



1430 Broadway
10th Floor
New York, NY 10018

212.221.7822 PHONE
212.221.7840 FAX

www.TRCSolutions.com

March 9, 2018

Nigel N. Crawford, P.E.
Environmental Engineer 2
Region 2
New York State Department of Environmental Conservation
47-40 21st Street
Long Island City, NY 11101

**Re: Brownfield Cleanup Program Interim Remedial Measures Work Plan
650 Waring Avenue, Bronx, New York 10467
Block 4341, Lot 13
NYSDEC Site No. 203068
TRC Project No. 297653.0000.0000**

Dear Mr. Crawford:

On behalf of the New York City School Construction Authority (NYCSCA), TRC Engineers, Inc. (TRC) has prepared this Brownfield Cleanup Program (BCP) Interim Remedial Measures (IRM) Work Plan. The Work Plan describes the remedial work planned at the site of Public School (P.S.) 96X, located at 650 Waring Avenue, Bronx, New York 10467 (the "Site"). The Work Plan will be implemented under the BCP. *Figure 1* presents the Site Location Map.

Site Description and Background

The Site is an approximately 79,000-square foot lot improved with a four-story public school building with a basement and an asphalt-paved play yard. The original four-story main school building, P.S. 96X, was constructed in 1929. The first of 11 temporary classroom units (TCUs) was constructed in the southern portion of the Site in 2001. The TCUs were later demolished as part of the construction of a four-story Addition to P.S. 96X, which was completed in September 2015. The Addition is located south and east of the original school building. The remainder of the Site is the fenced-in play yard.

Due diligence investigations performed in support of construction of the Addition to P.S. 96X revealed the presence of chlorinated volatile organic compound (CVOC)-impacted groundwater and soil vapor at the Site. NYCSCA provided the data collected during due diligence investigations to NYSDEC, which led to the signing of an Order on Consent (Index No. R2-0801-13-01) and subsequent implementation of an IRM. The IRM consisted of injection of sodium lactate in the footprint of the proposed Addition prior to the start of related construction activities. Additionally, groundwater samples were collected prior to and following the sodium lactate injection for the purpose of documenting groundwater conditions and the results of the injection. The results of post-injection groundwater samples showed a decrease in concentrations of CVOC parent compounds and an increase in concentrations of CVOC daughter compounds, indicating that the injection was effective at dechlorinating CVOCs.

The results of Phase I of the IRM were documented in the Phase I Construction Completion Report (CCR), which was submitted to NYSDEC in September 2015 along with a Site Management Plan (SMP). The Phase I CCR and SMP were approved by NYSDEC prior to school opening on September 8, 2015.

An IRM Work Plan – Phase II, dated September 2015, Revised August 2016, was approved by NYSDEC in a letter dated December 7, 2016. Portions of the IRM Work Plan – Phase II were implemented at the Site and south-adjacent properties (2260 Barker Avenue and 2275 Olinville Avenue) between February 2016 and January 2017. Additionally, a Supplemental Investigation (SI) was completed in September and October 2017 to further evaluate whether the CVOCs in groundwater at the Site and south-adjacent property are attributable to an off-Site source. After implementation of the SI, NYSDEC directed NYSCA to apply for enrollment of the Site into the BCP, and informed NYSCA that subsequent investigation and remedial activities at the Site should be performed under the BCP. NYSCA has submitted an application for entry into the BCP as a Participant.

The outstanding tasks that were part of the Interim Remedial Measure (IRM) Work Plan – Phase II have been reviewed and modified, as necessary, based on the results of the Supplemental Investigation performed in September and October 2017. Modifications to the scope of the IRM are presented in this BCP IRM Work Plan, which will supersede the previously-approved IRM Work Plan – Phase II.

BCP IRM Work Plan Scope of Work

The activities described in this Work Plan will be performed in accordance with applicable Federal, State, and local regulations, and the Quality Assurance Project Plan (QAPP) and site-specific Health and Safety Plan (HASP), presented as *Attachment 1* and *2*, respectively.

