation of field duplicates, laboratory replicate, and blank results.

Copies of data validation and usability reports, as well as data summary packages, will be provided to the NYSDEC project manager. In addition, copies of analytical raw data will be provided to NYSDEC electronically, on CD in pdf format.

7.2.2 Data Usability

A Data Usability Summary Report (DUSR) will be provided after review and evaluation of the analytical data package. The DUSR will contain required elements listed in Appendix 2B of *DER-10 Technical Guidance for Site Investigation and Remediation.*

The DUSR will include a description of the samples and analytical procedures used. Any data deficiencies, protocol deviations, or quality control problems will be discussed as to their effect on data results. The report will also include any suggestions for resampling or reanalysis.

Tables

Table 1
Proposed Sampling and Analysis Summary

Sample Type	Sample Location	Analytical Parameter	Analytical Method	Reporting Level	Estimated # Field Samples	Field Duplicates	Blanks		MS/MSD	Total
							Equip	Trip		
Groundwater	MW-JCL-02 MW-JCL-03 MW-13	TCL VOCs + TICS TAL Metals	8260 6010	Category A	**9-12**	-	-	-	-	**9-12**
Groundwater	MW-JCL-01, -02, -03; MW-01, MW-03, MW-06, MW-13	TCL VOCs + TICs TAL Metals	8260 6010	Category B	**7**	**1**	-	**1**	**1/1**	**11**
Soil Vapor	Sub-slab	VOCs	TO-15	Category B	**2**	**1**	-	-	-	**3**
Ambient Air	2 Indoors @ sub-slab locations 1 Outdoor- upwind	VOCs	TO-15	Category B	**3**	-	-	-	-	**3**

Table 2
Sample Preservation and Holding Times

Parameter	Method Number	Container Type and Size	Preservation	Holding Time*
Groundwater				
TCL VOCs	8260	3 x 40-ml. VOA	Cool to 4°C; minimize headspace; HCl to pH<2	5 days unpreserved / 12 days preserved
TAL Metals	6010	1 x 250 ml. plastic	HNO_3 to pH<2	180 days
Soil Vapor				
VOCs	TO-15	6-L. Summa canister or Minican	None	10 days

* Holding times are based on verified time of sample receipt (VTSR) at the laboratory

Attachment C-1

Centek TO-15 Reporting Limits

GENERAL PRICING

SOIL GAS VAPOR INTRUSION

Test	Price	Detection Limit	Comments
EPA TO-15		1 ug/m3	TO-15 list at 1 ug/m3 (sub slab/ Soil gas)
EPA TO-15		TCE @ .25 ug/m3	NYS ambient & indoor air Vapor Intrusion protocol
EPA TO-15 w/ Naphthalene	Call for Pricing	1ug/M3	
EPA TO-15 (Select List)	Call for Pricing	1ug/m3 & TCE @ 0.25 ug/M3	1-4 individual compounds

INDUSTRIAL HYGIENE & INDOOR AIR QUALITY

Test	Price	Detection Limit	Comments
EPA TO-15		5 ppbv	63 compounds TO-15 list
EPA TO-15 + TIC's		5 ppbv	
EPA TO-15 (Select List)	Call for Pricing	5ppbV	1-4 individual compounds
EPA TO-15 w/ Naphthalene	Call for Pricing	5ppbV	
EPA TO-14		5 ppbv	Complete TO-14 list
EPA TO-14 + TIC's		5 ppbv	
EPA TO-14 (Select List)	Call for Pricing	5ppbV	1-4 individual compounds
BTEX / MTBE only		5 ppbv	Selected Compounds
Freon's		5ppbv	
Freon's + TIC's		5ppbv	
EPA TO1		5ppbv	
EPA TO2		5ppbv	
EPA TO3		5ppbv	
Chlorinated Solvents		5ppbv	
Chlorinated Solvents + TIC's		5ppbv	

OZONE PRECURSORS

Test	Price	Detection Limit	Comments
Ozone Precursors		5ppbv	
Ozone Precursors + TIC's		5ppbv	

