FORMER DARBY DRUGS DISTRIBUTION CENTER
OPERABLE UNIT 2
SITE No. C130140

80-100 Banks Avenue
ROCKVILLE CENTRE, NEW YORK

INTERIM REMEDIAL MEASURE WORK PLAN

May 2015
Revised October 2015

Prepared for:

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CERTIFICATION PAGE

I Ariel Czemerinsky certify that I am currently a NYS registered professional engineer and that this Interim Remedial Measure Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

10/27/15

NYSPE 076508

1.0 INTRODUCTION

This Interim Remedial Measure Work Plan (IRMWP) was prepared on behalf of Darby Group Companies for the off-site remediation related to the Former Darby Drugs Distribution Center located at 80-100 Banks Avenue in the Village of Rockville Centre, Nassau County, New York (**Figure 1)**.

The chlorinated solvent, tetrachloroethylene (PCE), was first identified on the property, during a Phase II investigation performed in November 2003 as part of the due diligence by a potential purchaser of the property. The PCE is believed to have been released between 1972 and 1978 when a textile company leased the southern parcel (80 Banks Avenue) of the property. The contract vendee to purchase the property (Chase Partners) applied for and was accepted into the New York State Brownfield Clean-up Program (BCP) as a volunteer. Chase Partners entered into a Brownfield Clean-up Agreement (BCA) with the New York Department of Environmental Conservation (NYSDEC) on June 29, 2005. The property has since been purchased by Avalon Bay Communities (Avalon) of Melville, NY.

Chase Partners submitted a Draft Remedial Investigation (RI) Report and an Interim Remedial Measure (IRM) Work Plan for on-site contamination in September 2004. The IRM Work Plan was formally approved for implementation by the NYSDEC on May 12, 2006. Under the Brownfield's Program a volunteer is not required to investigate or remediate contamination which has left the boundaries of the property. The Draft RI Report for investigation of on-site contamination indicated that a groundwater plume was leaving the property in a southerly direction.

The remediation of on-site source contamination was completed under a modified Brownfield Cleanup Agreement between Chase Partners, Avalon Bay Communities and the NYSDEC. The Certificate of Completion was signed on December 19, 2011. Site management and groundwater treatment is on-going.

Although Darby Group did not cause the release of contaminants and did not own the property when the release occurred, Darby Group executed an Order on Consent with the NYSDEC on

April 9, 2007 to investigate and potentially remediate contamination in groundwater which had migrated off-site. This phase of the project is identified as Operable Unit 2 (OU2). The Remedial Investigation for OU2 was completed in October 2014 and documented in the Remedial Investigation Report (EBC, 1/2015).

This Interim Remedial Measure (IRM) Work Plan addresses the treatment of a "Hotspot" area of PCE contamination in groundwater located in the southeast corner of the Morgan Days Park parking lot. This work will reduce PCE contamination in the area with the highest concntrations and improve grpundewater quality overall while the process of developing a comprehensive remedial plan for the entire Site proceeds.

1.1 SITE LOCATION AND DESCRIPTION

The subject property is located at 80-100 Banks Avenue, Village of Rockville Centre, Town of Hempstead, Nassau County, New York (**Figure 1**). The site is situated at the northwest intersection of Nassau Street and Banks Avenue (**Figure 2**). The property comprises a total area of 7.1 acres, and is identified as Lots 27 and 30, Block 539, Section 38 on the Nassau County Tax Maps. The site is currently improved with two new apartment buildings which were constructed and placed in service by Avalon Bay Communities. OU2 comprises the off-site portion of the project and does not include any on-site investigative or remedial work. The Remedial Investigation performed under the OU2 portion of the project included the adjacent Morgan Days Park Parking lot to the west, and the entire municipal bus garage property located south of Nassau Street.

The elevation of the property is approximately 10 feet above the National Geodetic Vertical Datum (NGVD) feet. Based on measurements made at the Site as part of the Remedial Investigation, the depth to groundwater beneath the site is approximately 6 feet below existing grade.

1.2 SUMMARY OF PREVIOUS INVESTIGATIONS

The NYSDEC performed a subsurface investigation at the Site and surrounding area. This work was part of a general Site Characterization and consisted of two Phases as follows:

- Phase 1 Environmental Site Assessment, EcolSciences, Inc. March 2002
- Preliminary Soils and Foundation Report Melick-Tully and Associates August 2003
- Phase I1 Environmental Investigation, EcolSciences, Inc. January 2004
- Remedial Investigation Report (PWGC- September, 2004)

1.2.1 Phase 1 Environmental Site Assessment, ESI (March - 2002)

A Phase I Environmental Site Assessment (Phase I) was conducted by EcolSciences, Inc. (ESI) in March, 2002 to determine if there were any recognized environmental conditions associated with the subject site.

The document search identified records from the Nassau County Department of Health (NCDH) detailing the proper removal of four heating oil underground storage tanks (USTs). In addition, during the site reconnaissance, ESI identified an electrical panel along the western wall of the southern warehouse area containing circuit breakers with faded labels for Awell pumps@ and Adry cleaning still unit@.There was no record or information of a dry cleaning operation at the site. ESI recommended a test boring program beneath the concrete floor to assess potential impacts from possible former dry cleaning operations at the site, and soil samples in the vicinity of the heating oil tanks to verify the findings of the NCDH.

1.2.2 Preliminary Soils and Foundation Investigation Report (MTA - August 2003)

Melick-Tully and Associates (MTA) performed a number of borings on the subject property as part of a geotechnical analysis of site conditions to assist in the design of the proposed residential buildings. The investigation initially consisted of six soil borings with a recommendation that monitoring wells be installed for the basement design. A total of six monitoring wells were installed between January and May, 2003.

The MTA borings revealed that the geology beneath the site consists of 1 to 4 feet of sand fill material. Beneath the fill material is an orange-tan sand with gravel to a depth varying from 12 to 16 feet below grade. Beneath the sand and gravel unit is a black silty clay, which was determined to be 9 feet thick. The clay unit is underlain by sand to at least 31 feet below grade, the depth at which the borings were terminated.

MTA reported that the depth to water at the site varies between 5 to 9 feet below grade depending upon surface elevation. The water table was determined to exist within the sand unit situated above the black silty clay unit. Groundwater flow was determined to vary from a westerly to a southerly direction as you move west to east across the site.

1.2.3 Phase II Environmental Investigation (ESI - January 2004)

The Phase II investigation was completed by ESI in January, 2004. ESI identified a total of seven areas of concern (AOC) as part of their scope of work. In addition to the former heating oil tanks and the former potential dry cleaning still unit, other AOCs were identified as a result of further field observation and a geophysical survey performed as part of the Phase II investigation. A total of nineteen borings were advanced during the investigation with thirty-one soil samples submitted for analysis. Eleven groundwater samples were analyzed including five from the soil borings and six from the pre-existing monitoring wells installed by MTA. The results of the Phase II Investigation identified significant concentrations of PCE in soil and groundwater beneath the southwest corner of the building. Concentrations exceeding the pure product solubility of PCE were found at some locations just above the clay surface, indicating that DNAPL is present above the clay. Soil samples collected in the vicinity of the former fuel oil tanks did not indicate that a release had occurred at either location.

1.2.4 On-Site Remedial Investigation Report (PWGC- September, 2004)

A Remedial Investigation (RI) was performed by P.W. Grosser Consulting, Inc. (PWGC) during March 15 - March 26, 2004 to: collect data of sufficient quality and quantity to adequately characterize the nature and extent of contamination at the site, evaluate contaminant migration, characterize the potential exposure to human health and the environment and select the most appropriate remedial technology.

Summary of the Nature and Extent of Contamination

The results of the RI confirmed the findings of the previous investigations and support a release scenario of liquid phase PCE beneath the floor near the western wall of the south building. From here, PCE as a DNAPL, migrated along the clay surface to a low point approximately 50 feet east of the release point. There is sufficient evidence to indicate that DNAPL remains in this area of the building. A competent clay layer, approximately 9 feet thick, was documented throughout

the site. The report concluded that the presence of the clay limited the vertical migration of PCE in the soil column to a maximum depth of 18 feet below the surface. The clay surface was deepest in borings beneath the building and shallowest in borings at the property boundaries, effectively preventing further lateral migration of mobile DNAPL.

The RI Report concluded that shallow soil contamination, above the guidance value of 1,400 µg/kg, is limited to an area approximately 40 feet by 60 feet. Contamination at the clay surface was reported to be more extensive, covering an area roughly 180 feet by 160 feet.

The report noted that significant PCE contamination in soil was also found at the clay surface outside of the building in the north end of the west parking area. The location is in the general vicinity of a suspected leaching structure. The Report suggested that the structure, if present, may have received process water from the building contaminated with volatile organic compounds (VOCs).

The report concluded that the presence of DNAPL and high PCE concentrations in soil were acting as a continuing source of contamination to the shallow groundwater, and that a shallow groundwater plume of chlorinated VOCs (CVOCs), primarily PCE, is emanating from the source area beneath the southwestern portion of the south building. PCE concentrations in the source area were reported at or above the pure product solubility, providing further evidence of DNAPL in this area. The report concluded that the plume is migrating south in the direction of groundwater flow, toward the Long Island Bus Depot. PCE concentrations at the south property line were reported at 28,000 µg/L.

A supplemental investigation completed by PWGC at the site in August and September of 2008 (PWGC SIR Report 1/09) identified dissolved PCE contamination in a permeable sand zone beneath the clay layer at a depth of 30-50 feet below the surface. The report also identified elevated PCE concentrations in soil gas at the south property line.

1.3 SUMMARY OF THE REMEDIAL INVESTIGATION (OU2 - Offsite)

A Remedial Investigation was completed for OU2 by Environmental Business Consultants (EBC) from August 2011 through October 2014. The goals of the Remedial Investigation were to define the nature and extent of off-site contamination in groundwater and to assess the impact of the contamination on public health and/or the environment; and to provide information to support the development of a Remedial Work Plan to address the contamination.

Activities completed under the RI:

- Soil sampling and analysis for chlorinated solvent and petroleum compounds in soil samples from soil boring locations;
- The installation of groundwater monitoring wells;
- The collection and analysis of groundwater samples for chlorinated solvent and petroleum compounds.

The field work portion of the RI was initially performed by EBC in August 2011 with a secondary mobilization in October 2013. Groundwater samples were collected during four sampling events as follows: November 17, 2011, October 18, 2013, March 26, 2014 and October 29, 2014.

The results of sampling performed during the RI, identified CVOC contamination, consisting mainly of PCE and degradants including TCE, cis-1,2-DCE and vinyl chloride in shallow groundwater. Minimal VOC detections were reported south of Nassau Street including wells 3, 9 and 10 located just south of Nassau Street in front of the bus garage and in wells 4 through 8 located behind the garage. The absence of CVOCs in these wells indicates that the plume has not migrated south of Nassau Street. Plume velocity calculations which, indicate that the plume would not have traveled more than 225 feet from the source during the time it has been in transit, matches well with these observations.

Chlorinated compounds were reported in the wells along the east side of Morgan Days Park (MW12-MW14) during the October 2013, March 2014 and October 2014 sampling rounds. Little change was noted between the October 2013 and March 2014 rounds with total CVOC

concentrations ranging from 426 to 675 ug/L during the October round and from 524 to 782 ug/L during the March round. A spike in cis-1,2-DCE concentrations was noted in MW 14 during the October 2014 round with a concentration of 1,300, ug/L.

CVOC detections have also been reported in MW1 and MW2 located along the western edge of the Morgan Days Park parking lot. While initial concentrations were low to non-detect in MW1 and MW2 in 2011, an increase was reported in these wells during the October 2013 sampling round. These levels declined significantly by March 2014 and have stayed low in MW1 while concentrations in MW2 have rebounded to some extent. The fluctuating concentrations are likely related to the shallow nature of the groundwater and its sensitivity to recharge events.

MW11 which is located on the southeastern edge of the park entrance and directly downgradient from the former source areas at the Darby Site has shown the highest offsite CVOC concentrations. This area represents a hotspot and the center of the off-site plume. Total CVOC concentrations in this well were originally reported in October 2013 at 9,667 ug/L, increasing to 17,426 in March 2014 and then dropping to 5,882 ug/L in October 2014. The reduction may be related to the operation of the groundwater treatment system along the southwestern edge of the former Darby property.

Although the plume when first investigated was still attached to the source area forming a continuous zone of impacted groundwater to the terminus point, it is likely that remediation of the source area and operation of the onsite groundwater extraction and treatment system have resulted in a small detached remnant plume. Further migration of this plume would be minimal due to the low transport velocities and absence of a source.

Qualitative Human Health Exposure Assessment

The qualitative exposure assessment The exposure assessment identified potential exposures to church workers in the building at 51 Nassau Street (assuming the building remains occupied) through vapors off-gassing from impacted groundwater in this area. Due to the limited present and potential future extent of the plume, and the absence of downgradient receptors, no other potential exposures were identified.

1.4 SITE GEOLOGY / HYDROGEOLOGY

The lithologic description of the sediments from soil borings advanced during this investigation identifies the materials as fine to coarse sand and silt. The depth to groundwater ranged from approximately 3 to 7 feet below land surface (bls).

Groundwater elevation data, obtained on two occasions; November 17, 2011 and March 26, 2014, were used to prepare contour maps of the water table surface (see **Figures 3** and **4**). As shown, groundwater flow is generally to the south.

The horizontal hydraulic conductivity across the site, as determined from rising head tests performed during the onsite Remedial Investigation completed in 2004, ranged from 0.077 to 0.51 feet per day with a mean value of 0.242.

Using the high end of the hydraulic conductivity range, a measured water table gradient of 0.015 ft/ft and an average porosity of 25 percent, yields an average groundwater seepage velocity of 0.03 ft per day.

2.0 INTERIM REMEDIAL MEASURE PROGRAM

The IRM proposed for the Site consists of the injection of chemical oxidants along the eastern edge of the Morgan Days Park parking lot to treat remnants of the off-site PCE plume, including a PCE hotspot area near the southeast corner of the lot.

The IRM will be performed in accordance with the methods and specifications as described under the NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation (May, 2010).

2.1 GOVERNING DOCUMENTS

Governing documents and procedures included in the IRM Work Plan include a Site-specific Health and Safety Plan (HASP), a Community Air Monitoring Plan (CAMP), and analytical Quality Assurance Project Plan (QAPP). Highlights of these documents and procedures are provided in the following sections.

2.1.1 Health & Safety Plan (HASP)

The HASP takes into account the specific hazards inherent to the site and presents the minimum requirements which are to be met by the excavation subcontractor, and other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. A HASP has been prepared for the IRM activity at the site and is provided in **Attachment A**.

Contractors and subcontractors will have the option of adopting this HASP or developing their own site-specific document. If a contractor or subcontractor chooses to prepare their own HASP, the Project Remedial Engineer will ensure that it meets the minimum requirements as detailed in the site HASP and must be submitted to and approved by the NYSDEC.

2.1.2 Community Air Monitoring Plan (CAMP)

The CAMP provides measures for protection for on-site workers and the downwind community (i.e., off-site receptors including residences, businesses, and on-site workers not directly involved

in the remedial work) from potential airborne contaminant releases resulting from remedial activities.

The action levels specified require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that the remedial work did not spread contamination off-site through the air. The primary concerns for this site are vapors, and nuisance odors. A CAMP was prepared for implementation of the IRM and is provided in **Attachment B**.

2.1.3 Quality Assurance Project Plan (QAPP)

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The accuracy, precision and completeness requirements will be addressed by the laboratory for all data generated.

Collected samples will be appropriately packaged, placed in coolers and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of ice or cold-pak(s) to maintain a temperature of 4^{o}C.

Dedicated disposable sampling materials will be used for groundwater samples, eliminating the need to prepare field equipment (rinsate) blanks. However, if non-disposable equipment is used, field rinsate blanks will be prepared at the rate of 1 for every eight samples collected.

Decontamination of non-dedicated sampling equipment will consist of the following:

- Rinse with tap water;
- Wash with alconox® detergent solution and scrub ;
- Rinse with tap water;
- Rinse with distilled or deionized water.

Prepare field blanks by pouring distilled or deionized water over decontaminated equipment and collecting the water in laboratory provided containers. Trip blanks will accompany samples each time they are transported to the laboratory. Matrix spike and matrix spike duplicates (MS/MSD) will be collected at the rate of one per 20 samples submitted to the laboratory. Laboratory reports will be upgradeable to ASP category B deliverables for use in the preparation of a data usability report (DUSR). The DUSR will be applicable to all confirmation samples and final round samples. The QAPP prepared for the Site is provided in **Attachment C**.

2.2 GENERAL INFORMATION

2.2.1 Project Organization

The Project Manager for the Remedial Activity will be Mr. Robert Bennett. Overall responsibility for the BCP project will be Mr. Charles B. Sosik, P.G., P.HG. The Remedial Engineer for this project is Mr. Ariel Czemerinski, P.E.