The BCP IRM scope includes the following:

1. The collection and laboratory analysis of pre-injection groundwater samples from the targeted treatment zone wells (PS96X-TRC-MW-10R, -15R, -17, and -18) and off-Site downgradient monitoring well PS96X-TRC-MW-19, to document baseline conditions prior to the IRM Phase II injection event.
2. Injection of sodium lactate into monitoring wells PS96X-TRC-MW-15R, PS96X-TRC-MW-17, and PS96X-TRC-MW-18 to treat elevated concentrations of CVOCs in groundwater. Refer to *Attachment 3* for the sodium lactate dosage calculations.
3. Monitoring of water chemistry parameters (i.e., dissolved oxygen, specific conductivity, temperature, pH, and oxidation reduction potential) in monitoring wells PS96X-TRC-MW-10R, -15R, -17, -18 and -19 every other week for a period of three to four months following the injection.
4. Collection and laboratory analysis of groundwater samples from the monitoring wells in the targeted treatment zone (PS96X-TRC-MW-10R, -15R, -17, and -18) and the off-site groundwater monitoring well (PS96X-TRC-MW-19) approximately three to four months following the injection.

Refer to *Figure 2* for a Site Plan showing monitoring well locations.



Task 1 – Pre-Injection Groundwater Sampling

Pre-injection groundwater samples will be collected from monitoring wells PS96X-TRC-MW-10R, -15R, -17, -18, and -19. The groundwater samples will be analyzed for Target Compound List (TCL) VOCs and the following monitored natural attenuation parameters: sulfate, chloride, total organic carbon, volatile fatty acids, and soluble iron (MNA parameters). Groundwater sampling procedures, analytical methods, and QA/QC requirements are presented in the QAPP (refer to *Attachment 1*). Following receipt of NYSDEC ASP Category B data deliverables, a Data Usability Summary Report (DUSR) will be prepared, which will include an evaluation of the quality of the analytical data and the reliability of the data for its intended use.

Task 2 – In-Situ Injection of Sodium Lactate

Sodium lactate will be injected into monitoring wells PS96X-TRC-MW-15R, -17, and -18 to reduce CVOC concentrations in groundwater in the central area of the Site and near the southern Site boundary. In accordance with Underground Injection Control (UIC) Program Regulations (40 CFR Part 144), prior to injection, TRC will obtain authorization from Region 2 of the United States Environmental Protection Agency (USEPA) to perform the proposed injection.

Sodium lactate was selected as the appropriate substrate source for the bedrock formation based on its high solubility and documented success rate as an effective substrate source for de-chlorinating microbial populations. Sodium lactate is an anaerobic reductive de-chlorination agent. Microbes use the lactate to create dissolved hydrogen and then the hydrogen acts as an electron donor to de-chlorinate the CVOCs, ultimately to ethene, by cleaving off chlorine atoms. There is evidence of reductive de-chlorination in the potential source area and downgradient wells (i.e., the presence of tetrachloroethene [PCE] degradation byproducts trichloroethene [TCE], cis-1,2-dichloroethene, and vinyl chloride). In addition, the ratio of degradation byproducts to PCE increases in the downgradient groundwater, another indication that intrinsic microbial de-chlorination is naturally degrading the CVOCs in groundwater.

A dilute solution of sodium lactate and Hydrogen Release Compound (HRC) in water will be injected into monitoring wells PS96X-TRC-MW-15R, PS96X-TRC-MW-17, and PS96X-TRC-MW-18. The substrate will be injected into these three monitoring wells simultaneously through a common manifold. The in-situ injection will be performed by TRC technicians and the activities (i.e., dilution procedures, injection times, etc.) will be documented in field books and with photographs. Based on the volume of the proposed amendment (approximately 1,000 gallons) and the estimated porosity of the bedrock (1.1%), the injection will take approximately 6 days. The dosage calculations and related information are presented in *Attachment 3*.

Monitoring of dissolved oxygen, specific conductivity, temperature, pH, and oxidation reduction potential will be performed in wells PS96X-TRC-MW-10R, -15R, -17, -18, and -19 immediately prior to the sodium lactate injection to establish baseline conditions. Downgradient monitoring will continue during injection in wells PS96X-TRC-MW-10R and -19).

Task 3 – Post-Injection Monitoring and Groundwater Sampling

Following sodium lactate injection, measurement of dissolved oxygen, specific conductivity, temperature, pH, and oxidation reduction potential will be performed once every other week in wells PS96X-TRC-MW-10R, -15R, -17, -18, and -19 to document changes in water chemistry. This monitoring will be performed for a period of three to four months. Additionally, monitoring wells PS96X-TRC-MW-10R,



-15R, -17, -18 and -19 will be sampled three to four months after completion of the in-situ injection event (depending on the water chemistry trends) to determine post-injection groundwater quality. Post-injection groundwater samples will be analyzed for TCL VOCs and MNA parameters. Groundwater sampling procedures, analytical methods, and QA/QC requirements are presented in the QAPP (refer to *Attachment I*). Following receipt of NYSDEC ASP Category B data deliverables, a DUSR will be prepared, which will include an evaluation of the quality of the analytical data and the reliability of the data for its intended use.