SOIL GAS VAPOR INTRUSION

TO-15 POLAR AND NON-POLAR VOLATILE COMPOUNDS CAS#	Detection Limit 0.15ppbv 1ug/m3 (varies pending MW)	Detection Limit 1ug/m3+ TCE@.25 (varies pending MW)
acetone 67-64-1 allyl chloride 107-05-1 benzene 71-43-2 benzyl chloride 100-44-7 bromodichloromethane 75-27-4 bromoform 75-25-2 bromomethane 74-83-9 1,3-butadiene 106-99-0 2-butanone (Methyl Ethyl Ketone) 78-93-3 carbon disulfide 75-15-0 carbon tetrachloride 56-23-5 chlorobenzene 108-90-7 chloroethane 75-00-3 chloroform 67-66-3 chloromethane 74-87-3 cyclohexane 110-82-7 dibromochloromethane 124-48-1 *trans*-1,2-dichloroethene 156-60-5 1,2-dibromoethane 106-93-4 1,2-dichlorobenzene 95-50-1 1,3-dichlorobenzene 541-73-1 1,4-dichlorobenzene 106-46-7 1,1-dichloroethane 75-34-3 1,2-dichloroethane 107-06-2 1,1-dichloroethene 75-35-4 *cis*-1,2-dichloroethene 156-59-2 1,2-dichloropropane 78-87-5 *cis*-1,3-dichloropropene 10061-01-5 *trans*-1,3-dichloropropene 10061-02-6 1,4-dioxane 123-91-1 ethylbenzene 100-41-4 ethyl acetate 141-78-6 4-ethyltoluene 622-96-8 halocarbon 11 75-69-4 halocarbon 12 75-71-8 halocarbon 113 76-13-1 halocarbon 114 76-14-2 hexachloro-1,3-butadiene 87-68-3 hexane 110-54-3 2-hexanone (Methyl Butyl Ketone) 591-78-6 4-methyl-2-pentanone (Methyl Isobutyl Ketone) 108-10-1 methyl *tert*-butyl ether 163-04-4 methylene chloride 75-09-2		
	(cont)	(cont)

SOIL GAS VAPOR INTRUSION

TO-15 POLAR AND NON-POLAR VOLATILE COMPOUNDS CAS#	Detection Limit 0.15ppbv 1ug/m3 (varies pending MW)	Detection Limit 1ug/m3+ TCE@.25 (varies pending MW)
2-propanol (isopropyl alcohol) 67-63-0 propylene 115-07-1 styrene 100-42-5 1,1,2,2,-tetrachloroethane 71-55-6 tetrachloroethene 127-18-4 tetrahydrofurn 109-99-9 toluene 108-88-3 1,2,4-trichlorobenzene 120-82-1 1,1,1-trichloroethane 71-55-6 1,1,2-trichloroethane 79-00-5 trichloroethene 79-01-6 1,2,4-trimethylbenzene 95-63-6 1,3,5-trimethylbenzene 108-67-8 2,2,4-trimethylpentane 540-84-1 vinyl chloride 75-01-4 vinyl acetate 108-05-4 vinyl bromide 593-60-02 *m& p*-xylene 108-38-3 *o*-xylene 95-47-6 **Single Compound** **List** **List + TIC's** **TIC's Only**	**Call for pricing**	**Call for pricing**

SOIL GAS VAPOR INTRUSION NAPHTHALENE

TO-15 NAPHTHALENE CAS#	Detection Limit 1ug/m3	Detection Limit 1ug/m3+ TCE@.25
Naphthalene 91-20-3 **Single Compound** **Or with list**	**Call for pricing**	**Call for pricing**

Attachment D

Project Schedule & Draft Sign

Remedial Action Schedule

Former Churchville Ford Site # V00658-8

Remedial Action	**Month**														
Task/ Milestone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Work Plan Review & Approval	■														
30-day Public Comment Period		■													
Final WorkPlan Approval			■												
Record deed restrictions														■	
Remedial Measures															
Order Solution & Coordinate w/ Contractor			■												
Install Injection Wells				■											
Injection of solution				■	■	■									
Post-Injection groundwater & soil vapor sampling							■					■			
Submissions & Deliverables															
Monthly Progress Reports				■	■	■	■	■	■	■	■	■	■	■	
Draft DCR submission												■	■		
Draft FER Submission												■	■		
Agency Review & Approval														■	
Final FER Submission															■
Release & Covenant Not to Sue issued															■

Voluntary Cleanup Program

Former Churchville Ford Site
 # V00658-8
Antonio Gabrielle and Joseph Ognibene, Volunteers

David A. Paterson, Governor
Alexander B. Grannis, Commissioner
Nancy Steedman, Mayor

Transform the Past…. Build for the Future

Attachment E

Qualifications

ROBERT J. ELLIOTT, P.E.

Principal in Charge

LU ENGINEERS
Civil and Environmental

-EDUCATION-

B.S.C.T., Civil Engineering, 1976,
Rochester Institute of Technology, Rochester, NY

- 30 Years Experience
- Village of Penn Yan Engineer
- ERP Brownfield Experience
- Remedial Investigation Expert

-REGISTRATION-

Professional Engineer, NY
Professional Engineer, PA
NYSDOL Asbestos Project Designer

-PROJECT EXPERIENCE-

Mr. Elliott has worked for Lu Engineers since it was first established in 1980 and has 30 years of civil and environmental engineering experience. The majority of his experience involves project engineering and management duties for hazardous wastes, petroleum, and water and wastewater related projects. Mr. Elliott has also managed asbestos-related projects involving assessment, removal design and monitoring.