2.2.2 Remedial Engineer

The Remedial Engineer for this project will be Mr. Ariel Czemerinski, P.E.. The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the overall remedial program for the Site. The Remedial Engineer will certify that the remedial activities were observed by qualified environmental professionals under his supervision and that the remediation requirements set forth in the IRM Work Plan and any other relevant provisions of ECL 27-1419 have been achieved in conformance with that Plan.

The Remedial Engineer will oversee all aspects of the IRM program, including soil excavation, stockpiling, characterization, removal and disposal, air monitoring, emergency spill response services, import of back fill material, and management of waste transport and disposal.

2.2.3 Pre-Construction Meeting with NYSDEC

A pre-construction meeting with the Project Manager, Remedial Engineer, and Project Director will take place prior to the start of major construction activities. The NYSDEC will be permitted

an opportunity to participate in this meeting and will be given advance notice to enable attendance.

2.2.4 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in **Table 1**. That document will define the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

2.3 REPORTING

2.3.1 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each day in which remedial activity takes place. Daily reports will include:

- An update of progress made during the reporting day;
- Locations of work and quantities of material imported and injected at the Site;
- A summary of any and all complaints with relevant details (names, phone numbers);
- An explanation of notable Site conditions.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the IRM or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the IRM will be addressed directly to the NYSDEC Project Manager via personal communication. These reports will include a summary of odor and dust problems and corrective actions, and all complaints received from the public.

2.3.2 Monthly Reports

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers within 10 days following the end of the month of the reporting period and will include:

- Activities relative to the Site during the previous reporting period and those anticipated for the next reporting period, including an estimate of work performed (i.e. number of loads of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and,
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

2.3.3 Construction Completion Report (CCR)

Following completion of all IRM activity, a Construction Completion Report (CCR) will be prepared to document all aspects of the chemical injection program. This report will be summarized in the Remedial Action Work Plan (RAWP), and included in the Final Engineering Report (FER). The CCR will be prepared in accordance with DER-10 guidelines and will include:

- A summary of the removal action including a detailed description of the volumes of oxidant solution injected;.
- Scaled site plan showing the location of all performance samples;
- Results of all analyses, including summary tables, laboratory data sheets and the required laboratory data deliverables.
- Photographic documentation of the injection process.
- Information on backfill imported onto the Site including amount, type and origin and copies of transport tickets from the supplier.
- Certification of the Report by a P.E. as required.

2.3.4 Complaint Management Plan

Complaints from the public regarding nuisance or other Site conditions including noise, odor, truck traffic etc., will be recorded in the Site field book and reported to the NYSDEC in the daily status report.

2.3.5 Deviations from the IRM Work Plan

Minor deviations from the IRMWP will be identified in the daily update report and will be noted in the Final Engineering Report. When deviations are reported, a brief discussion will be provided which will state the following:

- Reasons for deviating from the approved IRMWP;
- Effect of the deviations on overall remedy.

Major changes to the scope of work must be discussed with the NYSDEC and the NYSDOH prior to implementation. If the changes are considered to be significant enough, an addendum to the IRMWP Work Plan will be prepared and submitted to NYSDEC/NYSDOH for review.

2.4 MOBILIZATION

Mobilization will include the delivery of excavation equipment and materials to the site. All remediation personnel will receive site orientation and training in accordance with the site specific HASP, CAMP and established policies and procedures to be followed during the implementation of the IRMWP. The remediation contractor, construction manager and all associated subcontractors will each receive a copy of the IRMWP and the site specific HASP and will be briefed on their contents.

2.5 SITE PREPARATION

2.5.1 Utility Mark-outs, Easements and Permits

The drilling sub-contractor is solely responsible for the identification of utilities that might be affected by work under the IRMWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this IRMWP. The

drilling contractor is solely responsible for safe execution of all invasive and other work performed under this IRMWP. The drilling contractor must obtain any local, State or Federal permits or approvals pertinent to such work that may be required to perform work under this IRMWP including but not limited to sidewal / road opening permits and permit to install injection wells on Village of Rockville Centre property. Approval of this IRMWP by NYSDEC does not constitute satisfaction of these requirements.The presence of utilities and easements on the Site will be investigated by the IRM Contractor and it must be determined that no risk or impediment to the planned work under this IRMWP is posed by utilities or easements on the Site. The IRM Contractor will provide copies of all permits and documentation of the utlility investigation to the Remedial Engineer prior to the start of work.

2.5.2 Equipment and Material Staging

Equipment and chemicals used for the injections temporarily staged in the Morgan Days Park parking area. It is anticipated that the chemicals and equipment will be staged for no more than 2-days at a time.

2.6 CHEMICAL OXIDANT INJECTION PLAN

To address residual solvent mass in groundwater, a chemical oxidant (sodium permanganate) will be injected within theshallow impacted groundwater zone along the eastern edge property line (see **Figure 5**). Injections will be completed using probe drilling equipment and tooling by driving an injection tool to the target depth and injecting the permanganate solution under pressure while slowly retracting the tool string.

Sodium permanganate will be delivered to the site as a 40% solution in 55 gallon poly drums and mixed with water onsite to create a 12% solution by weight. The application will consist of approximately 1,139 pounds (100 gallons) of oxidant diluted with 1,520 gallons of water. The injections will be completed near the southeastern corner of the park's parking lot.

To calculate the overall oxidant demand in pounds of permanganate, this area was divided into four 1,850 sf treatment zones. The estimate of contaminant mass for each parameter in groundwater was performed by assigning the total CVOC concentration reported in groundwater at monitoring well location MW11 during the RI. The total contaminant mass was then

calculated by multiplying the area of the zone by the depth of impact, porosity and stoichiometric demand. The total contaminant demand to remediate the CVOCs within Zone 1 was calculated at 1,139 pounds (99.9 gallons of 40% sodium permanganate) diluted with 380 gallons of water.

Injections for will be performed from the water table (approx 4 ft below grade) to the top of the clay layer (approximately 10 feet below grade) at 4 locations spaced 10 feet apart. Approximately 480 gallons of 12% solution will be injected at each location. Chemical oxidant calculations and oxidant specifications are included in **Attachment D**.

2.7 REMEDIAL PERFORMANCE EVALUATION (POST TREATMENT SAMPLING)

Groundwater performance monitoring samples will be collected from three monitoring well locations (MW2, MW11, MW12) located downgradient of the treatment area (see **Figure 5**). Sample analysis will include the following parameters:

- VOCs by Method 8260C
- Field colorimetric evaluation

Groundwater samples will initially be collected prior to the injection and then on a monthly basis for a period of three months. Sampling may continue after this time if requested by DEC.

2.7.1 Methodology

One groundwater sample will be obtained from each monitoring well using dedicated polyethylene tubing and a peristaltic pump. The sample will be drawn directly into pre-cleaned laboratory supplied glassware, stored in a cooler with ice. Samples will either be picked up at the Site by a laboratory dispatched courier at the end of the day or transported back to the EBC office where they will be picked up the following day by the laboratory courier. All samples will be analyzed by a NYSDOH ELAP certified environmental laboratory certified in the appropriate category. Groundwater samples will be submitted for analysis of VOCs by EPA method 8260C.

2.7.2 Reporting of Results

Sample analysis will be provided by a New York State ELAP certified environmental laboratory. Laboratory reports will include Analytical Systems Protocol July 2005 (ASP) category B data deliverables for use in the preparation of a data usability summary report (DUSR). All results will be provided in accordance with the NYSDEC Environmental Information Management System (EIMS) electronic data deliverable (EDD) format.

2.7.3 QA/QC

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The accuracy, precision and completeness requirements will be addressed by the laboratory for all data generated.

Collected samples will be appropriately packaged, placed in coolers and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel. Samples will be stored in the field in a cooler containing ice or cold-pak(s) to maintain a temperature of 4 degrees C. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of ice or cold-pak(s) to maintain a temperature of 4^{o}C, +/- 2 ^{o}C.

Dedicated disposable sampling materials will be used for both groundwater samples, eliminating the need to prepare field equipment (rinsate) blanks. However, if non-disposable equipment is used, field rinsate blanks will be prepared at the rate of 1 for every eight samples collected. Field blanks will be prepared by pouring distilled or deionized water over decontaminated equipment and collecting the water in laboratory provided containers.

Trip blanks will accompany samples each time they are transported to the laboratory. Matrix spike and matrix spike duplicates (MS/MSD) will be collected at the rate of one per 20 samples submitted to the laboratory.

2.7.4 DUSR

The DUSR provides a thorough evaluation of analytical data with full third party data validation. The primary objective of a DUSR is to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use. Verification and/or performance monitoring samples collected under this RAWP will be reviewed and evaluated in accordance with the Guidance for the Development of Data Usability Summary Reports as presented in Appendix 2B of DER-10. The completed DUSR for verification/performance samples collected during implementation of this RAWP will be included in the Final Engineering Report.

2.7.5 Reporting of Performance Data in CCR

Chemical labs used for all performance monitoring and final post-remedial sampling analysis will be NYSDOH ELAP laboratory certified in the appropriate categories. The CCR will provide a tabular and map summary of all performance monitoring and post-remedial sample results and exceedances of water quality standards.

3.0 SCHEDULE

The Work is anticipated to begin approximately 2 weeks following NYSDEC approval of the IRM Work Plan and within 10 days following the distribution of the IRM notification Fact Sheet. The estimated duration of the oxidant injections is 1 day with performance monitoring sampling continuing for an additional 3 months.

The anticipated schedule of events is as follows:

Schedule Task	Estimated Date
NYSDEC Approval of IRM Work Plan	November 2015
Obtain necessary permits and access with the local municipality and property owner (if necesary)	1 month following IRMWP Approval
Order oxidant chemicals	Immediately upon reciept of permits
Mobilize equipment to the Site (begin)	1 week following delivery of chemicals
Complete Injections	Within 2-3 days of chemical delivery
Begin performance monitoring program	1 month following completion of injection

TABLES

Table 1
Emergency Contact List

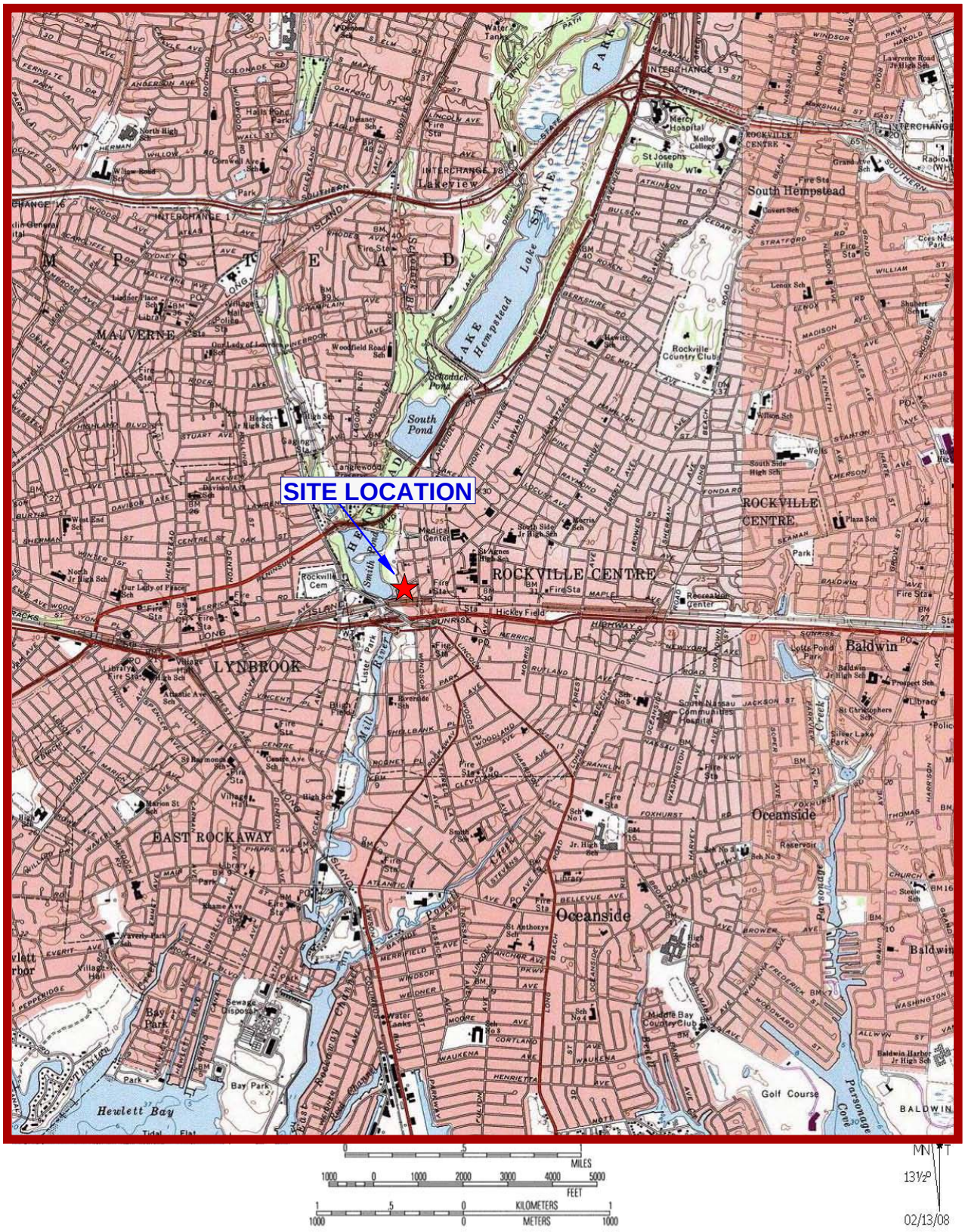
General Contacts

General Emergencies	911
NYC Police	911
NYC Fire Department	911
Nassau County Department of Health	516-2279697
Sounth Nassau Communities Hospital	516-632-3000
Poison Control	800-222-1222
National Response Center	800-424-8802
NYSDEC Spills Hotline	800-457-7362

Project Contacts

NYSDEC Project Manager	Kerry Maloney	518-402-9622
NYSDOH Project Manager	Steven Karpinski	518-402-7859
EBC Project Manager	Charles Sosik	631-504-6000
EBC Site Safety Officer	Chawinie Miller	631-504-6000
Remedial Engineer	Ariel Czemerinski	516-987-1662
Darby Group Representative	Justina Gordan	516-688-6801