Reporting

The results of investigations and the IRMs will be presented in a Remedial Action Work Plan (RAWP) in accordance with the requirements of DER-10, and submitted within 30 days of receipt of validated laboratory data. It is expected that no further action will be recommended in the RAWP following the injection.

Schedule

Following the 30-day public comment period and approval from NYSDEC to proceed, TRC will arrange for the pre-injection groundwater sampling to be conducted immediately, pending Site access. TRC will also endeavor to obtain authorization from USEPA to proceed with the injection. Field activities will be performed outside of school operating hours.

The following table summarizes the anticipated schedule based on unrestricted access to the Site.

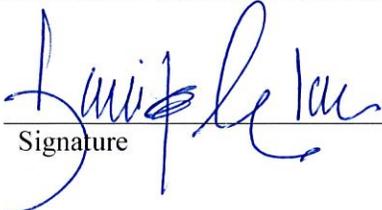
Task	Anticipated Time of Completion After Receipt of Approval from NYSDEC
Pre-Injection Groundwater Sampling	2 Weeks
In-Situ Injection of Sodium Lactate	5 Weeks
Post-Injection Monitoring and Groundwater Sampling	17 to 21 Weeks
Receipt of Validated Post-Injection Groundwater Data	21 to 25 Weeks
Reporting	25 to 29 Weeks

Certification

I, David S. Glass, certify that I am currently a New York State registered professional engineer and that this Brownfield Cleanup Program Interim Remedial Measures Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

068884-1

NYS Professional Engineer #



Signature

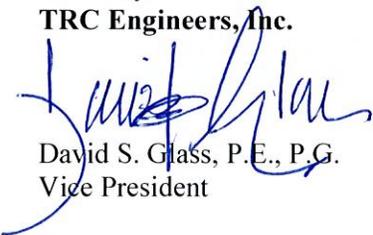
3/9/2018

Date



Please contact me at (212) 221-7822 with any questions or comments.

Sincerely,
TRC Engineers, Inc.


David S. Glass, P.E., P.G.
Vice President

cc: L. Guterman, S. Kanaparthi, M. Wagner – NYCSCA
J. O’Connell – NYSDEC
J. Raup – TRC

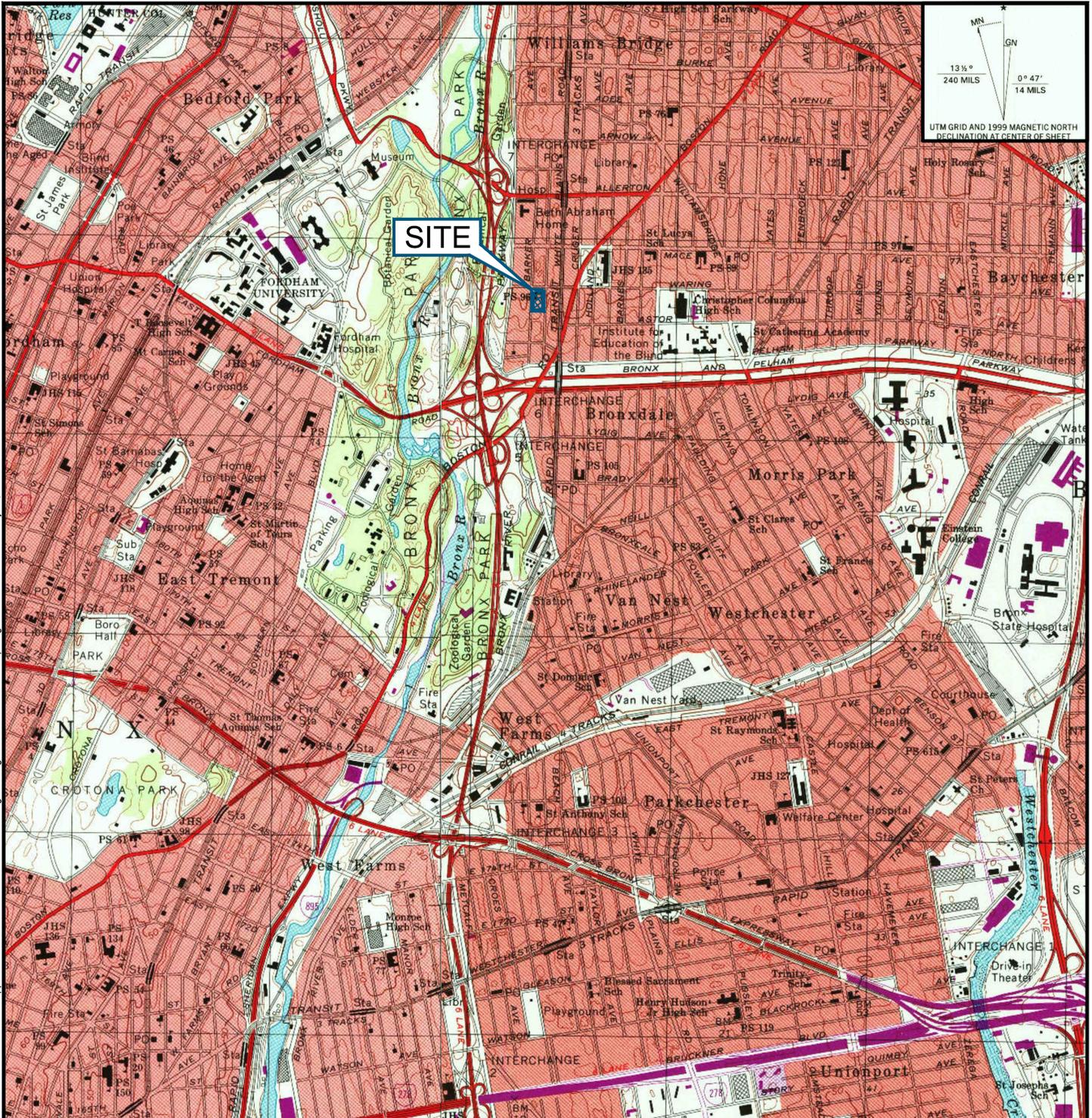
Attachments:

Figure 1 – Site Location Map
Figure 2 – Site Plan

Attachment 1 – Quality Assurance Project Plan
Attachment 2 – Health and Safety Plan
Attachment 3 – Dosage Calculations and Related Information

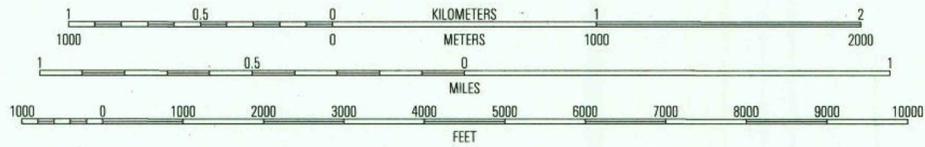
FIGURES

DRAWING NAME: \\INTAPLAN-NY\Projects\NYSCSA Contract C000014346\397653 - X096 BCP\BCP Application\Work Plan for IRW Under BCP\Figures\ Figure 1 - Site Location Map.dwg — PLOT DATE: February 26, 2018 - 1:20PM — LAYOUT: 8.5x11



UTM GRID AND 1999 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
 13 1/2° 240 MILS
 0° 47' 14 MILS

SCALE: 1:2400



NEW YORK
 QUADRANGLE LOCATION
 MAP INCLUDES INFORMATION FROM THE FOLLOWING MAP SHEET(S):
 TP, FLUSHING, NY, 7.5 MINUTE, DATED 1995
 W, CENTRAL PARK, NY, 7.5 MINUTE, DATED 1995
 MAP OBTAINED THROUGH USE OF MAPTECH TERRAIN NAVIGATOR PRO SOFTWARE.