REMEDIAL AND BROWNFIELD REDEVELOPMENT

Former Frink America ERP Brownfield Site, Clayton, NY
Senior Project Manager for NYS Environmental Restoration Program services on this waterfront Brownfield site. The project involved the identification of the vertical and horizontal extent of contamination, surface soil sampling, borings, removal of underground storage tanks, PCB sampling, an RI/FS report and development of a Work Plan to address known impacted soils.

Orchard-Whitney ERP Brownfield Investigation, City of Rochester, NY
Mr. Elliott served as Principal-in-Charge of environmental services at the Orchard-Whitney Brownfield site for the City of Rochester, NY under the NYSDEC Environmental Restoration Brownfield Program. This 3.9 acre site is located in a strategic economic development area of the City. The goal of this project is to generate a NYSDEC approved Site Investigation/Remedial Alternatives Report (SI/RAR). Initially, a waste characterization and an asbestos, hazardous waste and lead pre-demolition survey were performed. Subsurface investigation will begin after demolition is complete. The subsurface investigation will be used to further define the horizontal and vertical extent and concentrations of contaminants in the soil and groundwater.

Karenlee Drive, Henrietta, NY
Mr. Elliott was the Principal in Charge for implementing a Work Plan for the former wastewater treatment plant at 100 Karenlee Drive in the Town of Henrietta in accordance with the New York State Department of Environmental Conservation Brownfield Program. Lu Engineers provided oversight for installation of seven monitoring wells, the collection of subsurface soil samples during the well installation, the collection of water samples from the installed wells and the collection of surface soil samples. He provided coordination between NYSDEC and Town of Henrietta. A report describing the findings of the investigation was prepared for the Town of Henrietta.

Almor Voluntary Cleanup Plan, Warsaw, NY
Mr. Elliott was the Principal in Charge for the voluntary cleanup of the former Almor manufacturing plant. Extensive research was conducted during the remedial investigation in order to determine the nature and extent of the wastes and contamination associated with the property. Services provided included a geoprobe investigation of the site, stream sampling, groundwater sampling, limited soil removal and testing on an underground storage tank found on the site.

Abe Cooper Superfund Site, Watertown, NY
Mr. Elliott served as Project Manager responsible for the design of a River Bank Protection System along the Black River for the NYSDEC. This system was needed to prevent contaminated soils from leaching into the river. The system included remediation and stabilization of 700 linear feet of riverbank. A US Army Corps of Engineers Section 10 permit was completed for the excavation of approximately 6,000 cubic yards of existing soil at the riverbank and 2,575 c.y. of heavy stone fill for slope protection. A hazardous waste site remediation was also performed.

XLI Corporation, Brownfield Redevelopment, Rochester, NY
Mr. Elliott was the Principal in Charge for the Brownfield redevelopment project for this property listed on the New York State List of Inactive Hazardous Waste Disposal Sites. The project included: engineering design with site layout for parking, pedestrian access, site access, building location, vehicular traffic, utilities, and storm water collection and conveyance along with storm water retention/detention facility; surveying services including base mapping; health and safety plan; and developing a plan for the removal and relocation of landfill materials present on the site. Mr. Elliott worked closely with the City of Rochester and XLI Corporation to provide site development alternatives that satisfied the requirements of the City's Brownfield Pilot Program.

Davis Howland Oil Co. Site, Remedial Design and Construction Oversight, Rochester, NY
As Principal-In-Charge, Mr. Elliott was responsible for the construction oversight of remediation work and shop drawing review for remediation equipment at the Davis Howland Oil Corporation inactive hazardous waste disposal site in Rochester, NY. This $2 million NYSDEC Superfund project involves the implementation of remedial activities including a trailer mounted remediation system that treats the shallow groundwater, soil, and fractured bedrock beneath the site. We also continue to provide oversight and support the O&M subcontractor in the operations and maintenance and documentation associated with the continued remediation of this site. The remediation of the soil and groundwater included Air Sparging (AS) and Soil Vapor Extraction (SVE), groundwater pumping and treatment system and catalytic oxidation treatment (CatOX). In 2004, a soil vapor survey on properties in residential/commercial surrounding this site was conducted, as well as interior and basement air sampling.

Brownfield site, Wetland Delineation, Driving Park Ave., Rochester, NY
Mr. Elliott was the Principal-in-Charge of federal wetland delineation on a 12.7 acre Brownfield industrial site located in the City of Rochester, NY. The field delineation was done on approximately three acres of a wooded wetland. Hand-held global positioning system (GPS) was used to flag the boundary. Sampling was required to characterize the soils, hydrology and vegetation, and to support the boundary determination. A formal wetland delineation report suitable for submission to the U.S. Army Corps of Engineers was prepared and field visit with a representative of the U.S. Army Corps of Engineers was coordinated for concurrence on the boundary.