FIGURES



Source: USGS Lynbrook Quadrangle, 1969, Contour Interval = 5 feet

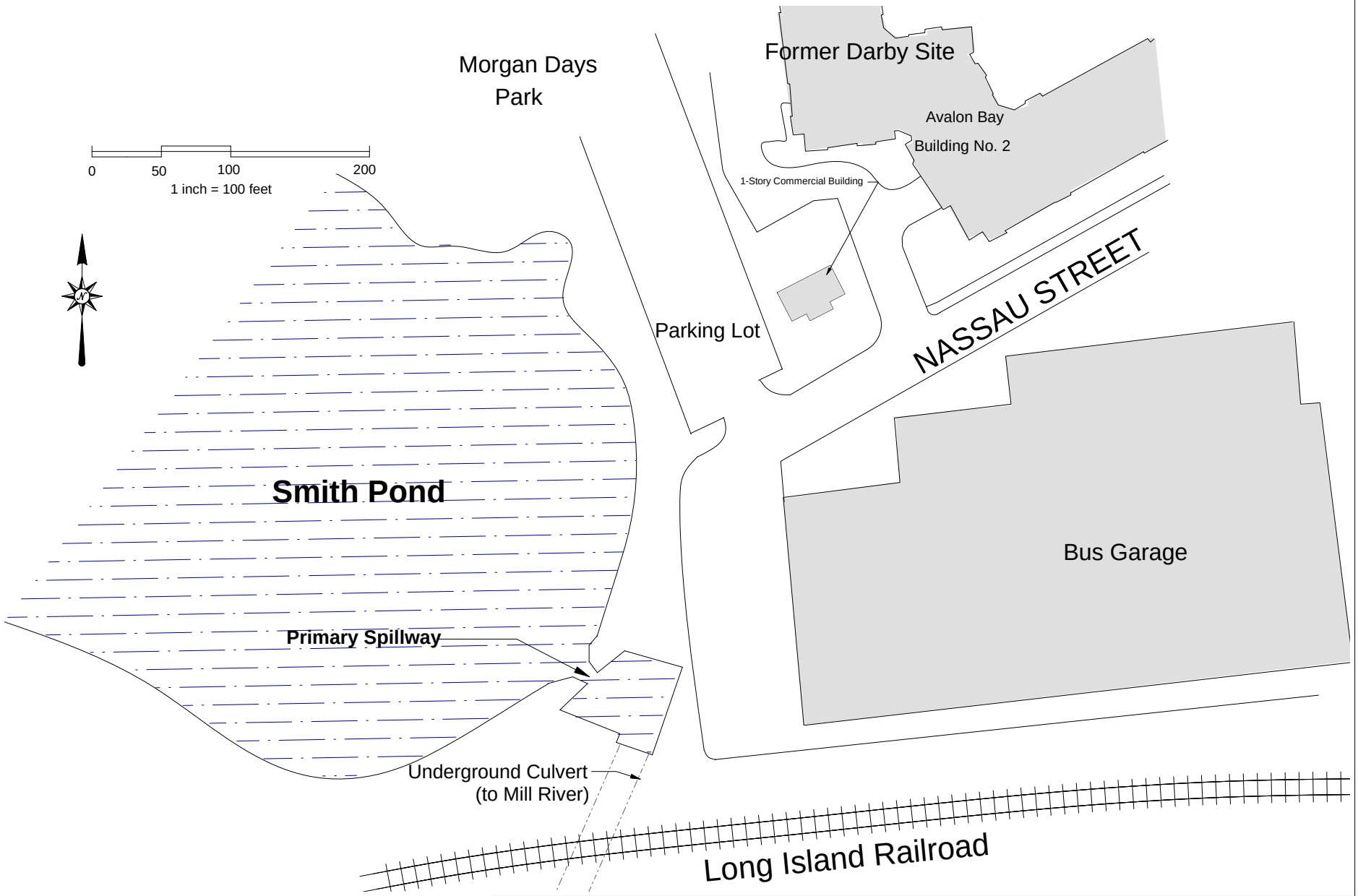
EBC
ENVIRONMENTAL BUSINESS CONSULTANTS

1808 Middle Country Road
Ridge, NY 11961

Phone 631.504.6000
Fax 631. 924 .2870

FORMER DARBY WAREHOUSE
ROCKVILLE CENTRE, NY
SITE LOCATION MAP

FIGURE 1



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FORMER DARBY DRUGS SITE
80-100 BANKS AVENUE, ROCKVILLE CENTRE, NY

FIGURE 2 SITE PLAN

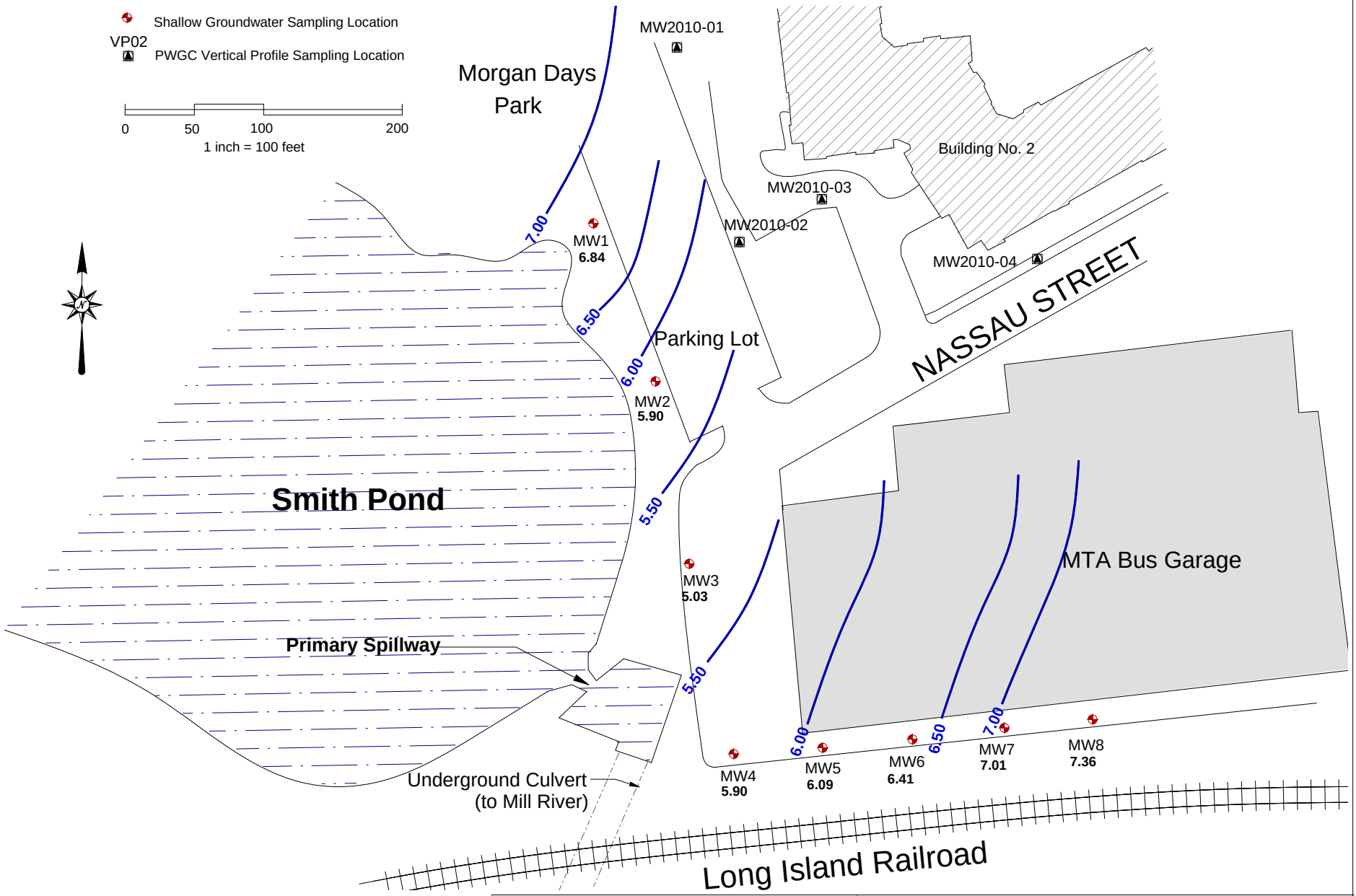

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FIGURE 3 GROUNDWATER ELEVATION MAP
NOVEMBER 17, 2011

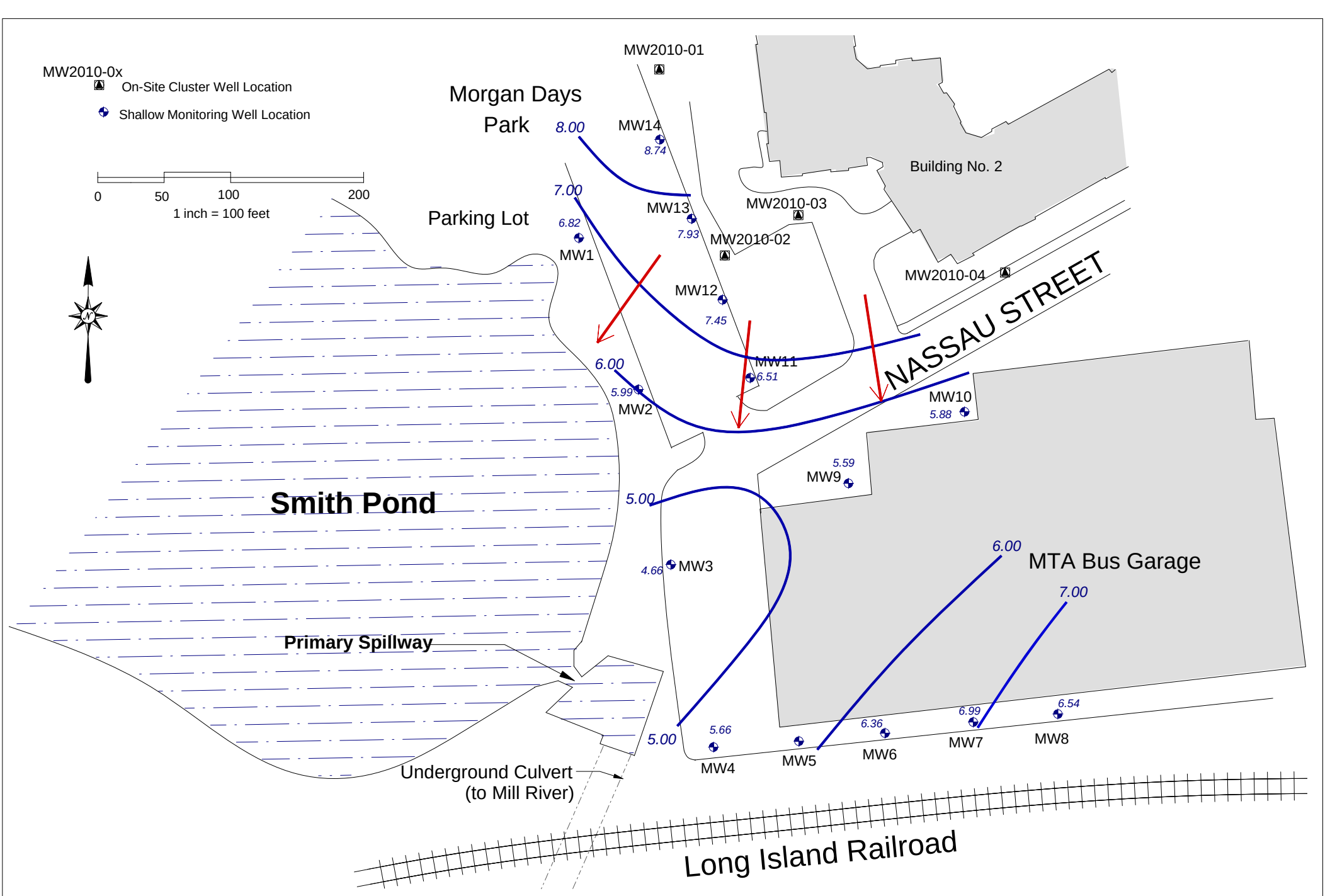

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Figure No. 4

Site Name: Former Darby Drugs
Site Address: 80 Banks Avenue, Rockville Centre, NY
Drawing Title: Groundwater Elevation - March 26, 2014

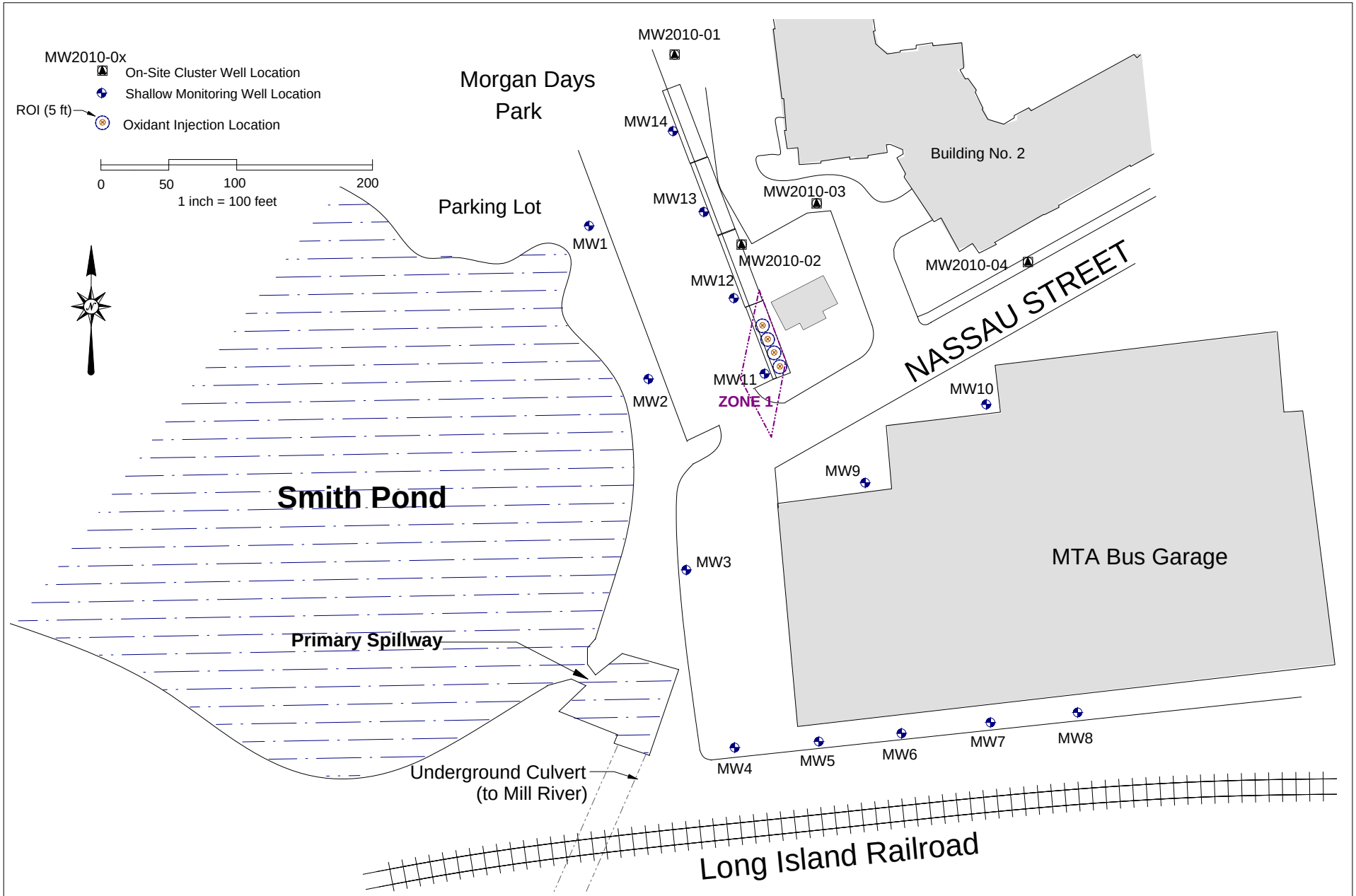

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Figure No. 5

Site Name: Former Darby Drugs
Site Address: 80 Banks Avenue, Rockville Centre, NY
Drawing Title: Oxidant Injection Plan

ATTACHMENT A
Health and Safety Plan

FORMER DARBY DRUGS DISTRIBUTION CENTER
OPERABLE UNIT 2
SITE No. C130140

80-100 Banks Avenue
ROCKVILLE CENTRE, NEW YORK

HEALTH AND SAFETY PLAN

MAY 2015

Prepared By:

EBC
ENVIRONMENTAL BUSINESS CONSULTANTS

1808 Middle Country Road
Ridge, NY 11961

HEALTH AND SAFETY PLAN

Site:	**Former Darby Drugs Distribution Center-OUII Off-Site**
Location:	**Morgan Days Park - Parking Lot**
Prepared By:	**ENVIRONMENTAL BUSINESS CONSULTANTS**
Date Prepared:	**May - 2015**
Version:	**1**
Revision:	**0**
Project Description:	
Waste types:	Vapor, groundwater
Characteristics:	CVOCs in soil vapor, CVOCs in groundwater.
Overall Hazard:	Low

ENVIRONMENTAL BUSINESS CONSULTANTS (EBC) AND EBC'S SUBCONTRACTORS DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE NATURE OF THIS SITE AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION.

HEALTH AND SAFETY PLAN
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FIGURES

APPENDICES

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STATEMENT OF COMMITMENT

This Construction Health and Safety Plan (CHASP) has been prepared to ensure that workers are not exposed to risks from hazardous materials during the Remedial Activities planned for the Former Darby Drugs Distribution Center Site - OUII offsite in Rockville Centre, New York.

This HASP, which applies to persons present at the site actually or potentially exposed to hazardous materials, describes emergency response procedures for actual and potential chemical hazards. This HASP is also intended to inform and guide personnel entering the work area or exclusion zone. Persons are to acknowledge that they understand the potential hazards and the contents of this Health and Safety policy by signing off on receipt of their individual copy of the document. The Drilling Contractor and their subcontractors and suppliers are retained as independent contractors and are responsible for ensuring the health and safety of their own employees. The Drilling contractor has the option of adopting this HASP or providing its own for the planned scope of work under the Interim Remedial Measure Work Plan.

1.0 INTRODUCTION

This document describes the health and safety guidelines developed by Environmental Business Consultants (EBC) for implementation of a Interim Remedial Measure Work Plan at the Former Darby Drugs Distribution Center OU2 - offsite area located in the Morgan Days Park Parking lot in Rockville Centre, New York, to protect on-site personnel, visitors, and the public from physical harm and exposure to hazardous materials or wastes during the injection of chemical oxidants. In accordance with the Occupational Safety and Health Administration (OSHA) 29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response Final rule, this CHASP, including the attachments, addresses safety and health hazards related to subsurface injection activities and is based on the best information available. The CHASP may be revised by EBC at the request of Darby Group and/or the New York State Department of Environmental Conservation (NYCDEC) upon receipt of new information regarding site conditions. Changes will be documented by written amendments signed by EBC's Project Manager, site safety officer and/or the EBC Health and Safety Consultant.

1.1 Scope

This CHASP addresses the potential hazards related to the site Interim Remedial Measure Work Plan (RAP). The RAP activities are as described below:

1) Site mobilization of Drilling Contractor (GC) to perform chemical oxidant at four locations in the southeast corner of the Morgan Days Park parking lot.

1.2 Application

The HASP applies to all personnel involved in the above tasks who wish to gain access to active work areas, including but not limited to:

- Drilling Contractor
- AMC / EBC employees and subcontractors;
- Client representatives; and
- Federal, state or local representatives.