TRC
 1430 Broadway
 10th Floor
 New York, NY 10018
 Phone: 212.221.7822

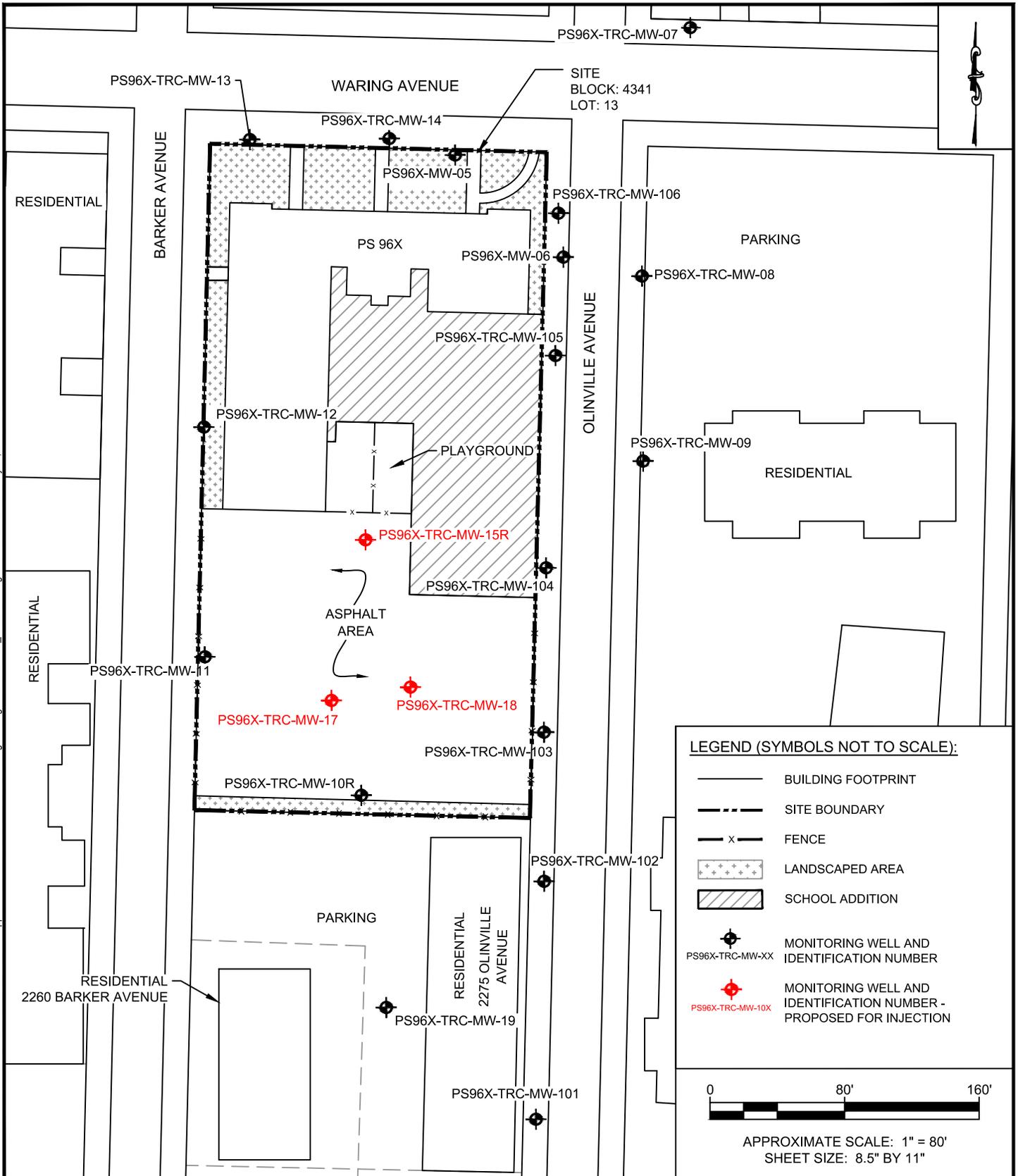
PROJECT:
NEW YORK CITY SCHOOL CONSTRUCTION AUTHORITY
650 WARING AVENUE - BLOCK: 4341, LOT: 13
BRONX, NEW YORK 10467

TITLE:
SITE LOCATION MAP

DRAWN BY: H. DELGADO
 CHECKED BY: J. RAUP
 APPROVED BY: D. GLASS
 DATE: MARCH 2018
 PROJ. NO.: 297653
 FILE: Figure 1 - Site Location Map.dwg

FIGURE IV-2

DRAWING NAME: \\INTAP\A-NY\Projects\NYOSCA Contract C000014345\297653 - X096 BCP\BCP Application\Work Plan for IRM Under BCP\Figures\ Figure 2 - Site Plan_2.16.2018.dwg -- PLOT DATE: February 26, 2018 - 1:22PM -- LAYOUT: 8.5X11P



1430 Broadway
10th Floor
New York, NY 10018
Phone: 212.221.7822

PROJECT:
NEW YORK CITY SCHOOL CONSTRUCTION AUTHORITY
650 WARING AVENUE
BRONX, NEW YORK 10467

TITLE:
SITE PLAN

DRAWN BY:	H. DELGADO
CHECKED BY:	J. RAUP
APPROVED BY:	D. GLASS
DATE:	MARCH 2018
PROJ. NO.:	297653.0000.0000
FILE:	Figure 2 - Site Plan_2.16.2018.dwg

FIGURE 2

ATTACHMENT 1
QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

APPENDIX C - QUALITY ASSURANCE PROJECT PLAN

This Section presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the field activities described in the scope of work. The Section also describes specific protocols for field sampling, sampling handling and storage, and laboratory analysis. The data generated from the analysis of samples will be used to document post-IRM groundwater conditions.