GREG ANDRUS, CHMM

Environmental Scientist

LU ENGINEERS
Civil and Environmental

-EDUCATION-

B.S., Geology, 1987, Washington & Lee University, Lexington, VA
Hydrogeology, Graduate Level Studies, SUNY at Brockport, Brockport, NY

- 21 Years Experience
- ERP Brownfield Specialist
- Certified Hazardous Materials Manager

-TRAINING, CERTIFICATIONS & ASSOCIATIONS-

Certified Hazardous Materials Manager
OSHA 40-Hour Training and Refresher Courses
OSHA Confined Space Entry Training
Air Program Information Management Systems
ACHMM Finger Lakes Chapter, Former President
Joint Services Pollution Prevention and Hazardous Waste Management Conference, San Antonio, TX
PC Application in Risk Assessment, Modeling and GIS
New York State Council of Professional Geologists
National Groundwater Association

-PROJECT EXPERIENCE-

Mr. Andrus' 21 years of experience includes a diverse range of geological and environmental engineering projects. Areas of specialization include remedial investigation/site characterization, site remediation, site assessment, regulatory compliance and permitting. His experience also includes noise impact analysis, wetland studies, asbestos building surveys, and abatement design and air contaminant impact analysis.

Air Force Research Laboratory / Rome Research Site (AFRL/RRS), Rome, NY
Mr. Andrus served as project manager for four consecutive multi-years IDIQ contracts to provide civil and environmental engineering services to the AFRL/RRS at the former Griffiss Air Force Base. Under these contracts, Lu Engineers has conducted wetland delineations, in-situ chemical oxidation, decommissioning of wells, archaeological, UST closures and disposal area closures, design of backflow preventers; on-call environmental sampling services, air emissions surveys and air emissions control process design; asbestos surveys and management plans and wastewater sampling.

Town of Clarkson, Phase I ESA and ERP Application, Clarkson, NY
Mr. Andrus conducted a Phase I Environmental Site Assessment on a vacant commercial property located on Route 104 in the Town of Clarkson. He also prepared an ERP Program application for NYSDEC funding of investigation and cleanup for this former gas/service station.

Port Leyden ERP Brownfield Investigation; Town of Leyden, NY
Mr. Andrus is the project manager for this NYSDEC funded Brownfield Remedial Investigation and implementation of interim remedial measures. This site investigation included subsurface sampling, soil vapor testing, well installation, sampling and testing and the removal of storage tanks, a geophysical investigation to identify the tanks; the sight was a former gas/service station. A report was developed evaluating remedial alternatives and recommendations for the next Brownfield Phase of this project.

Former Frink America property, NYSDEC ERP Brownfield, Clayton, NY
The former Frink America property underwent a Site Investigation under the NYSDEC Environmental Restoration Program. The goal of the project was to identify the vertical and horizontal extent of contamination located on site in order to establish an appropriate cleanup alternative. Mr. Andrus prepared scoping, budget, and hydrogeological and engineering review.

Orchard-Whitney ERP Brownfield Investigation, City of Rochester, NY
Lu Engineers is currently providing environmental services for the Orchard-Whitney Brownfield site for the City of Rochester under the NYSDEC Environmental Restoration Program. The 3.9 acres site is located in a strategic economic development area of the City. The goal of this project is to generate a NYSDEC approved Site Investigation/Remedial Alternatives Report (SI/RAR). Mr. Andrus is the Project Scientist involved in the initial task of waste characterization and an asbestos, hazardous waste and lead pre-demolition survey. He will assist with tasks such as tank and sensitive equipment removals and unforeseen environmental conditions.

Karenlee Drive, Henrietta, NY

Lu Engineers completed and implemented a Work Plan for the former wastewater treatment plant at 100 Karenlee Drive in the Town of Henrietta in accordance with the New York State Department of Environmental Conservation (NYSDEC) Voluntary Cleanup Program. Mr. Andrus provided oversight of installation of seven monitoring wells, the collection of subsurface soil samples during the well installation, the collection of water samples from the installed wells and the collection of eight surface soil samples. After all of the information had been obtained a report describing the findings of the investigation was prepared for the Town of Henrietta. The information from this project was utilized to determine the extent and concentration of suspected site contamination and its impact on proposed future site improvements.

Former Motel/Restaurant, Medina, NY
Mr. Andrus acted as regulatory liaison and conducted information review for "Brownfield" site redevelopment at a gasoline station.

Steel Plant, Latrobe, Pennsylvania
Mr. Andrus conducted a Phase I and II involving extensive sampling and monitoring well installation and soil gas assessment for "Brownfield" site redevelopment.