1.3 Site Safety Plan Acceptance, Acknowledgment and Amendments

The project superintendent and the site safety officer are responsible for informing personnel (EBC employees and/or owner or owners representatives) entering the work area of the contents of this plan and ensuring that each person signs the safety plan acknowledging the on-site hazards and procedures required to minimize exposure to adverse effects of these hazards. A copy of the Acknowledgement Form is included in **Appendix A**.

Site conditions may warrant an amendment to the HASP. Amendments to the HASP are acknowledged by completing forms included in **Appendix B**.

1.4 Key Personnel - Roles and Responsibilities

Personnel responsible for implementing this Health and Safety Plan are:

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Name	Title	Address	Contact Numbers
Mr. Robert Bennett	EBC Project Manager	1808 Middle Country Road Ridge, NY 11961	(631) 504-6000
Mr. Kevin Waters	EBC Site Safety Officer	1808 Middle Country Road Ridge, NY 11961	(631) 504-6000

The project manager is responsible for overall project administration and, with guidance from the site safety officer, for supervising the implementation of this HASP. The site safety officer will conduct daily (tail gate or tool box) safety meetings at the project site and oversee daily safety issues. Each subcontractor and supplier (defined as an OSHA employer) is also responsible for the health and safety of its employees. If there is any dispute about health and safety or project activities, on-site personnel will attempt to resolve the issue. If the issue cannot be resolved at the site, then the project manager will be consulted.

The site safety officer is also responsible for coordinating health and safety activities related to hazardous material exposure on-site. The site safety officer is responsible for the following:

1. Educating personnel about information in this HASP and other safety requirements to be observed during site operations, including, but not limited to, decontamination procedures, designation of work zones and levels of protection, air monitoring, fit testing, and emergency procedures dealing with fire and first aid.

2. Coordinating site safety decisions with the project manager.

3. Designating exclusion, decontamination and support zones on a daily basis.

4. Monitoring the condition and status of known on-site hazards and maintaining and implementing the air quality monitoring program specified in this HASP.

5. Maintaining the work zone entry/exit log and site entry/exit log.

6. Maintaining records of safety problems, corrective measures and documentation of chemical exposures or physical injuries (the site safety officer will document these conditions in a bound notebook and maintain a copy of the notebook on-site).

The person who observes safety concerns and potential hazards that have not been addressed in the daily safety meetings should immediately report their observations/concerns to the site safety officer or appropriate key personnel.

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2.0 SITE BACKGROUND AND SCOPE OF WORK

The subject property is located at 80-100 Banks Avenue, Village of Rockville Centre, Town of Hempstead, Nassau County, New York. The site is situated at the northwest intersection of Nassau Street and Banks Avenue. The property comprises a total area of 7.1 acres, and is identified as Lots 27 and 30, Block 539, Section 38 on the Nassau County Tax Maps. The site is currently improved with two new apartment buildings which were constructed and placed in service by Avalon Bay Communities.

2.1 Remedial Investigation

A Remedial Investigation was completed for OU2 by Environmental Business Consultants (EBC) from August 2011 through Mach 2014. The goals of the Remedial Investigation were to define the nature and extent of off-site contamination in groundwater and to assess the impact of the contamination on public health and/or the environment; and to provide information to support the development of a Remedial Work Plan to address the contamination.

Activities completed under the RI:

- Soil sampling and analysis for chlorinated solvent and petroleum compounds in soil samples from soil boring locations;
- The installation of groundwater monitoring wells;
- The collection and analysis of groundwater samples for chlorinated solvent and petroleum compounds.

The field work portion of the RI was initially performed by EBC in August 2011 with a secondary mobilization in October 2013. Groundwater samples were collected during four sampling events as follows: November 17, 2011, October 18, 2013, March 26, 2014 and October 29, 2014.

The results of sampling performed during the RI, identified CVOC contamination, consisting mainly of PCE and degradants including TCE, cis-1,2-DCE and vinyl chloride in shallow groundwater. Minimal VOC detections were reported south of Nassau Street including wells 3, 9 and 10 located just south of Nassau Street in front of the bus garage and in wells 4 through 8 located behind the garage. The absence of CVOCs in these wells indicates that the plume has not migrated south of Nassau Street. Plume velocity calculations which, indicate that the plume would not have traveled more than 225 feet from the source during the time it has been in transit, matches well with these observations.

Chlorinated compounds were reported in the wells along the east side of Morgan Days Park (MW12-MW14) during the October 2013, March 2014 and October 2014 sampling rounds. Little change was noted between the October 2013 and March 2014 rounds with total CVOC concentrations ranging from 426 to 675 ug/L during the October round and from 524 to 782 ug/L during the March round. A spike in cis-1,2-DCE concentrations was noted in MW 14 during the October 2014 round with a concentration of 1,300, ug/L.

CVOC detections have also been reported in MW1 and MW2 located along the western edge of the Morgan Days Park parking lot. While initial concentrations were low to non-detect in MW1 and MW2 in 2011, an increase was reported in these wells during the October 2013 sampling

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round. These levels declined significantly by March 2014 and have stayed low in MW1 while concentrations in MW2 have rebounded to some extent. The fluctuating concentrations are likely related to the shallow nature of the groundwater and its sensitivity to recharge events.

MW11 which is located on the southeastern edge of the park entrance and directly downgradient from the former source areas at the Darby Site has shown the highest offsite CVOC concentrations. This area represents a hotspot and the center of the off-site plume. Total CVOC concentrations in this well were originally reported in October 2013 at 9,667 ug/L, increasing to 17,426 in March 2014 and then dropping to 5,882 ug/L in October 2014. The reduction may be related to the operation of the groundwater treatment system along the southwestern edge of the former Darby property.

Although the plume when first investigated was still attached to the source area forming a continuous zone of impacted groundwater to the terminus point, it is likely that remediation of the source area and operation of the onsite groundwater extraction and treatment system have resulted in a small detached remnant plume. Further migration of this plume would be minimal due to the low transport velocities and absence of a source.

Qualitative Human Health Exposure Assessment
The qualitative exposure assessment The exposure assessment identified potential exposures to church workers in the building at 51 Nassau Street (assuming the building remains occupied) through vapors off-gassing from impacted groundwater in this area. Due to the limited present and potential future extent of the plume, and the absence of downgradient receptors, no other potential exposures were identified.

2.2 Description of Interim Remedial Measure Work Plan

Site activities included within the IRM that are included within the scope of this HASP include the following:

The proposed remedial action will consist of:

1. Injection of chemical oxidants at 4 locations to depths of 12 feet below grade;
2. Collection and analysis of groundwater samples to evaluate the performance of the remedy.

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3.0 HAZARD ASSESSMENT

This section identifies the hazards associated with the proposed scope of work, general physical hazards that can be expected at most sites; and presents a summary of documented or potential chemical hazards at the site. Every effort must be made to reduce or eliminate these hazards. Those that cannot be eliminated must be guarded against using engineering controls and/or personal protective equipment.

3.1 Physical Hazards

3.1.1 Tripping Hazards

An area of risk associated with on-site activities are presented by uneven ground, concrete, curbstones or equipment which may be present at the site thereby creating a potential tripping hazard. During intrusive work, care should be taken to mark or remove any obstacles within the exclusion zone.

3.1.2 Climbing Hazards

During site activities, workers may have to work on excavating equipment by climbing. The excavating contractor will conform with any applicable NIOSH and OSHA requirements or climbing activities.

3.1.3 Cuts and Lacerations

Field activities that involve excavating activities usually involve contact with various types of machinery. A first aid kit approved by the American Red Cross will be available during all intrusive activities.

3.1.4 Lifting Hazards

Improper lifting by workers is one of the leading causes of industrial injuries. Field workers in the excavation program may be required to lift heavy objects. Therefore, all members of the field crew should be trained in the proper methods of lifting heavy objects. All workers should be cautioned against lifting objects too heavy for one person.

3.1.5 Utility Hazards

Before conducting any excavation, the excavation contractor will be responsible for locating and verifying all existing utilities at each excavation.

3.1.6 Traffic Hazards

All traffic, vehicular and pedestrian, shall be maintained and protected at all times consistent with local, state and federal agency regulations regarding such traffic and in accordance with NYCDOT guidelines. The excavation contractor shall carry on his operations without undue interference or delays to traffic. The excavation contractor shall furnish all labor, materials, guards, barricades, signs, lights, and anything else necessary to maintain traffic and to protect his work and the public, during operations.

3.2 Work in Extreme Temperatures

Work under extremely hot or cold weather conditions requires special protocols to minimize the chance that employees will be affected by heat or cold stress.

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3.2.1 Heat Stress

The combination of high ambient temperature, high humidity, physical exertion, and personal protective apparel, which limits the dissipation of body heat and moisture, can cause heat stress.

The following prevention, recognition and treatment strategies will be implemented to protect personnel from heat stress. Personnel will be trained to recognize the symptoms of heat stress and to apply the appropriate treatment.

1. Prevention
    a. Provide plenty of fluids. Available in the support zone will be a 50% solution of fruit punch and water or plain water.
    b. Work in Pairs. Individuals should avoid undertaking any activity alone.
    c. Provide cooling devices. A spray hose and a source of water will be provided to reduce body temperature, cool protective clothing and/or act as a quick-drench shower in case of an exposure incident.
    d. Adjustment of the work schedule. As is practical, the most labor-intensive tasks should be carried out during the coolest part of the day.

2. Recognition and Treatment
    a Heat Rash (or prickly heat):
        Cause: Continuous exposure to hot and humid air, aggravated by chafing clothing.
        Symptoms: Eruption of red pimples around sweat ducts accompanied by intense itching and tingling.
        Treatment: Remove source or irritation and cool skin with water or wet cloths.

    b. Heat Cramps (or heat prostration)
        Cause: Profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.
        Symptoms: Muscular weakness, staggering gait, nausea, dizziness, shallow breathing, pale and clammy skin, approximately normal body temperature.
        Treatment: Perform the following while making arrangement for transport to a medical facility. Remove the worker to a contamination reduction zone. Remove protective clothing. Lie worker down on back in a cool place and raise feet 6 to 12 inches. Keep warm, but loosen all clothing. If conscious, provide sips of salt-water solution, using one teaspoon of salt in 12 ounces of water. Transport to a medical facility.
    c. Heat Stroke
        Cause: Same as heat exhaustion. This is also an extremely serious condition.
        Symptoms: Dry hot skin, dry mouth, dizziness, nausea, headache, rapid pulse.
        Treatment: Cool worker immediately by immersing or spraying with cool water or sponge bare skin after removing protective clothing. Transport to hospital.

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3.2.2 Cold Exposure

Exposure to cold weather, wet conditions and extreme wind-chill factors may result in excessive loss of body heat (hypothermia) and /or frostbite. To guard against cold exposure and to prevent cold injuries, appropriate warm clothing should be worn, warm shelter must be readily available, rest periods should be adjusted as needed, and the physical conditions of on-site field personnel should be closely monitored. Personnel and supervisors working on-site will be made aware of the signs and symptoms of frost bite and hypothermia such as shivering, reduced blood pressure, reduced coordination, drowsiness, impaired judgment, fatigue, pupils dilated but reactive to light and numbing of the toes and fingers.

3.3 Chemical Hazards

Samples collected from the site as part of the Remedial Investigation performed at the site has identified elevated levels of CVOCs in groundwater and soil vapor.

VOCs reported to be present at elevated concentrations in groundwater at the Site include the following:

Cis-1,2-dichloroethene	Trans-1,2-dichloroethene	Trichloroethene	Tetrachloroethene
Vinyl Chloride			

CVOCs reported to be present at elevated concentrations in soil vapor at the Site include the following:

Trichloroethene	Tetrachloroethene

The primary routes of exposure to identified contaminants groundwater and soil vapor to on-site remediation workers are through inhalation, ingestion and absorption. In addition to the site chemicals, the remedial work will require the handling of liquid sodium permanganate at a 40% concentration. The primary routes of exposure to the sodium permanganate to on-site remediation workers are through inhalation, ingestion and absorption.

Appendix C includes information sheets for all detected chemicals that may be encountered at the site.

3.3.1 Respirable Dust

Dust is not expected to be generated during drilling and injection activities. If visible observation detects elevated levels of dust, a program of wetting will be employed by the site safety officer. If elevated dust levels persist, the site safety office will employ dust monitoring using a particulate monitor (Miniram or equivalent). If monitoring detects concentrations greater than 150 µg/m3 over daily background, the site safety officer will take corrective actions as defined herein, including the use of water for dust suppression and if this is not effective, requiring workers to wear APRs with efficiency particulate air (HEPA) cartridges.

Absorption pathways for dust and direct contact with soils or groundwater will be mitigated with the implementation of latex gloves, hand washing and decontamination exercises when necessary.

3.3.2 Dust Control and Monitoring During Drilling

Dust generated during drilling activities will be controlled by wetting the working surface with

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water. Calcium chloride may be used if the problem cannot be controlled with water. Air monitoring and dust control techniques are specified in a site specific Dust Control Plan (if applicable). Site workers will not be required to wear APR's unless dust concentrations are consistently over 150 µg/m^3 over site-specific background in the breathing zone as measured by a dust monitor unless the site safety officer directs workers to wear APRs. The site safety officer will use visible dust as an indicator to implement the dust control plan.

3.3.3 Organic Vapors

The site safety officer will periodically monitor organic vapors with a Photo-ionization Detector (PID) during drilling activities to determine whether organic vapor concentrations exceed action levels shown in Section 5 and/or the Community Air Monitoring Plan.

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4.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) shall be selected in accordance with the site air monitoring program, OSHA 29 CFR 1910.120(c), (g), and 1910.132. Protective equipment shall be NIOSH approved and respiratory protection shall conform to OSHA 29 CFR Part 1910.133 and 1910.134 specifications; head protection shall conform to 1910.135; eye and face protection shall conform to 1910.133; and foot protection shall conform to 1910.136. The only true difference among the levels of protection from D thru B is the addition of the type of respiratory protection. **It is anticipated that work will be performed in Level D PPE.**

4.1 Level D

Level D PPE shall be donned when the atmosphere contains no known hazards and work functions preclude splashes, immersion, or the potential for inhalation of, or contact with, hazardous concentrations of harmful chemicals. Level D PPE consists of:

- standard work clothes, coveralls, or tyvek, as needed;
- steel toe and steel shank work boots;
- hard hat;
- gloves, as needed;
- safety glasses; face shield while mixing chemicals
- hearing protection;
- equipment replacements are available as needed.

4.2 Level C

Level C PPE shall be donned when sustained concentrations of measured total organic vapors in the breathing zone exceed background concentrations (using a portable OVA, or equivalent), by more than 5 ppm. The specifications on the APR filters used must be appropriate for contaminants identified or expected to be encountered. Level C PPE shall be donned when the identified contaminants have adequate warning properties and criteria for using APR have been met. Level C PPE consists of:

- chemical resistant or coated tyvek coveralls;
- steel-toe and steel-shank workboots;
- chemical resistant overboots or disposable boot covers;
- disposable inner gloves (surgical gloves);
- disposable outer gloves;
- full face APR fitted with organic vapor/dust and mist filters or filters appropriate for the identified or expected contaminants;
- hard hat;
- splash shield, as needed; and,
- ankles/wrists taped with duct tape.

The site safety officer will verify if Level C is appropriate by checking organic vapor concentrations using compound and/or class-specific detector tubes.

The exact PPE ensemble is decided on a site-by-site basis by the Site Safety Officer with the intent to provide the most protective and efficient worker PPE.

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4.3 Activity-Specific Levels of Personal Protection

The required level of PPE is activity-specific and is based on air monitoring results (Section 4.0) and properties of identified or expected contaminants. **It is expected that site work will be performed in Level D.** If air monitoring results indicate the necessity to upgrade the level of protection, engineering controls (i.e. Facing equipment away from the wind and placing site personnel upwind of excavations, active venting, etc.) will be implemented before requiring the use of respiratory protection.

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5.0 AIR MONITORING AND ACTION LEVELS

29 CFR 1910.120(h) specifies that monitoring shall be performed where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed permissible exposure limits, or published exposure levels if there are no permissible exposure limits, for hazardous substances.

5.1 Air Monitoring Requirements

If excavation work is performed, air will be monitored for VOCs with a portable ION Science 3000EX photoionization detector, or the equivalent. If necessary, Lower Explosive Limit (LEL) and oxygen will be monitored with a Combustible Gas Indicator (CGI). If appropriate, fugitive dust will be monitored using a MiniRam Model PDM-3 aerosol monitor. Air will be monitored when any of the following conditions apply:

- initial site entry;
- during any work where a potential IDLH condition or flammable atmosphere could develop;
- excavation work begins on another portion of the site;
- contaminants, other than those previously identified, have been discovered;
- each time a different task or activity is initiated;
- during drilling and sampling.

The designated site safety officer will record air monitoring data and ensure that air monitoring instruments are calibrated and maintained in accordance with manufacturer's specifications. Instruments will be zeroed daily and checked for accuracy. Monitoring results will be recorded in a field notebook and will be transferred to instrument reading logs.