Project Organization and Responsibility

A qualified person will coordinate and manage the sampling and analysis program, data reduction, QA/QC, data validation, analysis, and reporting. TRC will direct the sampling activities and coordinate laboratory activities. The TRC Project QA Officer will be Elizabeth Denly and will report directly to the project manager, Jenna Raup (refer to Appendix D for resumes).

A qualified person will ensure that the QAPP is implemented and will oversee data validation. A qualified person will provide oversight and technical support for the sampling and analytical procedures followed in this project. This individual has the broad authority to approve or disapprove project plans, specific analyses, and final reports. The Project QA Officer is independent from the data generation activities. In general, the QA officer will be responsible for reviewing and advising on all QA/QC aspects of this program.

Laboratories used will be NYSDOH ELAP certified laboratories. The laboratories will communicate directly with the sampler regarding the analytical results and reporting and will be responsible for providing all labels, sample containers, trip blanks, shipping coolers, and laboratory documentation.

QA Objectives for Data Management

The analytical data will be provided by the laboratory using the New York State ASP Category B deliverable format.

All analytical measurements will be made so that the results are representative of the media sampled and the conditions measured. Data will be reported in consistent $\mu\text{g/L}$ or mg/L for aqueous samples. Table 1 presents the proposed samples, sampling and analytical parameters, analytical methods, sample preservation requirements, containers and QA/QC samples.

Quantitation Limits (QLs) are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. Data Quality Levels (DQLs) are those reporting limits required to meet the objectives of the program (i.e., program action levels, cleanup standards, etc.). Data Quality Objectives (DQOs) define the quality of data and documentation required to support decisions made in the various phases of the data collection activities. The DQOs are dependent on the end uses of the data to be collected and are also expressed in terms of objectives for precision, accuracy, representativeness, completeness, and comparability.

The analytical methods to be used at this site provide the highest level of data quality and can be used for purposes of risk assessment, evaluation of remedial alternatives and verification that cleanup standards have been met. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy and precision.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs.

For quantitation limits for parameters associated with groundwater samples, the laboratory will be required to attempt to meet or surpass the parameter-specific limits for groundwater from the Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values.

The QA objectives are defined as follows:

- **Accuracy** is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.

Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements, and through the collection of equipment blanks prior to the collection of samples for each type of equipment being.

The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of “standards,” materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds. Table 2 summarizes the laboratory accuracy requirements.

- **Precision** is the agreement among a set of replicate measurements without consideration of the “true” or accurate value: i.e., variability between measurements of the same material for the same analyte. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation.

Precision in the field is assessed through the collection and measurement of field duplicates (one extra sample in addition to the original field sample). Field duplicates will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter. Precision will be measured through the calculation of relative percent differences (RPDs). The resulting information will be used to assess sampling and analytical variability. Field duplicate RPDs must be ≤ 30 for aqueous samples. These criteria apply only if the sample and/or duplicate results are $>5x$ the quantitation limit; if both results are $\leq 5x$ the quantitation limit, the criterion will be doubled. Due to the uncertainty of available representative soil gas volume, field duplicates will not be collected for this matrix.

Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For organic groundwater analyses, laboratory precision will be assessed through the analysis of field duplicates.

- **Completeness** is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. “Normal conditions” are defined as the conditions expected if the sampling plan was implemented as planned.

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project and (2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

- **Representativeness** is a qualitative parameter that expresses the degree to which data accurately and precisely represents either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data. In addition, field duplicate samples will provide an additional measure of representativeness at a given location.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plan are followed and that proper sampling, sample handling, and sample preservation techniques are used.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample holding times.

- **Comparability** expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plan are followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

Comparability is dependent on the use of recognized EPA or equivalent analytical methods and the reporting of data in standardized units. Laboratory procedures are consistent with those used for previous sampling efforts.

Table 1
Analytical Parameters, Methods, Preservation, Holding Time and Container Requirements