State Police Barracks, Warsaw, NY
Mr. Andrus was the project geologist for remediation work on the NYS Police Troop 2 Barracks on Buffalo Road in Warsaw, NY. Tasks included a utility stakeout, test excavations, excavation and staging of impacted soils, and oversight of removal and disposal of excavated soils. Mr. Andrus assisted with preparation of a written report of the work performed, laboratory analysis, summary of soil contamination and recommendations for future work.

Transit Bus/DPW Storage and Maintenance Facility, Watertown, NY
Lu Engineers provided oversight of the building of trenches (for installing new utility lines) and advised them on the removal of the petroleum contaminated soils. As Project Geologist, Mr. Andrus assisted with background information review and performed site sampling and testing.

Regional Traffic Operations Center/Former Webaco Oil Property, Rochester, NY
Mr. Andrus assisted with periodic biocell evaluation of petroleum contaminated soils at the former Webaco Oil property at the Greater Rochester International Airport. Long-term biocell monitoring services and soil sampling were necessary to satisfy NYSDEC requirements.

STEVEN CAMPBELL, CHMM

Project Manager

LU ENGINEERS
Civil and Environmental

- 21 Years Experience
- ERP Brownfield Specialist
- Certified Hazardous Materials Manager
- Environmental/Remediation Group Leader

-EDUCATION-

B.S., Environmental Health and Safety, 1987, Brockport State University

-CERTIFICATIONS-

Certified Hazardous Materials Manager (CHMM)
Hazardous Waste Operations and Emergency Response
40 Hour Site Worker- Supervisor Level
Emergency Spill Response-Hazmat Technician and Incident Commander
US Department of Transportation Hazardous Materials -Transport Awareness Level

-PROJECT EXPERIENCE-

Mr. Campbell is the Environmental/Remediation Group Leader, and is responsible for all Brownfield/ERP projects for the company. He has worked in the field of environmental health and safety for over 20 years. During his career, he has worked as an environmental scientist and a Project Manager in the governmental, consulting, and private sectors. Mr. Campbell has investigated and inspected properties ranging from low environmental concerns to major Superfund sites as both a government contractor and private consultant.

BROWNFIELDS

Orchard-Whitney ERP Brownfield Investigation, Rochester, NY
As Project Manager, Mr. Campbell was responsible for providing environmental services for the Orchard-Whitney Brownfield site for the City of Rochester, NY under the NYSDEC Environmental Restoration Program. The 3.9 acres site is located in a strategic economic development area of the City. The goal of this project is to generate a NYSDEC approved Site Investigation/Remedial Alternatives Report (SI/RAR). Initial tasks involved waste characterization and an asbestos, hazardous waste and lead pre-demolition survey. After this is complete, demolition oversight of the buildings will be provided. Lu Engineers staff will assist with tasks such as tank and sensitive equipment removals and unforeseen environmental conditions. Subsurface investigation will begin after demolition is complete. The subsurface investigation will be used to further define the horizontal and vertical extent and concentrations of contaminants in the soil and groundwater. All of this will provide a basis for developing remedial alternatives that are based on conceptual future uses. Survey, GIS mapping and planning for citizen's participation meetings will be provided as necessary.

Former Frink America property, NYSDEC ERP Brownfield, Clayton, NY
On this waterfront Brownfield site, Mr. Campbell served as Project Manager for the NYS Environmental Restoration Program (ERP). The project involved the identification of the vertical and horizontal extent of contamination, surface soil sampling, borings, removal of underground storage tanks, PCB sampling, an RI/FS report and development of a Work Plan to address known impacted soils. An ERP grant application was also prepared. After remediation, the newly developed property will house residences, public boat docks, a riverwalk, a small inn, office space and a marina while creating new park areas and enhanced deep water port space along the St. Lawrence River.

City of Rochester, Brownfield Assistance Program, Term Contract, Rochester, NY
Project Manager responsible for providing environmental investigation services through a 3 year term contract for the City of Rochester's Brownfield Assistance Program (BAP). The BAP provides technical and financial assistance to private parties that need to investigate environmental conditions on Brownfield properties. This program is part of the City of Rochester's 2003 Brownfield Assessment grant from the United States Environmental Protection Agency (EPA). Therefore, all work performed by Lu Engineers meets the EPA standards.

Sewall's Island, ERP Brownfield Investigation, City of Watertown, NY
Mr. Campbell is the Project Manager in charge of providing the City of Watertown with a Remedial Investigation/ Alternatives Analysis Report (RI/AAR) a site on Sewall's Island in the City of Watertown, New York. The site consists of 11 parcels representing a total of 15.18 acres. Our scope of work on this project includes completion of a NYSDEC approved Environmental Assessment and as necessary an Interim Remedial Measures (IRM) Work Plan, a geophysical survey, identification of asbestos containing materials in on-site debris, Remedial Investigation Implementation, completion of an instrument survey, a Remedial Investigation/ Alternatives Analysis Report and conducting public meetings to inform the public of findings and recommendations pursuant to requirements of the ERP program.