5.2 Work Stoppage Responses

The following responses will be initiated whenever one or more of the action levels necessitating a work stoppage are exceeded:

1 The SSO will be consulted immediately
2 All personnel (except as necessary for continued monitoring and contaminant migration, if applicable) will be cleared from the work area (eg from the exclusion zone).
3 Monitoring will be continued until intrusive work resumes.

5.3 Action Levels During Excavation Activities

Instrument readings will be taken in the breathing zone above the excavation pit unless otherwise noted. Each action level is independent of all other action levels in determining responses.

Organic Vapors (PID)	LEL %	Responses
0-1 ppm above background	0%	• Continue excavating • Level D protection • Continue monitoring every 10 minutes
1-5 ppm Above Background, Sustained Reading	1-10%	• Continue excavating • Go to Level C protection or employ

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		engineering controls • Continue monitoring every 10 minutes
5-25 ppm Above Background, Sustained Reading	10-20%	• Discontinue excavating, unless PID is only action level exceeded. • Level C protection or employ engineering controls • Continue monitoring for organic vapors 200 ft downwind • Continuous monitoring for LEL at excavation pit
>25 ppm Above Background, Sustained Reading	>20%	• Discontinue excavating • Withdraw from area, shut off all engine ignition sources. • Allow pit to vent • Continuous monitoring for organic vapors 200 ft downwind.

Notes: Air monitoring will occur in the breathing zone 30 inches above the work area.If action levels for any one of the monitoring parameters are exceeded, the appropriate responses listed in the right hand column should be taken. If instrument readings do not return to acceptable levels after the area has been vented for a period of greater than one-half hour, a decision will then be made whether or not to abandon the boring.

If, during injection activities, downwind monitoring PID readings are greater than 5 ppm above background for more than one-half hour, excavation will stop until sustained levels are less then 5 ppm (see Community Air Monitoring Plan).

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6.0 SITE CONTROL

6.1 Work Zones

The primary purpose of site controls is to establish the perimeter of a hazardous area, to reduce the migration of contaminants into clean areas, and to prevent access or exposure to hazardous materials by unauthorized persons. When operations are to take place involving hazardous materials, the site safety officer will establish an exclusion zone, a decontamination zone, and a support zone. These zones "float" (move around the site) depending on the tasks being performed on any given day. The site safety officer will outline these locations before work begins and when zones change. The site safety officer records this information in the site log book.

Due to the dimensions of the Site and the work area, it is expected that an exclusion zone will include a a5 ft area around the work zone. All onsite workers who will come into contact with hazardous materials must provide evidence of OSHA 24 or 40-hour Hazardous Waste Operations and Emergency Response Operations training to conduct work within the exclusion zone established by the site safety officer. The exclusion zone is defined by the site safety officer but will typically be a 50-foot area around work activities. Gross decontamination (as determined by the site Health and Safety Officer) is conducted in the exclusion zone; all other decontamination is performed in the decontamination zone or trailer, if provided.

Protective equipment is removed in the decontamination zone. Disposable protective equipment is stored in receptacles staged in the decontamination zone, and non-disposable equipment is decontaminated. All personnel and equipment exit the exclusion zone through the decontamination zone.

The support zone is used for vehicle parking, daily safety meetings, and supply storage. Eating, drinking, and smoking are permitted only in the support zone. When a decontamination trailer is not provided, the eye wash unit, first aid equipment, and drinking water are kept in the work truck.

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7.0 CONTINGENCY PLAN/EMERGENCY RESPONSE PLAN

Site personnel must be prepared in the event of an emergency. Emergencies can take many forms: illnesses, injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather.

Emergency telephone numbers and a map to the hospital will be posted in the command post. Site personnel should be familiar with the emergency procedures, and the locations of site safety, first aid, and communication equipment.

7.1 Emergency Equipment On-site

Private telephones:	Site personnel.
Two-way radios:	Site personnel where necessary.
Emergency Alarms:	On-site vehicle horns*.
First aid kits:	On-site, in vehicles or office.
Fire extinguisher:	On-site, in office or on equipment.

* Horns: Air horns will be supplied to personnel at the discretion of the project superintendent or site safety officer.

7.2 Emergency Telephone Numbers

General Emergencies	911
Suffolk County Police	911
NYC Fire Department	911
St Johns Episcopal Hospital Emergency	(718) 869-7000
NYSDEC Spills Hotline	1-800-457-7362
NYSDEC Project Manager	(518) 402-9773
NYSDOH Project Manager	(718) 402-7860
NYC Department of Health	(212) 676-2400
National Response Center	1-800-424-8802
Poison Control	1-800-222-1222
Project Manager	1-631-504-6000
Site Safety Officer	1-631-504-6000

7.3 Personnel Responsibilities During an Emergency

The project manager is primarily responsible for responding to and correcting any emergency situations. However, in the absence of the project manager, the site safety officer shall act as the project manager's on-site designee and perform the following tasks:

- Take appropriate measures to protect personnel including: withdrawal from the exclusion zone, evacuate and secure the site, or upgrade/downgrade the level of protective clothing and respiratory protection;

- Ensure that appropriate federal, state, and local agencies are informed and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. If toxic materials are released to the air, the local authorities should be informed in order to assess the need for evacuation;

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Ridge, NY 11961
Phone 631.504.6000
Fax 631.924.2870

- Ensure appropriate decontamination, treatment, or testing for exposed or injured personnel;

- Determine the cause of incidents and make recommendations to prevent recurrence; and,

- Ensure that all required reports have been prepared.

The following key personnel are planned for this project:

- Project Manager — Mr. Robert Bennett (631) 504-6000
- Site Safety Officer — Mr. Kevin Waters (631) 504-6000

7.4 Medical Emergencies

A person who becomes ill or injured in the exclusion zone will be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination will be completed and first aid administered prior to transport. First aid will be administered while waiting for an ambulance or paramedics. A Field Accident Report (**Appendix D**) must be filled out for any injury.

A person transporting an injured/exposed person to a clinic or hospital for treatment will take the directions to the hospital (**Appendix D**).and information on the chemical(s) to which they may have been exposed (**Appendix C**).

7.5 Fire or Explosion

In the event of a fire or explosion, the local fire department will be summoned immediately. The site safety officer or his designated alternate will advise the fire commander of the location, nature and identification of the hazardous materials on-site. If it is safe to do so, site personnel may:

- use fire fighting equipment available on site; or,
- remove or isolate flammable or other hazardous materials that may contribute to the fire.

7.6 Evacuation Routes

Evacuation routes established by work area locations for each site will be reviewed prior to commencing site operations. As the work areas change, the evacuation routes will be altered accordingly, and the new route will be reviewed.

Under extreme emergency conditions, evacuation is to be immediate without regard for equipment. The evacuation signal will be a continuous blast of a vehicle horn, if possible, and/or by verbal/radio communication. When evacuating the site, personnel will follow these instructions:

- Keep upwind of smoke, vapors, or spill location.
- Exit through the decontamination corridor if possible.
- If evacuation through the decontamination corridor is not possible, personnel should remove contaminated clothing once they are in a safe location and leave it near the exclusion zone or in a safe place.

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- The site safety officer will conduct a head count to ensure that all personnel have been evacuated safely. The head count will be correlated to the site and/or exclusion zone entry/exit log.
- If emergency site evacuation is necessary, all personnel are to escape the emergency situation and decontaminate to the maximum extent practical.

7.7 Spill Control Procedures

Spills associated with site activities may be attributed to project equipment and include gasoline, diesel and hydraulic oil. In the event of a leak or a release, site personnel will inform their supervisor immediately, locate the source of spillage and stop the flow if it can be done safely. A spill containment kit including absorbent pads, booms and/or granulated speedy dry absorbent material will be available to site personnel to facilitate the immediate recovery of the spilled material. Daily inspections of site equipment components including hydraulic lines, fuel tanks, etc. will be performed by their respective operators as a preventative measure for equipment leaks and to ensure equipment soundness. In the event of a spill, site personnel will immediately notify the NYSDEC (1-800-457-7362), and a spill number will be generated.

7.8 Vapor Release Plan

If work zone organic vapor (excluding methane) exceeds 5 ppm, then a downwind reading will be made either 200 feet from the work zone or at the property line, whichever is closer. If readings at this location exceed 5 ppm over background, the work will be stopped.

If 5 ppm of VOCs are recorded over background on a PID at the property line, then an off-site reading will be taken within 20 feet of the nearest residential or commercial property, whichever is closer. If efforts to mitigate the emission source are unsuccessful for 30 minutes, then the designated site safety officer will:

- contact the local police;
- continue to monitor air every 30 minutes, 20 feet from the closest off-site property. If two successive readings are below 5 ppm (non-methane), off-site air monitoring will be halted.
- All property line and off site air monitoring locations and results associated with vapor releases will be recorded in the site safety log book.

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APPENDIX A

SITE SAFETY ACKNOWLEDGEMENT FORM

DAILY BREIFING SIGN-IN SHEET

Date:_____ Person Conducting Briefing:_____

Project Name and Location:_____

1. AWARENESS (topics discussed, special safety concerns, recent incidents, etc…):

_____

_____

_____

_____

2. OTHER ISSUES (HASP changes, attendee comments, etc…):

_____

_____

_____

3. ATTENDEES (Print Name):

1.	11.
2.	12.
3.	13.
4.	14.
5.	15.
6.	16.
7.	17.
8.	18.
9.	19.
10.	20.

APPENDIX B

SITE SAFETY PLAN AMENDMENTS

SITE SAFETY PLAN AMENDMENT FORM

Site Safety Plan Amendment #: _____

Site Name: _____

Reason for Amendment: _____

_____

_____

_____

Alternative Procedures: _____

_____

_____

_____

Required Changes in PPE: _____

_____

_____

_____

_____ _____

Project Superintendent (signature) **Date**

_____ _____

Health and Safety Consultant (signature) **Date**

_____ _____

Site Safety Officer (signature) **Date**

APPENDIX C

CHEMICAL HAZARDS

CHEMICAL HAZARDS

The attached International Chemical Safety Cards are provided for contaminants of concern that have been identified in soils and/or groundwater at the site.

CARUS REMEDIATION



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

RemOx® L ISCO Reagent

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 including chlorinated solvents, polyaromatic hydrocarbons, phenolics, organo-pesticides, and substituted aromatics. RemOx L is shipped with a certificate of analysis to document assay, pH, and trace metals.

PRODUCT SPECIFICATIONS

Assay
39.5-41.0% as $NaMnO_4$

pH
5.0-8.0

Trace Metals
(see Table 1)

CHEMICAL/PHYSICAL DATA

Formula	$NaMnO_4$
Formula Weight	141.93 g/mol
Appearance	Dark Purple Solution
Specific Gravity	1.365-1.385 g/mL
Freezing Point	-15° C/ 5° F
Solubility in Water	Miscible with water in all proportions.

Material will pass through a 10 micron filter.

APPLICATIONS

RemOx L is used for soil and groundwater remediation by *in situ* or *ex situ* chemical oxidation and as an active agent in subsurface reactive barriers for treatment of: chlorinated ethenes, phenolic compounds, polyaromatic hydrocarbons, RDX, HMX, and various pesticides.

SHIPPING CONTAINERS

5-gallon pail (20-L) (UN Specification: UN3H1/Y1.8/100) Made of high-density polyethylene (HDPE), weighs 3.5 lbs (1.6 kg). The net weight is 57 lbs (25.9 kg). The pail stands approximately 14.8 in (37.6 cm) tall, 10.6 in (26.9 cm) wide, and 11.0 in (27.9 cm) deep. (Domestic and international)

55-gallon drum (208-L) (UN Specification: UN1H1/Y1.41100) Made of high-density polyethylene (HDPE), weighs 22 lbs (10 kg). The net weight is 550 lbs (250 kg). The drum stands approximately 34.8 in (88.3 cm) tall, has an outside diameter of 23.3 in (59.1 cm). (Domestic and international)

SHIPPING CONTAINERS

275-gallon IBC (Intermediate Bulk Container) (1040-L) (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 lbs (1360 kg). The IBC contains 263 gallons (1000 L) of product. The IBC dimensions are 45.4 in (115.3 cm) high, 48 in (121.9 cm) long, and 40 in (101.6 cm) wide. The IBC has a 2 in (5 cm) butterfly valve with NPT threads in bottom sump. (Domestic)

275-gallon IBC (Intermediate Bulk Container) (1040-L) (UN Specification: UN31HA1/Y1.9/100) They are also marked "MX" for multi-trip. IBC weighs 132.5 lbs (60 kg). The net weight is 3000 lbs (1360 kg). The IBC contains 263 gallons (1000 L) of product. The IBC dimensions are 45.8 in (116.2 cm) high, 39.4 in (100.0 cm) long, and 47.3 in (120.0 cm) wide. The IBC has a 2 in (5 cm) butterfly valve with NPT threads in bottom sump. (International)

Bulk Shipping- Quantities up to 4000-gallons (15,142-L) are available. (Domestic only)

HANDLING, STORAGE, AND INCOMPATIBILITY

Like any strong oxidizer RemOx L should be handled with care. Protective equipment during handling should include face shields and/or goggles, rubber or plastic gloves, 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.

Store in accordance with NFPA 30 requirements in the United States or the European Fire Protection Association in Europe for Class II oxidizers. Additional regulations in Europe are REACH (Regulation for Registration, Evaluation, Authorisation and Restriction of Chemicals), and CLP (Classification, Labeling, Packaging). REACH is a regulation that increases the responsibility of the industry to manage the risks that the chemical may pose. For REACH registration numbers refer to the eSDS. The product should be stored in a cool, dry area in closed containers. Concrete floors are preferred. Check local regulations to ensure proper storage. Avoid wooden decks. Spillage should be collected and disposed of properly. To clean up spills and leaks follow the steps recommended in our MSDS or eSDS.

Avoid contact with acids, peroxides, and all combustible organic or readily oxidizable materials including inorganic oxidizable materials and metal powders. With hydrochloric acid, chlorine gas is liberated. RemOx L is not combustible, but will support combustion. It may decompose if exposed to intense heat. Fires may be controlled and extinguished by using large quantities of water. Refer to the MSDS or eSDS for more information.

CARUS CORPORATION ONE COMPANY, ENDLESS SOLUTIONS

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rev. 09/13
form RX 1603

CARUS REMEDIATION



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

RemOx® L ISCO Reagent

FACT SHEET

RemOx® L ISCO reagent is classified as an oxidizer for both domestic and international transportation. Liquid permanganate is shipped domestically as Freight Class 70 and in E.U. as Class 5.1.

Proper Shipping Name: Permanganates, inorganic, aqueous solution n.o.s. (contains sodium permanganate).

Hazard Class: Oxidizer, Class 5.1
Identification Number: UN 3214
Division/APR/RID Class: 5.1
Label Requirements: Oxidizer, 5.1
Packaging Group: II
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, (IMDG Regulation):

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.

H.S. Code 28.41.69.00

SHIPPING CONTAINERS

RemOx L 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 be compatible with any kind of acid or alkali being used.

In neutral and alkaline solutions, RemOx L 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, and HDPE are also compatible with liquid permanganate.

Aluminum, zinc, copper, lead, and alloys containing these metals may be (slightly) affected by RemOx L. Actual corrosion or compatibility studies should be made under the conditions in which RemOx L will be used.

Table 1: Typical Trace Metal Content and Specifications

Element	Typical Analysis (mg/kg)	Specifications (mg/kg)	DL* (mg/kg)	Element	Typical Analysis (mg/kg)	Specifications (mg/kg)	DL* (mg/kg)
Ag	BDL	0.15	0.034	Fe	BDL	2.00	0.053
Al	BDL	2.00	0.24	Hg	BDL	0.03	0.003
As	BDL	4.00	0.006	Ni	BDL	0.1	0.03
Ba	2.96	15.00	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	0.0034	0.50	0.0003
Cr	3.2	5.00	0.031	Tl	BDL	3.50	0.80
Cu	BDL	0.10	0.022	Zn	0.034	0.40	0.011

DL* is detection limit
BDL is below detection limit

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rev. 09/13
form RX 1603

Material Safety Data Sheet

cis-1,2-Dichloroethylene, 97%

ACC# 97773

Section 1 - Chemical Product and Company Identification

MSDS Name: cis-1,2-Dichloroethylene, 97%
Catalog Numbers: AC113380000, AC113380025, AC113380100
Synonyms: cis-Acetylene dichloride.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
156-59-2	cis-1,2-Dichloroethylene	97	205-859-7

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: Clear liquid. Flash Point: 6 deg C.
Warning! Flammable liquid and vapor. Harmful if inhaled. Unstabilized substance may polymerize. Causes eye and skin irritation. May be harmful if swallowed. May cause respiratory tract irritation.
Target Organs: Central nervous system, respiratory system, eyes, skin.