Sample Matrix	Analytical Parameter	Sample Type	No. of Samples ¹	No. of QA/QC Samples	EPA Analytical Method	Sample Preservation	Holding Time ¹	Sample Container ³
Groundwater	VOCs	Grab	5	Trip Blank ² : as necessary Equipment Blank: 1/20 Duplicate: 1/20	SW-846 Method 8260C	pH<2 with HCl; Cool to 4 ⁰ C; no headspace	14 days to analysis	(3) 40 mL VOA vials
Groundwater	Sulfate and Chloride	Grab	5	Equipment Blank: 1/20 Duplicate: 1/20	300.0 Rev 2.1	Cool to 4 ⁰ C	28 days to analysis	(1) 250 mL poly container
Groundwater	Total Organic Carbon	Grab	5	Equipment Blank: 1/20 Duplicate: 1/20	415.2	pH<2 with HCl; Cool to 4 ⁰ C	28 days to analysis	(1) 60 mL glass
Groundwater	Volatile Fatty Acids	Grab	5	Equipment Blank: 1/20 Duplicate: 1/20	DIONEX APP NOTE 291	Cool, 4°C	14 days to analysis	(2) 40 mL VOA vials
Groundwater	Soluble Iron	Grab	5	Equipment Blank: 1/20 Duplicate: 1/20	6020A	Field filtered then pH<2 with HNO ₃ ; Cool to 4 ⁰ C	28 days to analysis	(1) 500 mL poly container

¹ From date of sample collection

² Trip blank bottleware = (3) 40 mL VOA vials

Table 2
Laboratory Data Quality Objectives: Precision and Accuracy: Groundwater Samples

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements								
VOCs (TCL)	SW-846 Method 8260C	Groundwater	<table border="0"> <tr> <td><u>Surrogates</u></td> <td><u>% Rec.</u></td> </tr> <tr> <td>1,2-Dichloroethane-d4</td> <td>78-122</td> </tr> <tr> <td>p-Bromofluorobenzene</td> <td>87-112</td> </tr> <tr> <td>Toluene-d8</td> <td>91-110</td> </tr> </table>	<u>Surrogates</u>	<u>% Rec.</u>	1,2-Dichloroethane-d4	78-122	p-Bromofluorobenzene	87-112	Toluene-d8	91-110	<u>Surrogates:</u> All samples, standards, QC samples	<u>Field Duplicates</u> RPD ≤ 30	<u>Field Duplicates:</u> One per 20
<u>Surrogates</u>	<u>% Rec.</u>													
1,2-Dichloroethane-d4	78-122													
p-Bromofluorobenzene	87-112													
Toluene-d8	91-110													
Sulfate and Chloride	300.0 Rev 2.1	Groundwater	<u>Matrix Spikes</u> 85-115% recovery	<u>Matrix Spikes:</u> One per 20 per matrix per batch	<u>Field Duplicates</u> RPD ≤ 30 <u>Matrix Duplicates</u> RPD ≤ 30	<u>Field Duplicates:</u> One per 20								
Total Organic Carbon	415.2	Groundwater	<u>Matrix Spikes</u> 70-130% recovery	<u>Matrix Spikes:</u> One per 20 per matrix per batch	<u>Field Duplicates</u> RPD ≤ 30 <u>Matrix Duplicates</u> RPD ≤ 30	<u>Field Duplicates:</u> One per 20								
Volatile Fatty Acids	DIONEX APP NOTE 291	Groundwater	<u>Matrix Spikes</u> 75-125% recovery											
Soluble Iron	6020A	Groundwater	<u>Matrix Spikes</u> 75-125% recovery	<u>Matrix Spikes:</u> One per 20 per matrix per batch	<u>Field Duplicates</u> RPD ≤ 30 <u>Matrix Duplicates</u> RPD ≤ 30	<u>Field Duplicates:</u> One per 20								

Sampling Plan

Environmental sampling will include collection of groundwater samples. Groundwater samples will be collected from permanent monitoring wells using low flow pumps and new dedicated polyethylene tubing.

Groundwater Sampling

Groundwater samples will be collected from permanent monitoring wells. Groundwater from each well will be purged via a bladder pump (QED SamplePro[®] MicroPurge 1.75-inch outer diameter pump) lined with a polyethylene bladder operated by an air compressor until parameters have stabilized in accordance with USEPA Low-Stress (Low-Flow) sampling procedures. A turbidity level of 50 nephelometric turbidity units (NTUs) or less is the well purging goal, but not an absolute value before sampling. Other field parameters including temperature, conductivity, pH, and dissolved oxygen (DO) will also be monitored. As practical, all field measurements will be taken from the flow cell and will be recorded during and after purging, and before sampling. Field parameters should generally be within ± 10 percent for three consecutive readings, prior to sampling.

It is anticipated that no more than three well volumes will be purged in order for turbidity to reach a minimum and the other parameters to stabilize. Ideally, pumping rates will be at a rate maintained between 100 and 500 milliliters per minute (ml/min) so that no drawdown of the groundwater level occurs (i.e., pumping rate is less than recharge rate). During purging, the sampler will actively monitor and track the volume of water purged and the field parameter readings. Data will be recorded in the field logbook. For example, the sampler will record the running total volume purged from each well and note the readings for the corresponding field parameters.