Nichol Inn, ERP Brownfield Investigation, Steuben County, NY
Mr. Campbell is the Project Manager currently working with Steuben County at the Nichol Inn property located in the Town of Pulteney, NY to provide a Remedial Investigation/ Alternatives Analysis Report. This report will be relied upon as a basis for making appropriate decisions for site remediation and future development. The Scope of Work also includes an Environmental Assessment and Interim Remedial Measures Work Plan, geophysical survey, asbestos survey, asbestos removal, building demolition and tank removal, a remedial Investigation Implementation, and instrument survey. This project is being completed under the NYSDEC Environmental Restoration Program.

XLI Corporation, Brownfield Redevelopment, Rochester, NY
Mr. Campbell was the Project Manager for a Brownfield redevelopment project for property located within the boundaries of a landfill listed on the NYS List of Inactive Hazardous Waste Disposal Sites. The project included: engineering design with site layout, storm water collection and conveyance along with storm water retention/detention facility; surveying services including base mapping; review of site specific environmental investigations; health and safety plan; and developing a plan for the removal and relocation of landfill materials present. Mr. Campbell worked closely with the City of Rochester and XLI Corporation to provide site development alternatives that satisfy the requirements of the City's Brownfield Pilot Program.

Karenlee Drive, Henrietta, NY
Project Manager, implementing a Work Plan for the former wastewater treatment plant at 100 Karenlee Drive in the Town of Henrietta, NY, in accordance with the New York State Department of Environmental Conservation Brownfield Program. Phase I and Phase II Environmental Assessments were completed and tank removals were performed. Oversight was provided for installation of seven monitoring wells, the collection of subsurface soil samples during the well installation, the collection of water samples from the installed wells and the collection of surface soil samples was provided. The information from this project was utilized to determine the extent and concentration of suspected site contamination and its impact on proposed future site improvements.

Almor Voluntary Cleanup Plan, Warsaw, NY
In his role as Project Manager, Mr. Campbell assisted the Wyoming County Industrial Development Agency by providing environmental services for the cleanup of the former Almor manufacturing plant. Extensive research was conducted during the remedial investigation in order to determine the nature and extent of the wastes and contamination associated with the property. Additional services include a geoprobe investigation of the site, stream sampling, groundwater sampling, limited soil removal and testing on an underground storage tank found on the site.

Regional Traffic Operations Center, Rochester, NY
Project Manager for the hazardous substance and remedial investigations, including abatement design, for the proposed facility located at the Greater Rochester International Airport. The $10 million facility was constructed on lands previously used, in part, as an electroplating facility and an above Major Oil Storage Facility. Work tasks include a geophysical survey to determine the location of buried features, soil-vapor surveys, completion of over 60 soil borings, installation of groundwater monitoring wells, sampling, recommendations for design abatement; development of construction abatement drawings, coordination with NYDEC and environmental construction monitoring.

ERIC DETWEILER

Environmental Technician

LU ENGINEERS
Civil and Environmental

-EDUCATION-

B.S., Geology, 1994, St. Lawrence University, Canton, New York

- 14 Years Experience
- ERP Brownfield Experience
- Geological Expertise
- Remedial Investigation Specialist

-CERTIFICATIONS & ASSOCIATIONS-

OSHA 40-Hour HAZWOPER Training
OSHA Confined Space Entry Training
New York State Council of Professional Geologists

-PROJECT EXPERIENCE-

Mr. Detweiler's 14 years of experience includes a diverse range of geological and environmental engineering projects. Areas of specialization include site assessment, remedial investigation/ site characterization, site remediation, and regulatory compliance. He has also provided asbestos and lead inspections, surveying services and wetland delineations.

ERP/BROWNFIELD SITES

Orchard-Whitney ERP Brownfield Investigation, City of Rochester, NY
Lu Engineers is currently providing environmental services for the Orchard-Whitney Brownfield site for the City of Rochester under the NYSDEC Environmental Restoration Program. The goal of this project is to generate a NYSDEC approved Site Investigation/Remedial Alternatives Report (SI/RAR). Mr. Detweiler performed sampling to determine the presence of hazardous wastes.