Potential Health Effects
Eye: Causes moderate eye irritation.
Skin: Causes moderate skin irritation. May cause dermatitis.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May be harmful if swallowed. May cause central nervous system depression.
Inhalation: May cause respiratory tract irritation. May cause narcotic effects in high concentration. Eye irritation, vertigo, and nausea were reported in humans exposed at 2200 ppm.
Chronic: Not available. Some German investigators reported fatty degeneration of the liver upon repeated narcotic doses in rats and

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, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.
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. Vapors may form an explosive mixture with air. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. Fire or excessive heat may result in violent rupture of the container due to bulk polymerization. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. Hazardous polymerization may occur under fire conditions.
Extinguishing Media: Use water fog, dry chemical, carbon dioxide, or regular foam.
Flash Point: 6 deg C (42.80 deg F)
Autoignition Temperature: 440 deg C (824.00 deg F)
Explosion Limits, Lower:9.70 vol %
Upper: 12.80 vol %
NFPA Rating: (estimated) Health: 2; Flammability: 3; Instability: 2

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. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Pure vapor will be uninhibited and may polymerize in vents or other confined spaces.
Storage: Keep away from sources of ignition. Store in a tightly closed container. Flammables-area. Store protected from light and air.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
cis-1,2-Dichloroethylene	200 ppm TWA	none listed	none listed

OSHA Vacated PELs: cis-1,2-Dichloroethylene: No OSHA Vacated PELs are listed for this chemical.
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
Odor: Pleasant odor
pH: Not available.
Vapor Pressure: 201 mm Hg @ 25 deg C
Vapor Density: 3.34 (air=1)
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 60 deg C @ 760 mm Hg
Freezing/Melting Point:-80 deg C
Decomposition Temperature: Not available.
Solubility: Insoluble.
Specific Gravity/Density:1.2800
Molecular Formula:C2H2Cl2
Molecular Weight:96.94

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures. This material is a monomer and may polymerize under certain conditions if the stabilizer is lost.
Conditions to Avoid: Light, ignition sources, exposure to air, excess heat.
Incompatibilities with Other Materials: Strong oxidizing agents, strong bases, copper.
Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.
Hazardous Polymerization: May occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 156-59-2: KV9420000
LD50/LC50:
CAS# 156-59-2:
Inhalation, rat: LC50 = 13700 ppm;
.

Carcinogenicity:
CAS# 156-59-2: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No data available.
Teratogenicity: No data available.
Reproductive Effects: No data available.
Mutagenicity: No data available.
Neurotoxicity: No data available.
Other Studies:

Section 12 - Ecological Information

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: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	DOT regulated - small quantity provisions apply (see 49CFR173.4)	1,2-DICHLOROETHYLENE
Hazard Class:		3
UN Number:		UN1150
Packing Group:		II

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 156-59-2 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
None of the chemicals in this material have an RQ.
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
Section 313 No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
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.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 156-59-2 can be found on the following state right to know lists: Pennsylvania, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European / International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols:
XN F
Risk Phrases:

R 11 Highly flammable.
R 20 Harmful by inhalation.
R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 16 Keep away from sources of ignition - No smoking.
S 29 Do not empty into drains.
S 7 Keep container tightly closed.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 156-59-2: No information available.

Canada - DSL/NDSL

CAS# 156-59-2 is listed on Canada's NDSL List.

Canada - WHMIS

WHMIS: Not available.

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

Section 16 - Additional Information

MSDS Creation Date: 2/09/1998
Revision #5 Date: 3/16/2007

International Chemical Safety Cards

TETRACHLOROETHYLENE

ICSC: 0076

1,1,2,2-Tetrachloroethylene
Perchloroethylene
Tetrachloroethene
C_2Cl_4 / $Cl_2C=CCl_2$
Molecular mass: 165.8

ICSC # 0076
CAS # 127-18-4
RTECS # KX3850000
UN # 1897
EC # 602-028-00-4
April 13, 2000 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		STRICT HYGIENE! PREVENT GENERATION OF MISTS!	
•INHALATION	Dizziness. Drowsiness. Headache. Nausea. Weakness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
•SKIN	Dry skin. Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness. Pain.	Safety goggles , face shield .	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Rest.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. Personal protection: filter respirator for organic gases and vapours.	Separated from metals ,(see Chemical Dangers), food and feedstuffs . Keep in the dark. Ventilation along the floor.	Do not transport with food and feedstuffs. Marine pollutant. Xn symbol N symbol R: 40-51/53 S: (2-)23-36/37-61 UN Hazard Class: 6.1 UN Packing Group: III

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0076

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

International Chemical Safety Cards

TETRACHLOROETHYLENE

ICSC: 0076

I M P O R T A N T D A T A

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour is heavier than air.

CHEMICAL DANGERS:
On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes (hydrogen chloride, phosgene, chlorine). The substance decomposes slowly on contact with moisture producing trichloroacetic acid and hydrochloric acid. Reacts with metals such as aluminium, lithium, barium, beryllium.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 25 ppm as TWA, 100 ppm as STEL; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2004).
MAK: skin absorption (H);
Carcinogen category: 3B;
(DFG 2004).
OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 3-hours)
NIOSH REL: Ca Minimize workplace exposure concentrations. See Appendix A
NIOSH IDLH: Ca 150 ppm See: 127184

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes , the skin and the respiratory tract . If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure at high levels may result in unconsciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the liver and kidneys. This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 121°C
Melting point: -22°C
Relative density (water = 1): 1.6
Solubility in water, g/100 ml at 20°C: 0.015

Vapour pressure, kPa at 20°C: 1.9
Relative vapour density (air = 1): 5.8
Relative density of the vapour/air-mixture at 20°C (air = 1): 1.09
Octanol/water partition coefficient as log Pow: 2.9

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment.

N O T E S

Depending on the degree of exposure, periodic medical examination is suggested. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert. Card has been partly updated in April 2005. See section Occupational Exposure Limits.

Transport Emergency Card: TEC (R)-61S1897

NFPA Code: H2; F0; R0;

ADDITIONAL INFORMATION

IMPORTANT LEGAL NOTICE:

Material Safety Data Sheet

Version 4.2
Revision Date 01/19/2011
Print Date 12/07/2011

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	*trans*-1,2-Dichloroethene
Product Number	:	48527
Brand	:	Supelco
Product Use	:	For laboratory research purposes.

Supplier	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA	Manufacturer	: Sigma-Aldrich Corporation 3050 Spruce St. St. Louis, Missouri 63103 USA
Telephone	:	+1 800-325-5832		
Fax	:	+1 800-325-5052		
Emergency Phone # (For both supplier and manufacturer)	:	(314) 776-6555		
Preparation Information	:	Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956		

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Flammable liquid, Harmful by ingestion., Irritant

Target Organs

Central nervous system, Liver, Kidney

GHS Classification
Flammable liquids (Category 2)
Acute toxicity, Inhalation (Category 4)
Acute toxicity, Oral (Category 4)
Skin irritation (Category 2)
Eye irritation (Category 2A)
Acute aquatic toxicity (Category 3)

GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H225	Highly flammable liquid and vapour.
H302 + H332	Harmful if swallowed or if inhaled.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H402	Harmful to aquatic life.

Precautionary statement(s)

P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

HMIS Classification

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical hazards:	0

NFPA Rating

Health hazard:	2
Fire:	3
Reactivity Hazard:	0

Potential Health Effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Skin	Harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.
Ingestion	Harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : *trans*-1,2-Dichloroethene
trans-1,2-Dichloroethylene
trans-Acetylene dichloride

Formula : $C_2H_2Cl_2$ $C_2H_2Cl_2$
Molecular Weight : 96.94 g/mol

CAS-No.	EC-No.	Index-No.	Concentration
trans-Dichloroethylene			
156-60-5	205-860-2	602-026-00-3	-

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

Special protective equipment for fire-fighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Hydrogen chloride gas, Carbon oxides, Phosgene gas
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
trans-Dichloroethylene	156-60-5	TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Central Nervous System impairment Eye irritation			

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid, clear
Colour	light yellow

Safety data

pH	no data available
Melting/freezing point	Melting point/range: -50 °C (-58 °F)
Boiling point	48 °C (118 °F)
Flash point	6.0 °C (42.8 °F) - closed cup
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	9.7 %(V)
Upper explosion limit	12.8 %(V)
Vapour pressure	no data available
Density	1.257 g/mL at 25 °C (77 °F)
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions

Vapours may form explosive mixture with air.

Conditions to avoid
Heat, flames and sparks. Extremes of temperature and direct sunlight.

Materials to avoid
Oxidizing agents, Bases

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Hydrogen chloride gas, Carbon oxides, Phosgene gas
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
LD50 Oral - rat - 1,235 mg/kg

Inhalation LC50
LC50 Inhalation - rat - 24100 ppm

Remarks: Behavioral:Somnolence (general depressed activity).

Dermal LD50
LD50 Dermal - rabbit - > 5,000 mg/kg
Remarks: Prolonged skin contact may cause skin irritation and/or dermatitis. Nutritional and Gross Metabolic:Weight loss or decreased weight gain.

Other information on acute toxicity
no data available

Skin corrosion/irritation
Skin - rabbit - Skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - rabbit - Eye irritation

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion	Harmful if swallowed.
Skin	Harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure
prolonged or repeated exposure can cause:, narcosis, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects
no data available

Additional Information

RTECS: Not available

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to daphnia and other aquatic invertebrates.	EC50 - Daphnia magna (Water flea) - 220.00 mg/l - 48 h

Persistence and degradability
no data available

Bioaccumulative potential
no data available

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN-Number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene
Reportable Quantity (RQ): 1000 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN-Number: 1150 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: 1,2-DICHLOROETHYLENE
Marine pollutant: No

IATA
UN-Number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene

15. REGULATORY INFORMATION

OSHA Hazards
Flammable liquid, Harmful by ingestion., Irritant

DSL Status
All components of this product are on the Canadian DSL list.

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
trans-Dichloroethylene	156-60-5	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
trans-Dichloroethylene	156-60-5	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
trans-Dichloroethylene	156-60-5	1993-04-24

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Co., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

International Chemical Safety Cards

TRICHLOROETHYLENE

ICSC: 0081

1,1,2-Trichloroethylene
Trichloroethene
Ethylene trichloride
Acetylene trichloride
C_2HCl_3 / $ClCH=CCl_2$
Molecular mass: 131.4

ICSC # 0081
CAS # 79-01-6
RTECS # KX4550000
UN # 1710
EC # 602-027-00-9
April 10, 2000 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible under specific conditions. See Notes.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION		Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS! STRICT HYGIENE!	
•INHALATION	Dizziness. Drowsiness. Headache. Weakness. Nausea. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
•SKIN	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness. Pain.	Safety spectacles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give one or two glasses of water to drink. Rest.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Personal protection: filter respirator for organic gases and vapours adapted to the airborne concentration of the substance. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment.	Separated from metals (see Chemical Dangers), strong bases, food and feedstuffs . Dry. Keep in the dark. Ventilation along the floor. Store in an area without drain or sewer access.	Do not transport with food and feedstuffs. Marine pollutant. T symbol R: 45-36/38-52/53-67 S: 53-45-61 UN Hazard Class: 6.1 UN Packing Group: III

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0081 OSHA PELs, NIOSH RELs and NIOSH IDLH values.

International Chemical Safety Cards

TRICHLOROETHYLENE

ICSC: 0081

I M P O R T A N T D A T A

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour is heavier than air. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes (phosgene , hydrogen chloride). The substance decomposes on contact with strong alkali producing dichloroacetylene , which increases fire hazard. Reacts violently with metal powders such as magnesium, aluminium, titanium, and barium. Slowly decomposed by light in presence of moisture, with formation of corrosive hydrochloric acid.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 50 ppm as TWA; 100 ppm as STEL; A5; BEI issued; (ACGIH 2004).
MAK:
Carcinogen category: 1; Germ cell mutagen group: 3B; (DFG 2007).
OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)
NIOSH REL: Ca See Appendix A See Appendix C
NIOSH IDLH: Ca 1000 ppm See: 79016

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and by ingestion.

INHALATION RISK:
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the skin . Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system , resulting in respiratory failure . Exposure could cause lowering of consciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the central nervous system , resulting in loss of memory. The substance may have effects on the liver and kidneys (see Notes). This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 87°C
Melting point: -73°C
Relative density (water = 1): 1.5
Solubility in water, g/100 ml at 20°C: 0.1
Vapour pressure, kPa at 20°C: 7.8
Relative vapour density (air = 1): 4.5
Relative density of the vapour/air-mixture at 20°C (air = 1): 1.3
Auto-ignition temperature: 410°C
Explosive limits, vol% in air: 8-10.5
Octanol/water partition coefficient as log Pow: 2.42
Electrical conductivity: 800pS/m

ENVIRONMENTAL DATA

The substance is harmful to aquatic organisms. The substance may cause long-term effects in the aquatic environment.

N O T E S

Combustible vapour/air mixtures difficult to ignite, may be developed under certain conditions. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is suggested. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.

Transport Emergency Card: TEC (R)-61S1710

NFPA Code: H2; F1; R0;
Card has been partially updated in October 2004: see Occupational Exposure Limits, EU Classification, Emergency Response.
Card has been partially updated in April 2010: see Occupational Exposure Limits, Ingestion First Aid, Storage.

ADDITIONAL INFORMATION

International Chemical Safety Cards

VINYL CHLORIDE

ICSC: 0082

Chloroethene
Chloroethylene
VCM
C_2H_3Cl / $H_2C=CHCl$
Molecular mass: 62.5
(cylinder)

ICSC # 0082
CAS # 75-01-4
RTECS # KU9625000
UN # 1086 (stabilized)
EC # 602-023-00-7
April 13, 2000 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Extremely flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking handtools.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Dizziness. Drowsiness. Headache. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Protective gloves. Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes.
•EYES	Redness. Pain.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation. Remove all ignition sources. Personal protection: complete protective clothing including self-contained breathing apparatus.	Fireproof. Separated from incompatible materials .(See Chemical Dangers.) Cool. Store only if stabilized.	Note: D F+ symbol T symbol R: 45-12 S: 53-45 UN Hazard Class: 2.1

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0082

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

International Chemical Safety Cards

VINYL CHLORIDE

ICSC: 0082

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS COMPRESSED LIQUEFIED GAS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The gas is heavier than air, and may travel along the ground; distant ignition possible. Vinyl chloride monomer vapours are uninhibited and may form polymers in vents or flame arresters of storage tanks, resulting in blockage of vents.

CHEMICAL DANGERS:
The substance can under specific circumstances form peroxides, initiating explosive polymerization. The substance will polymerize readily due to heating and under the influence of air, light and on contact with a catalyst, strong oxidizing agents and metals such as copper and aluminium, with fire or explosion hazard. The substance decomposes on burning producing toxic and corrosive fumes (hydrogen chloride , phosgene). Attacks iron and steel in the presence of moisture.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 1 ppm as TWA; A1 (confirmed human carcinogen); (ACGIH 2004).
MAK:
Carcinogen category: 1;
(DFG 2004).
OSHA PEL: 1910.1017 TWA 1 ppm C 5 ppm 15-minute
NIOSH REL: Ca See Appendix A
NIOSH IDLH: Ca N.D. See: IDLH INDEX

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation.

INHALATION RISK:
A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes . The liquid may cause frostbite. The substance may cause effects on the central nervous system . Exposure could cause lowering of consciousness. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the liver, spleen, blood andperipheral blood vessels, and tissue and bones of the fingers. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: -13°C
Melting point: -154°C
Relative density (water = 1): 0.9 (liquid)
Density: 8 (vapour) at 15°C
g/l
Solubility in water:
none

Relative vapour density (air = 1): 2.2
Flash point:
-78°C c.c.
Auto-ignition temperature: 472°C
Explosive limits, vol% in air: 3.6-33
Octanol/water partition coefficient as log Pow: 0.6

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to ground water contamination.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert. Card has been partly updated in April 2005. See section Occupational Exposure Limits.

Transport Emergency Card: TEC (R)-20S1086

NFPA Code: H 2; F 4; R 2;

ADDITIONAL INFORMATION

APPENDIX D

HOSPITAL INFORMATION AND MAP

FIELD ACCIDENT REPORT

FIELD ACCIDENT REPORT

This report is to be filled out by the designated Site Safety Officer after EVERY accident.