Churchville Ford, NYS Brownfield Program Investigation, Churchville, NY
An environmental subsurface investigation was conducted to identify the nature and extent of contamination for a NYS Brownfield Program at the Churchville Ford site. Mr. Detweiler developed a Work Plan which specified all investigation, sampling and testing methods to be used. Field services included storm water drainage system investigation, groundwater investigation, residential well survey and a topographic survey. Once the investigation work was completed, a remedial alternatives report (RAR) was developed that included an analysis of available remedial strategies along with a recommendation for a remedial approach. Mr. Detweiler supervised the installation of three new monitoring wells, sediment/soil sampling and aquifer testing.

Former Frink America property, ERP Brownfield Investigation, Clayton, NY
The former Frink America property in Clayton, New York underwent a Site Investigation under the NYSDEC Environmental Restoration Program. One goal of the project was to identify the vertical and horizontal extent of contamination located on site in order to establish an appropriate cleanup alternative for the property. As a result of the information from previous environmental investigations, a two-phased approach was developed to satisfy NYSDEC Environmental Restoration Program requirements. Mr. Detweiler completed borings to delineate the horizontal extent of migration. During the borings, samples were taken for waste profiles to confirm the waste was non-hazardous. He took samples of the on-site cinders and black ash to determine appropriate disposal options. He installed three monitoring wells and eight test pits were dug. A report (RI/FS) identifying the vertical/horizontal extent of contaminant migration and evaluating appropriate remedial alternatives was completed.

Voluntary Cleanup Program, Karenlee Drive, Henrietta, NY
Mr. Detweiler provided oversight for the installation of seven monitoring wells, collection of subsurface soil and water samples and the collection of surface soil samples. Mr. Detweiler also provided coordination between NYSDEC and Town of Henrietta for this former wastewater treatment plant.

Regional Transportation Operations Center, Rochester, NY
As the on-site geologist, Mr. Detweiler performed monitoring of cleanup activities, sampling, air monitoring, as well as oversight of the construction of a remedial bio-cell. He was also the Health and Safety Officer during construction.

SUBSURFACE INVESTIGATIONS/SOIL VAPOR

Mr. Detweiler conducts subsurface investigations for a variety of private and public clients. Projects involve contractor oversight duties, work plan development, on-site drilling excavation supervision, sample classification, sampling coordination, and preparation of reports. Additional responsibilities include aquifer testing, monitoring, and preparing site status reports for NYSDEC and other regulatory entities.

Town of Henrietta Department of Public Works, Henrietta, NY
Mr. Detweiler provided project oversight and project coordination of the installation and operation of an Air Sparging and Soil Vapor Extraction (SVE) system. Activities included SVE system design, well installation oversight, SVE system installation, and sample collection.

Smith-Corona Site, Vapor Intrusion Study, Cortlandville, NY
Mr. Detweiler conducted a vapor intrusion study associated with the Smith-Corona NYSDEC Inactive Hazardous Waste Site in Cortlandville, NY. Home inventories were also performed as part of the project.

Stuart-Olver-Holtz Site Inspection, Henrietta, NY
Mr. Detweiler provided inspection services for the demolition of a former metal finishing facility (Stuart-Olver-Holtz), which was a NYSDEC Inactive Hazardous Waste Site. He was on site for all contractor activities.

Leastman Landfill, Murray, NY
As Project Geologist/Land Surveyor, Mr. Detweiler performed preliminary site assessment of the inactive landfill. He also assisted with oversight of excavation of test trenches, installation of overburden and bedrock monitoring wells and soil and water sampling. He also served as Surveyor, locating monitoring wells and test trenches at the landfill.

NYSDEC Lehigh Valley Railroad Spill Site, Rochester, NY
As Project Geologist/Health & Safety Officer, Mr. Detweiler's responsibilities included installation of open bedrock extraction wells, vapor extraction pilot studies, geoprobe and conventional drill rig and rock coring activities. As the project coordinator, he was also responsible for soil and rock classification and logging, bedrock and soil sampling, test boring locations and map generation.

Davis-Howland Oil Remediation Site, Rochester, NY
Mr. Detweiler was the Project Oversight/Site Engineer on this NYS Superfund project. Responsibilities included continuous monitoring of field activities during installation of large-scale Air Sparging/Soil Vapor Extraction System, ensuring contractor compliance with project specifications, surveying as-built elevations, collecting all as-built information, creating site sketches, maintaining photo log, and documentation and verification of daily site activities.

LAURA SMITH

Environmental Technician

LU ENGINEERS
Civil and Environmental

- 6 Years Experience
- ERP Brownfield Expertise
- Hazardous Waste Certified
- Soil Vapor Extraction Experience

-EDUCATION-

B.S., Environmental Management, 2005,
Rochester Institute of Technology, Rochester, NY

-REGISTRATION-

OSHA 40-hour Health and Safety Training for Hazardous Waste Site Operations Certification
OSHA Confined Space Entry Training
Attended OSHA 501 Trainer's Course

-PROJECT EXPERIENCE-

Ms. Smith has worked on a variety of projects in her 6 year career including environmental site assessments, site investigations, environmental compliance and management systems, pollution prevention, and remediation project monitoring.