PROJECT NAME _____ PROJECT. NO._____

Date of Accident _____ Time _____ Report By _____

Type of Accident (Check One):

( ) Vehicular ( ) Personal ( ) Property

Name of Injured _____ DOB or Age _____

How Long Employed _____

Names of Witnesses _____

_____

Description of Accident _____

_____

_____

Action Taken _____

_____

_____

Did the Injured Lose Any Time? _____ How Much (Days/Hrs.)? _____

Was Safety Equipment in Use at the Time of the Accident (Hard Hat, Safety Glasses, Gloves, Safety Shoes, etc.)? _____

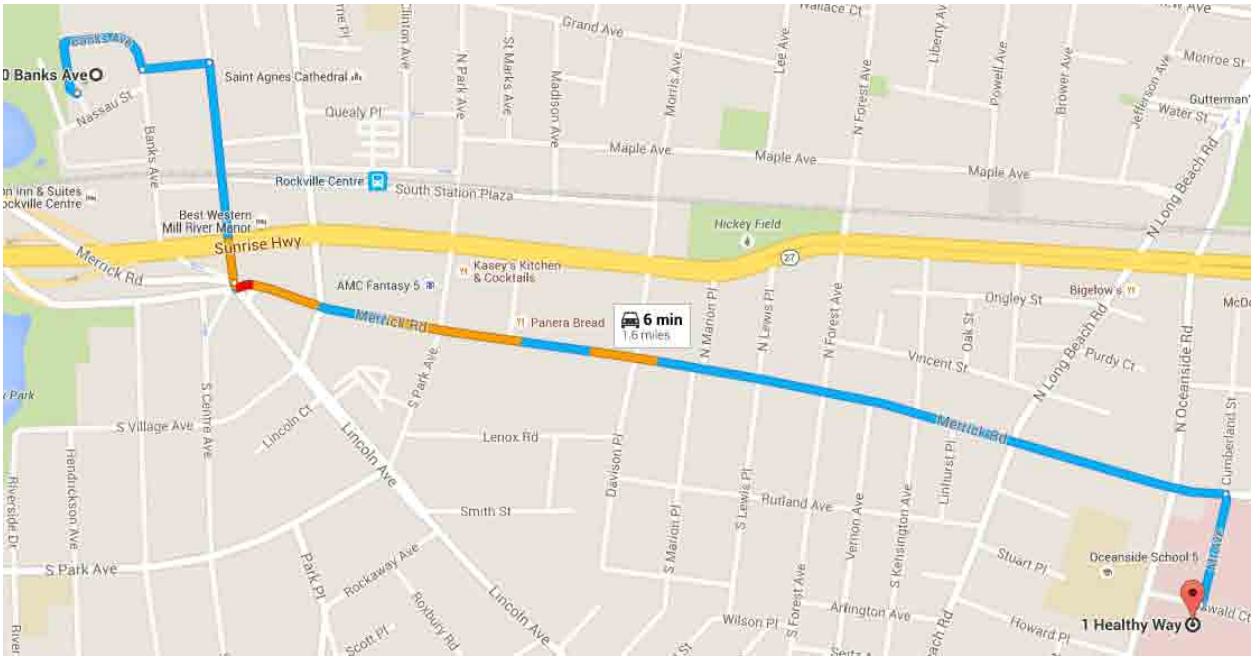
_____

(If not, it is the EMPLOYEE'S sole responsibility to process his/her claim through his/her Health and Welfare Fund.)

INDICATE STREET NAMES, DESCRIPTION OF VEHICLES, AND NORTH ARROW

HOSPITAL INFORMATION AND MAP

The hospital nearest the site is:
South Nassau Communities Hospital
1 Healthy Way
Oceanside, NY 11572
(516) 632-3000
1.6 Miles – About 6 Minutes



80 Banks Ave
Rockville Centre, NY 11570

1. Head **northwest** on **Banks Ave/Claude St** toward **Morgan Days Ln**
   Continue to follow Banks Ave — 0.2 mi
2. Turn **left** onto **Morgan Days Ln** — 358 ft
3. Turn **right** onto **N Centre Ave** — 0.2 mi
4. Turn **left** onto **Merrick Rd** — 1.0 mi
5. Turn **right** onto **Healthy Way/Mount Ave/One Healthy Way** — 0.1 mi
6. Turn **right** onto **Oswald Ct**
   Destination will be on the left — 3 ft

1 Healthy Way
Oceanside, NY 11572

ATTACHMENT B
Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN

Former Darby Drugs Distribution Center - OU2
80-100 Banks Avenue, Rockville Centre, NY

MAY - 2015

COMMUNITY AIR MONITORING PLAN
TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) has been prepared for the remedial activities to be performed under an Interim Remedial Action Work Plan (IRMWP) at the Foerm Darby Distribution Center - OUII area. The CAMP provides measures for protection for the downwind community (i.e., off-site receptors including residences, businesses, and on-site workers not directly involved in the remedial activities) from potential airborne contaminant releases resulting from remedial activities at the site.

Compliance with this CAMP is required during all activities associated with drilling and oxidant injection that have the potential to generate airborne particulate matter and volatile organic compounds (VOCs). These activities include drilling, injecting oxidants and sampling. This CAMP has been prepared to ensure that soil disturbance activities do not adversely affect passersby, residents, or workers in the area immediately surrounding the Site and to preclude or minimize airborne migration of related contaminants to offsite areas.

1.1 Regulatory Requirements

This CAMP was established in accordance with the following requirements:

- New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan as presented in DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC May 3, 2010). This guidance specifies that a community air-monitoring program shall be implemented to protect the surrounding community and to confirm that the work does not spread contamination off-site through the air.

2.0 AIR MONITORING

VOCs in air are the constituents of concern at the Site. The appropriate method to monitor air for these constituents during soil disturbance activities is through real-time VOC monitoring. Dust is not expected to be a concern as drilling will take place in native soils with a high moisture content. However, should visible dust be generated, the appropriate method for monitoring will be through real time particulate monitoring.

2.1 Meteorological Data

At a minimum, wind direction will be evaluated at the start of each workday, noon of each workday, and the end of each workday. These readings will be utilized to position the monitoring equipment in appropriate upwind and downwind locations.

2.2 Community Air Monitoring Requirements

To establish ambient air background concentrations, air will be monitored at several locations around the site perimeter before activities begin. These points will be monitored periodically in series during the site work. When the excavation area is within 20 feet of potentially exposed populations or occupied structures, the perimeter monitoring points will be located to represent the nearest potentially exposed individuals at the downwind location.

Fugitive respirable dust will be monitored using a MiniRam Model PDM-3 aerosol monitor (or equivalent). Air will be monitored for VOCs with a portable Ionscience 3000 photoionization detector (PID), minirae 2000, or equivalent. All air monitoring data will be documented in a site log book by the designated site safety officer. The site safety officer or delegate must ensure that air monitoring instruments are calibrated and maintained in accordance with manufacturer's specifications. All instruments will be zeroed daily and checked for accuracy. A daily log will be kept. If additional monitoring is required, the protocols will be developed and appended to this plan

3.0 VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

Volatile organic compounds (VOCs) will 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.

All readings will be recorded and made available for NYSDEC and NYSDOH personnel to review. If an exceedance of the Action Limits occurs, an Action Limit Report, as shown in Appendix A, will be completed.

3.1 Potential Corrective Measures and VOC Suppression Techniques

If the 15-minute integrated VOC level at the downwind location persists at a concentration that exceeds the upwind level by more than 5 ppm but less than 25 ppm during remediation activities, then vapor suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive organic vapors:

- Collection of purge water in covered containers;
- storage of excess sample and drill cuttings in drums or covering with plastic

4.0 PARTICULATE MONITORING

Air monitoring for particulates (i.e., dust) will not be performed unless drilling activities generate visible dust. If this occurs then monitoring will be performed continuously using both air monitoring equipment and visual observation at upwind and downwind locations. Monitoring equipment capable of measuring particulate matter smaller than 10 microns (PM_{10}) and capable of integrating (averaging) over periods of 15 minutes or less will be set up at upwind (i.e., background) and downwind locations, at heights approximately four to five feet above land surface (i.e., the breathing zone). Monitoring equipment will be MIE Data Ram monitors, or equivalent. The audible alarm on the particulate monitoring device will be set at 90 micrograms per cubic meter ($\mu g/m_3$). This setting will allow proactive evaluation of worksite conditions prior to reaching the action level of 100 $\mu g/m^3$ above background. The monitors will be calibrated at least once per day prior to work activities and recalibrated as needed thereafter. In addition, fugitive dust migration will be visually assessed during all intrusive work activities.

The following summarizes particulate action levels and the appropriate responses:

- If the downwind PM-10 particulate level is 150 $\mu g/m^3$ 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 100 $\mu g/m^3$ 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 100 $\mu g/m^3$ above the upwind level, work must be stopped and an evaluation of activities initiated. Work can resume provided that dust suppression measures (as described in Section 2.3.1 below) and other controls are successful in reducing the downwind PM-10 particulate concentration to within 100 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. If an exceedance of the Action Limits occurs, an Action Limit Report as shown in **Appendix A** will be completed.

4.1 Potential Particulate Suppression Techniques

If the integrated particulate level at the downwind location exceeds the upwind level by more than 100 $\mu g/m_3$ at any time during drilling activities, then dust suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive dusts:

- Placement of drill cuttings in drums or covering stockpiles with plastic;
- Misting of the drilling area with a fine water spray from a hand-held spray bottle

Work may continue with dust suppression techniques provided that downwind PM_{10} levels are not more than 150 $\mu g/m^3$ greater than the upwind levels.

There may also be situations where the dust is generated by drilling activities and migrates to downwind locations, but is not detected by the monitoring equipment at or above the action level. Therefore, if dust is observed leaving the working area, dust suppression techniques such as those listed above will be employed.

If dust suppression techniques do not lower particulates to below 150 $\mu g/m^3$, or visible dust persists, work will be suspended until appropriate corrective measures are identified and implemented to remedy the situation.

All air monitoring readings will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review.

5.0 DATA QUALITY ASSURANCE

5.1 Calibration

Instrument calibration shall be documented on instrument calibration and maintenance sheets or in the designated field logbook. All instruments shall be calibrated as required by the manufacturer. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

5.2 Operations

All instruments shall be operated in accordance with the manufacturer's specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on-site by the SSO for reference.

5.3 Data Review

The SSO will interpret all monitoring data based the established criteria and his/her professional judgment. The SSO shall review the data with the PM to evaluate the potential for worker exposure, upgrades/downgrades in level of protection, comparison to direct reading instrumentation and changes in the integrated monitoring strategy.

Monitoring and sampling data, along with all sample documentation will be periodically reviewed by the PM.

6.0 RECORDS AND REPORTING

All air readings must be recorded on daily air monitoring log sheets and made available for review by personnel from NYSDEC and NYSDOH.

APPENDIX A
ACTION LIMIT REPORT

CAMP
ACTION LIMIT REPORT

Project Location: _____

Date: _____ Time: _____

Name: _____

Contaminant: _____ PM-10: _____ VOC: _____

Wind Speed: _____ Wind Direction: _____

Temperature: _____ Barometric Pressure: _____

DOWNWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID#: _____ Location: _____ Level Reported: _____

UPWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID#: _____ Location: _____ Level Reported: _____

BACKGROUND CORRECTED LEVELS

Monitor ID #: Location: _____ Level Reported: Level Reported: _____

ACTIONS TAKEN

_____
_____
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_____
_____

ATTACHMENT C
Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN
Former Darby Drugs Distribution Center - OU2
80-100 Banks Avenue, Rockville Centre, NY

Prepared on behalf of:

DARBY GROUP COMPANIES
865 Merrick Avenue
Westbury, NY 11590

Prepared by:

EBC
ENVIRONMENTAL BUSINESS CONSULTANTS
1808 MIDDLE COUNTRY ROAD
RIDGE, NY 11961

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QUALITY ASSURANCE PROJECT PLAN

Former Darby Drugs Distribution Center - OU2
80-100 Banks Avenue, Rockville Centre, NY

TABLES

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared in accordance with DER-10 to detail procedures to be followed during the course of the sampling and analytical portion of the project, as required by the approved work plan.

To ensure the successful completion of the project each individual responsible for a given component of the project must be aware of the quality assurance objectives of his / her particular work and of the overall project. The EBC Project Director, Charles Sosik will be directly responsible to the client for the overall project conduct and quality assurance/quality control (QA/QC) for the project. The Project Director will be responsible for overseeing all technical and administrative aspects of the project and for directing QA/QC activities. Ms. Chawinie Miller will serve as the Quality Assurance Officer (QAO) and in this role may conduct:

- conduct periodic field and sampling audits;
- interface with the analytical laboratory to resolve problems; and
- interface with the data validator and/or the preparer of the DUSR to resolve problems.

Robert Bennett will serve as the Project Manager and will be responsible for implementation of the Workplan and coordination with field sampling crews and subcontractors. Reporting directly to the Project Manager will be the Field Operations Officer, Kevin Waters; who will serve as the on-Site environmental professional who will record observations, direct the drilling crew and be responsible for the collection and handling of all samples.

1.1 Organization

Project QA will be maintained under the direction of the Project Manager, in accordance with this QAPP. QC for specific tasks will be the responsibility of the individuals and organizations listed below, under the direction and coordination of the Project Manager

.

GENERAL RESPONSIBILITY	SCOPE OF WORK	RESPONSIBILITY OF QUALITY CONTROL
Field Operations	Supervision of Field Crew, sample collection and handling	K. Waters, EBC
Project Manager	Implementation of the RAWP.	Robert Bennett, EBC
Laboratory Analysis	Analysis of soil samples by NYSDEC ASP methods Laboratory	NYSDOH-Certified Laboratory
Data review	Review for completeness and compliance	3rd party validation

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2.0 QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

2.1 Overview

Overall project goals are defined through the development of Data Quality Objectives (DQOs), which are qualitative and quantitative Statements that specify the quality of the data required to support decisions; DQOs, as described in this section, are based on the end uses of the data as described in the work plan.

In this plan, Quality Assurance and Quality Control are defined as follows:

- Quality Assurance - The overall integrated program for assuring reliability of monitoring and measurement data.

- Quality Control - The routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process.

2.2 QA / QC Requirements for Analytical Laboratory

Samples will be analyzed by a New York State Department of Health (NYSDOH) certified laboratory, certified in the appropriate categories. Data generated from the laboratory will be used to evaluate contaminants such as metals and semi-volatile organic compounds (SVOCs) in both historic fills and hot-spot areas, chlorinated volatile organic compounds (VOCs) in soil, soil gas and groundwater and SVOCs in groundwater. The QA requirements for all subcontracted analytical laboratory work performed on this project are described below. QA elements to be evaluated include accuracy, precision, sensitivity, representativeness, and completeness. The data generated by the analytical laboratory for this project are required to be sensitive enough to achieve detection levels low enough to meet required quantification limits as specified in NYSDEC Analytical Services Protocol (NYSDEC ASP, 07/2005). The analytical results meeting the required quantification limits will provide data sensitive enough to meet the data quality objectives of this remedial program as described in the work plan. Reporting of the data must be clear, concise, and comprehensive. The QC elements that are important to this project are completeness of field data, sample custody, sample holding times, sample preservation, sample storage, instrument calibration and blank contamination.

2.2.1 Instrument Calibration

Calibration curves will be developed for each of the compounds to be analyzed. Standard concentrations and a blank will be used to produce the initial curves. The development of calibration curves and initial calibration response factors must be consistent with method requirements presented in NYSDEC ASP 07/2005.

2.2.2 Continuing Instrument Calibration

The initial calibration curve will be verified every 12 hrs by analyzing one calibration standard. The standard concentration will be the midpoint concentration of the initial calibration curve. The calibration check compound must come within 25% relative percent difference (RPD) of the average response factor obtained during initial calibration. If the RPD is greater than 25%, then corrective action must be taken as provided in the specific methodology.

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2.2.3 Method Blanks

Method blank or preparation blank is prepared from an analyte·free matrix which includes the same reagents, internal standards and surrogate standards as me related samples. II is carried through the entire sample preparation and analytical procedure. A method blank analysis will be performed once for each 12 hr period during the analysis of samples for volatiles. An acceptable method blank will contain less than two (2) times the CRQL of methylene chloride, acetone and 2-butanone. For all other target compounds, the method blank must contain less than or equal to the CRQL of any single target compound. For non-target peaks in the method blank, the peak area must be less than 10 percent of the nearest internal standard. The method blank will be used to demonstrate the level of laboratory background and reagent contamination that might result from the analytical process itself.

2.2.4 Trip Blanks.

Trip blanks consist of a single set of sample containers filled at the laboratory with deionized. laboratory-grade water. The water used will be from the same source as that used for the laboratory method blank. The containers will be carried into the field and handled and transported in the same way as the samples collected that day. Analysis of the trip blank for VOCs is used to identify contamination from the air, shipping containers, or from other items coming in contact with the sample bottles. (The bottles holding the trip blanks will be not opened during this procedure.) A complete set of trip blanks will be provided with each shipment of samples to the certified laboratory.

2.2.5 Surrogate Spike Analysis

For organic analyses, all samples and blanks will be spiked with surrogate compounds before purging or extraction in order to monitor preparation and analyses of samples. Surrogate spike recoveries shall fall within the advisory limits in accordance with the NYSDEC ASP protocols for samples falling within the quantification limits without dilution.

2.2.6 Matrix Spike / Matrix Spike Duplicate / Matrix Spike Blank (MS/MSDIMSB) Analysis

MS, MSD and MSB analyses will be performed to evaluate the matrix effect of the sample upon the analytical methodology along with the precision of the instrument by measuring recoveries. The MS / MSD / MSB samples will be analyzed for each group of samples of a similar matrix at a rate of one for every 20 field samples. The RPD will be calculated from the difference between the MS and MSD. Matrix spike blank analysis will be performed to indicate the appropriateness of the spiking solution(s) used for the MS/MSD.

2.3 Accuracy

Accuracy is defined as the nearness of a real or the mean (x) of a set of results to the true value. Accuracy is assessed by means of reference samples and percent recoveries. Accuracy includes both precision and recovery and is expressed as percent recovery (% REC). The MS sample is used to determine the percent recovery. The matrix spike percent recovery (% REC) is calculated by the following equation:

$$\%REC = \frac{SSR - SR}{SA} \times 100$$

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Where:

SSR = spike sample results
SR = sample results
SA = spike added from spiking mix

2.4 Precision

Precision is defined as the measurement of agreement of a set of replicate results among themselves without a Precision is defined as the measurement of agreement of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analyses.

Analytical precision is expressed in terms of RPD. The RPD is calculated using the following formula:

$$RPD = \frac{D^1 - D^2}{(D^1 + D^2)/2} \times 100$$

Where:
RPD = relative percent difference
D^1 = first sample value
D^2 = second sample value (duplicate)

2.5 Sensitivity

The sensitivity objectives for this plan require that data generated by the analytical laboratory achieve quantification levels low enough to meet the required detection limits specified by NYSDEC ASP and to meet all site-specific standards, criteria and guidance values (SGCs) established for this project.

2.6 Representativeness

Representativeness is a measure of the relationship of an individual sample taken from a particular site to the remainder of that site and the relationship of a small aliquot of the sample (i.e., the one used in the actual analysis) to the sample remaining on site. The representativeness of samples is assured by adherence to sampling procedures described in the Remedial Investigation Work Plan.

2.7 Completeness

Completeness is a measure of the quantity of data obtained from a measurement system as compared to the amount of data expected from the measurement system. Completeness is defined as the percentage of all results that are not affected by failing QC qualifiers, and should be between 70 and 100% of all analyses performed. The objective of completeness in laboratory reporting is to provide a thorough data support package. The laboratory data package provides documentation of sample analysis and results in the form of summaries, QC data, and raw analytical data. The laboratory will be required to submit data packages that follow NYSDEC ASP reporting format which, at a minimum, will include the following components:

1. All sample chain-of-custody forms.
2. The case narrative(s) presenting a discussion of any problems and/or procedural changes required during analyses. Also presented in the case narrative are sample summary forms.
3. Documentation demonstrating the laboratory's ability to attain the contract specified detection limits for all target analytes in all required matrices.

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4. Tabulated target compound results and tentatively identified compounds.
5. Surrogate spike analysis results (organics).
6. Matrix spike/matrix spike duplicate/matrix spike blank results.
7. QC check sample and standard recovery results
8. Blank results (field, trip, and method).
9. Internal standard area and RT summary.

2.8 Laboratory Custody Procedures

The following elements are important for maintaining the field custody of samples:

- Sample identification
- Sample labels
- Custody records
- Shipping records
- Packaging procedures

Sample labels will be attached to all sampling bottles before field activities begin; each label will contain an identifying number. Each number will have a suffix that identifies the site and where the sample was taken. Approximate sampling locations will be marked on a map with a description of the sample location. The number, type of sample, and sample identification will be entered into the field logbook. A chain-of-custody form, initiated at the analytical laboratory will accompany the sample bottles from the laboratory into the field. Upon receipt of the bottles and cooler, the sampler will sign and date the first received blank space. After each sample is collected and appropriately identified, entries will be made on the chain-of-custody form that will include:

- Site name and address
- Samplers' names and signatures

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3.0 ANALYTICAL PROCEDURES

3.1 Laboratory Analysis

Samples will be analyzed by the NYSDEC ASP laboratory for one or more of the following parameters: VOCs in groundwater by USEPA Method 8260C. If any modifications or additions to the standard procedures are anticipated. and if any nonstandard sample preparation or analytical protocol is to be used, the modifications and the nonstandard protocol will be explicitly defined and documented. Prior approval by EBC's PM will be necessary for any nonstandard analytical or sample preparation protocol used by the laboratory, i.e., dilution of samples or extracts by greater than a factor of five (5).

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4.0 DATA REDUCTION, REVIEW, AND REPORTING

4.1 Overview

The process of data reduction, review, and reporting ensures the assessments or a conclusion based on the final data accurately reflects actual site conditions. This plan presents the specific procedures, methods, and format that will be employed for data reduction, review and reporting of each measurement parameter determined in the laboratory and field. Also described in this section is the process by which all data, reports, and work plans are proofed and checked for technical and numerical errors prior to final submission.

4.2 Data Reduction

Standard methods and references will be used as guidelines for data handling, reduction, validation, and reporting. All data for the project will be compiled and summarized with an independent verification at each step in the process to prevent transcription/typographical errors. Any computerized entry of data will also undergo verification review.

Sample analysis will be provided by a New York State certified environmental laboratory. Laboratory reports will include ASP category B deliverables for use in the preparation of a data usability summary report (DUSR). All results will be provided in accordance with the NYSDEC Environmental Information Management System (EIMS) electronic data deliverable (EDD) format. Analytical results shall be presented on standard NYSDEC ASP-B forms or equivalents, and include the dates the samples were received and analyzed, and the actual methodology used. Note that waste characterization samples (if collected) will be in results only format and will not be evaluated in the DUSR.

Laboratory QA/QC information required by the method protocols will be compiled, including the application of data QA/QC qualifiers as appropriate. In addition, laboratory worksheets, laboratory notebooks, chains-of-custody, instrument logs, standards records, calibration records, and maintenance records, as applicable, will be provided in the laboratory data packages to determine the validity of data. Specifics on internal laboratory data reduction protocols are identified in the laboratory's SOPs.

Following receipt of the laboratory analytical results by EBC, the data results will be compiled and presented in an appropriate tabular form. Where appropriate, the impacts of QA/QC qualifiers resulting from laboratory or external validation reviews will be assessed in terms of data usability.

4.3 Laboratory Data Reporting

All sample data packages submitted by the analytical laboratory will be required to be reported in conformance to the NYSDEC ASP (7/2005), Category B data deliverable requirements as applicable to the method utilized. All results will be provided in accordance with the NYSDEC Environmental Information Management System (EIMS) electronic data deliverable (EDD) format. Note that waste characterization samples will be in results only format and will not be evaluated in the DUSR.

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5.0 CORRECTIVE ACTION

Review and implementation of systems and procedures may result in recommendations for corrective action. Any deviations from the specified procedures within approved project plans due to unexpected site-specific conditions shall warrant corrective action. All errors, deficiencies, or other problems shall be brought to the immediate attention of the EBC PM, who in turn shall contact the Quality Assurance/Data Quality Manager or his designee (if applicable).

Procedures have been established to ensure that conditions adverse to data quality are promptly investigated, evaluated and corrected. These procedures for review and implementation of a change are as follows:

- Define the problem.
- Investigate the cause of the problem.
- Develop a corrective action to eliminate the problem, in consultation with the personnel who defined the problem and who will implement the change.
- Complete the required form describing the change and its rationale (see below for form requirements).
- Obtain all required written approvals.
- Implement the corrective action.
- Verify that the change has eliminated the problem.

During the field investigation, all changes to the sampling program will be documented in field logs/sheets and the EBC PM advised.

If any problems occur with the laboratory or analyses, the laboratory must immediately notify the PM, who will consult with other project staff. All approved corrective actions shall be controlled and documented.

All corrective action documentation shall include an explanation of the problem and a proposed solution which will be maintained in the project file or associated logs. Each report must be approved by the necessary personnel (e.g., the PM) before implementation of the change occurs. The PM shall be responsible for controlling, tracking, implementing and distributing identified changes.

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TABLE 1
SUMMARY OF
SAMPLING PROGRAM RATIONALE AND ANALYSIS

Matrix	Location	Approximate Number of Samples	Frequency	Rationale for Sampling	Laboratory Analysis	Duplicates	Matrix Spikes	Spike Duplicates	Trip Blanks
Groundwater	MW2, MW11, MW12	3	1x per month	Performance monitoring	VOCs EPA8260C	1 per day	1 per 20 samples	1 per 20 samples	1 per trip

TABLE 2
SAMPLE COLLECTION AND ANALYSIS PROTOCOLS

Sample Type	Matrix	Sampling Device	Parameter	Sample Container	Sample Preservation	Analytical Method#	CRQL / MDLH	Holding Time
Groundwater	Liquid	Peristaltic pump	VOCs	(3) 40ml VOA	Cool to 4^{o} C	EPA Method 8260C	Compound specific (1-5 ug/kg)	14 days*

Notes:
All holding times listed are from Verified Time of Sample Receipt (VTSR) unless noted otherwise. * Holding time listed is from time of sample collection.
The number in parentheses in the "Sample Container" column denotes the number of containers needed.
Triple volume required when collected MS/MSD samples
The number of trip blanks are estimated.
CRQL / MDL = Contract Required Quantitation Limit / Method Detection Limit.
MCAWW = Methods for Chemical Analysis of Water and Wastes.
NA = Not available or not applicable.
* = all collection and holding times will be as be the ASP

ATTACHMENT D
Oxidant Calculations and Information

ZONE 1
OXIDANT CALCULATIONS

Parameters	Units	Estimates
*** Site Description ***		
Length	Ft.	37
Width	Ft.	50
Area	Sq. Ft.	1850
Thickness	Ft.	6
Total Volume	Cu. Yd.	411
Porosity	%	30
Plume Total Pore Volume	Gal.	1
Avg. Contaminant Conc.	ppm	5.9
Mass of Contaminant	lb.	0.000049914
NOD	g/kg	1.41
Effective NOD %	10	0.141
NOD	lb/yd3	0.629800893
NOD Oxidant Demand	lb	258.92
Avg. Stoichiometric Demand	lb/lb	2.4
Contaminant Oxidant Demand	lb.	0.000119794
Theoritical Oxidant Demand	lb.	258.92
SWAG Factor	*???*	2
Calculated Oxidant Demand		517.84
*** Injection Design ***		
Radius of Influence	Ft.	5.00
Number of Injection Points		4
Injection Concentration	% wt/wt	12.00%
Flow Rate - Per Injection Point	GPM	1.00
Number of Wells per Phase		4
Total Injection Flow Rate	GPM	10.00
Estimated Injection Pressure	PSIG	10.00
Injection Volume/Hole	Gal	120.19
*** Injection Schedule ***		
Hours per Day	Hrs	8.00
Days Per Week	Days	5.00
Number of Inj. Days	Days	0.10
Number of Inj. Weeks	Weeks	0.02

40% NaMnO4 Injection Options

Pounds of 40% NaMnO4 Solution	Gallons of 40% Solution	Number of Pails	Number of Drums	Number of Totes	Price per Lb of Solution	
1,139	99.93	19.99	2.08	0.45	$ 3.75	$

Total Gallons of Dillution Water Required	Dillution Water Flow Rate - GPM	NaMnO4 40% Solution Flow Rate - GPM		Dillution Water Gals per Pail	Dillution Water Gals per Drum	
380.82	7.92	2.08	OR	19.05	182.92	

Dry KMnO4 Injection Options

Pounds of KMnO4 (Dry Crystals)		Number of Pails	Number of Drums	Number of Totes	Price per Lb (Dry)	
518		9.42	1.57	0.16		$

Total Gallons of Dillution Water Required	Dillution Water Flow Rate - GPM		Dillution Water Gals per Pail	Dillution Water Gals per Drum	
455.33	10.00	OR	48.36	290.17	

CARUS REMEDIATION



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

RemOx® L ISCO Reagent

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 including chlorinated solvents, polyaromatic hydrocarbons, phenolics, organo-pesticides, and substituted aromatics. RemOx L is shipped with a certificate of analysis to document assay, pH, and trace metals.

PRODUCT SPECIFICATIONS

Assay
39.5-41.0% as $NaMnO_4$

pH
5.0-8.0

Trace Metals
(see Table 1)

CHEMICAL/PHYSICAL DATA

Formula	$NaMnO_4$
Formula Weight	141.93 g/mol
Appearance	Dark Purple Solution
Specific Gravity	1.365-1.385 g/mL
Freezing Point	-15° C/ 5° F
Solubility in Water	Miscible with water in all proportions.

Material will pass through a 10 micron filter.

APPLICATIONS

RemOx L is used for soil and groundwater remediation by *in situ* or *ex situ* chemical oxidation and as an active agent in subsurface reactive barriers for treatment of: chlorinated ethenes, phenolic compounds, polyaromatic hydrocarbons, RDX, HMX, and various pesticides.

SHIPPING CONTAINERS

5-gallon pail (20-L) (UN Specification: UN3H1/Y1.8/100) Made of high-density polyethylene (HDPE), weighs 3.5 lbs (1.6 kg). The net weight is 57 lbs (25.9 kg). The pail stands approximately 14.8 in (37.6 cm) tall, 10.6 in (26.9 cm) wide, and 11.0 in (27.9 cm) deep. (Domestic and international)

55-gallon drum (208-L) (UN Specification: UN1H1/Y1.41100) Made of high-density polyethylene (HDPE), weighs 22 lbs (10 kg). The net weight is 550 lbs (250 kg). The drum stands approximately 34.8 in (88.3 cm) tall, has an outside diameter of 23.3 in (59.1 cm). (Domestic and international)

SHIPPING CONTAINERS

275-gallon IBC (Intermediate Bulk Container) (1040-L) (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 lbs (1360 kg). The IBC contains 263 gallons (1000 L) of product. The IBC dimensions are 45.4 in (115.3 cm) high, 48 in (121.9 cm) long, and 40 in (101.6 cm) wide. The IBC has a 2 in (5 cm) butterfly valve with NPT threads in bottom sump. (Domestic)

275-gallon IBC (Intermediate Bulk Container) (1040-L) (UN Specification: UN31HA1/Y1.9/100) They are also marked "MX" for multi-trip. IBC weighs 132.5 lbs (60 kg). The net weight is 3000 lbs (1360 kg). The IBC contains 263 gallons (1000 L) of product. The IBC dimensions are 45.8 in (116.2 cm) high, 39.4 in (100.0 cm) long, and 47.3 in (120.0 cm) wide. The IBC has a 2 in (5 cm) butterfly valve with NPT threads in bottom sump. (International)

Bulk Shipping- Quantities up to 4000-gallons (15,142-L) are available. (Domestic only)

HANDLING, STORAGE, AND INCOMPATIBILITY

Like any strong oxidizer RemOx L should be handled with care. Protective equipment during handling should include face shields and/or goggles, rubber or plastic gloves, 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.

Store in accordance with NFPA 30 requirements in the United States or the European Fire Protection Association in Europe for Class II oxidizers. Additional regulations in Europe are REACH (Regulation for Registration, Evaluation, Authorisation and Restriction of Chemicals), and CLP (Classification, Labeling, Packaging). REACH is a regulation that increases the responsibility of the industry to manage the risks that the chemical may pose. For REACH registration numbers refer to the eSDS. The product should be stored in a cool, dry area in closed containers. Concrete floors are preferred. Check local regulations to ensure proper storage. Avoid wooden decks. Spillage should be collected and disposed of properly. To clean up spills and leaks follow the steps recommended in our MSDS or eSDS.

Avoid contact with acids, peroxides, and all combustible organic or readily oxidizable materials including inorganic oxidizable materials and metal powders. With hydrochloric acid, chlorine gas is liberated. RemOx L is not combustible, but will support combustion. It may decompose if exposed to intense heat. Fires may be controlled and extinguished by using large quantities of water. Refer to the MSDS or eSDS for more information.

CARUS CORPORATION ONE COMPANY, ENDLESS SOLUTIONS

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CARUS REMEDIATION



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

RemOx® L ISCO Reagent

FACT SHEET

RemOx® L ISCO reagent is classified as an oxidizer for both domestic and international transportation. Liquid permanganate is shipped domestically as Freight Class 70 and in E.U. as Class 5.1.

Proper Shipping Name: Permanganates, inorganic, aqueous solution n.o.s. (contains sodium permanganate).

Hazard Class: Oxidizer, Class 5.1
Identification Number: UN 3214
Division/APR/RID Class: 5.1
Label Requirements: Oxidizer, 5.1
Packaging Group: II
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, (IMDG Regulation):

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.

H.S. Code 28.41.69.00

SHIPPING CONTAINERS

RemOx L 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 be compatible with any kind of acid or alkali being used.

In neutral and alkaline solutions, RemOx L 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, and HDPE are also compatible with liquid permanganate.

Aluminum, zinc, copper, lead, and alloys containing these metals may be (slightly) affected by RemOx L. Actual corrosion or compatibility studies should be made under the conditions in which RemOx L will be used.

Table 1: Typical Trace Metal Content and Specifications

Element	Typical Analysis (mg/kg)	Specifications (mg/kg)	DL* (mg/kg)	Element	Typical Analysis (mg/kg)	Specifications (mg/kg)	DL* (mg/kg)
Ag	BDL	0.15	0.034	Fe	BDL	2.00	0.053
Al	BDL	2.00	0.24	Hg	BDL	0.03	0.003
As	BDL	4.00	0.006	Ni	BDL	0.1	0.03
Ba	2.96	15.00	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	0.0034	0.50	0.0003
Cr	3.2	5.00	0.031	Tl	BDL	3.50	0.80
Cu	BDL	0.10	0.022	Zn	0.034	0.40	0.011

DL* is detection limit
BDL is below detection limit

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