BROWNFIELDS

Former Frink America, ERP Brownfield Site, Clayton, NY
Lu Engineers obtained a NYSDEC Environmental Restoration Program grant for investigation and remediation activities at the Former Frink America property, on behalf of the Clayton Local Development Corporation. Ms. Smith created a Quality Assurance Project Plan (QAPP), Citizen Participation Plan (CPP), and assisted with preparation of the Remedial Investigation Work Plan, RI Report, and Interim Remedial Measures Work Plan for approval by the NYSDEC. A sub-slab vapor sampling and indoor air sampling was also conducted for the NYSDOH.

Regional Traffic Operations Center, Rochester, NY
Lu Engineers provided engineering services for the remediation of petroleum contaminated soils as part of the RTOC project at the Greater Rochester International Airport. Ms. Smith prepared a Summary of Site Investigation and Remedial Actions/ Risk Assessment Report to gain petroleum spill site inactivation status for the former Webaco Oil parcel on Scottsville Road.

Town of Leyden, ERP Brownfield Site, Leyden, NY
Ms. Smith performed a Phase I Environmental Site Assessment for the Town of Leyden at a vacant former Mobil Service Station. She also assisted the Town by preparing an application for the Environmental Restoration Program. The ERP application was approved by the NYSDEC.

Town of Clarkson, Phase I ESA and ERP Application, Clarkson, NY
Ms. Smith conducted a Phase I Environmental Site Assessment on a vacant commercial property located on Route 104 in the Town and Hamlet of Clarkson. We also prepared a successful ERP program application for NYSDEC funding of investigation and cleanup. The property was a former gas/service station.

NYSDEC SUPERFUND SITES

Davis Howland Site, Rochester, NY
Ms. Smith conducted indoor air and sub-slab vapor sampling in residences surrounding the former Davis Howland Oil Company site. She also performed a vacuum survey to assess effectiveness of the soil vapor extraction system.

Former Smith-Corona Site, Cortland, NY
Ms. Smith provided assistance with indoor air and sub-slab vapor surveys and sampling for a large number of residences located at the former Smith-Corona site in Cortland, NY.

Diamond Cleaners Site, Elmira, NY

Ms. Smith provided assistance on a Remedial Investigation/ Feasibility Study (RI/FS) at Diamond Cleaners and four other drycleaner sites for the NYSDEC in Elmira, NY. She assisted with indoor air and sub-slab vapor sampling at the Diamond Cleaners site, soil borings, groundwater well and piezometer installation and soil vapor sampling.

Hidden Valley Electronics Site, Vestal, NY

Ms. Smith assisted with installation of a sub-slab vapor extraction system at the former Hidden Valley Electronics, a NYSDEC Inactive Hazardous Waste Site. She conducts continuing operations and maintenance activities to optimize system performance.

Preferred Electric Motors Site, Rochester, NY

Ms. Smith provided assistance with a Remedial Investigation/ Feasibility Study at the Preferred Electric Motors NYSDEC Inactive Hazardous Waste Site in Rochester, NY. Ms. Smith prepared the site-specific Health and Safety Plan and conducted indoor ambient air, sub-slab vapor sampling in residences surrounding the site and sub-slab ventilation system installation oversight.

ENVIRONMENTAL REMEDIATION

Oil Removal at Finger Lakes Developmental Disabilities Office, Newark, NY

Lu Engineers provided oversight for the removal of approx. 37,750 gallons of #6 fuel oil from two of the four underground storage tanks (UST) at the Finger Lakes Developmental Disabilities Office facility located in Newark, NY. Following the oil removal, Lu Engineers performed a subsurface investigation of existing soil and groundwater conditions in the area of the USTs. Ms. Smith assisted with the subsurface investigation and oil removal report.

Rochester Genesee Regional Transportation Authority, Rochester, NY

Ms. Smith performed subsurface investigation and remediation at the RGRTA facility. A petroleum product recovery well pump system was designed and installed as part of interim remedial activities. She also assisted with monitoring well development and preparation of the project report.

Longway's Diner, Phase II ESA, Pamelia, NY

Assisted with performed a Phase II Environmental Site Assessment in Pamelia, NY. Lu Engineers provided oversight of soil borings, coordinated lab analysis, interpreted analytical results, and prepared a report on the findings. Ms. Smith then prepared a Remediation Work Plan to address petroleum contamination at the site.

Phase II/Remediation, 70 & 81 N. Main Street, Fairport, NY

Lu Engineers provided Phase II and environmental remediation services for property on Main Street which was a former petroleum storage facility in Fairport, NY. Ms. Smith provided oversight of the tank removal.