Once groundwater conditions have stabilized and groundwater levels have recovered, samples will be collected. Sampling will be performed with the pump intake at the same location used for purging. Pumping rates for withdrawing the samples will be similar to those followed for well purging.

The samples will be collected in sample bottles (pre-preserved, if appropriate), placed in iced coolers and removed from light immediately after collection. In addition, all sample bottles must be filled to the top so that no aeration of the samples occurs during transport. All bottles will be filled to avoid cascading and aeration of the samples, the goal being to minimize any precipitation of colloidal matter.

QC Sample Collection

QC samples will include trip blanks, equipment blanks, and field duplicates for groundwater samples.

Trip blanks will consist of distilled water (supplied by the laboratory) and will be used to assess the potential for volatile organic compound contamination of groundwater samples due to contaminant migration during sample shipment and storage. Trip blanks will be transported to the site unopened, stored with the investigative samples, and kept closed until analyzed by the laboratory. Trip blanks will be submitted to the laboratory at a frequency of one per cooler that contains groundwater samples for analysis for VOCs.

Equipment blanks will consist of distilled water and will be used to check for potential contamination of the equipment which may cause sample contamination. Equipment blanks will be collected by routing the distilled water through the sampling equipment prior to sample collection. Equipment blanks will be submitted to the laboratory at a frequency of one per 20 samples per matrix per type of non-dedicated

equipment being used per parameter. Equipment blanks will not be collected with samples submitted for soil gas samples.

Field duplicates are an additional aliquot of the same sample submitted for the same parameters as the original sample. Field duplicates will be used to assess the sampling and analytical reproducibility. Field duplicates will be collected by alternately filling sample bottles from the source being sampled. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters with the exception of soil gas samples.

Refer to Table 1 for a summary of QC sample preservation and container requirements.

Sample Preservation and Containerization

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest U.S. EPA's *Specifications and Guidance for Contaminant-Free Sample Containers*. Certificates of analysis are provided with each bottle lot and maintained on file to document conformance to EPA specifications. Groundwater samples will be placed in iced coolers immediately after collection.

Equipment Decontamination

Re-usable stainless steel and aluminum sampling equipment shall be cleaned between each use in the following manner:

- Wash and scrub with Alconox and water mixture
- Tap water rinse
- Wash/scrub with a biodegradable degreaser ("ZEP") if there is oily residue on equipment surface
- Tap water rinse
- Distilled/deionized water rinse
- Air dry

Cleaned equipment shall be wrapped in aluminum foil if not used immediately after air-drying.

Groundwater sampling pumps will be cleaned by washing and scrubbing with an Alconox/water mixture, rinsing with tap water and irrigating with deionized water.

Field Custody Procedures

Sample chain-of-custody and packaging procedures are summarized below. These procedures are intended to ensure that the samples will arrive at the laboratory with the chain-of-custody intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.
- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis.

- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the pen would not function in wet weather.
- Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage location.
- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files.
- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by field personnel. The cooler will be strapped shut with strapping tape in at least two locations.
- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.
- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature of the laboratory sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.

ATTACHMENT 2
HEALTH AND SAFETY PLAN

**SITE-SPECIFIC HEALTH AND SAFETY PLAN
FOR
INTERIM REMEDIAL MEASURES**

**PUBLIC SCHOOL 96X
650 Waring Avenue
Bronx, New York 10467**

Prepared by:

**TRC Engineers, Inc.
1430 Broadway, 10th Floor
New York, New York 10018**

**TRC Project Number 297653.0000.0000
MARCH 2018**

DISCLAIMER

STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THESE SITES. THE HEALTH AND SAFETY GUIDELINES IN THIS HEALTH AND SAFETY PLAN WERE PREPARED SPECIFICALLY FOR THIS PROJECT AND SHOULD NOT BE USED ON ANY OTHER SITE OR PROJECT WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

TABLE OF CONTENTS

Section	Page
1.0 SITE-SPECIFIC TRAINING	1
2.0 SITE-SPECIFIC SAFETY PLAN	2
2.1 Introduction.....	2
2.2 Purpose.....	3
2.3 Site Description and History.....	3
3.0 SCOPE OF WORK.....	4
4.0 CONTAMINANTS OF CONCERN	5
5.0 EMERGENCY AND TRC CONTACT NUMBERS	6
5.2 TRC Contacts.....	7
5.3 Level of Protection.....	8
5.4 Personal Protective Equipment (PPE)	8
6.0 ON-SITE OPERATION	9
6.1 Biological Hazards.....	9
6.2 Physical Hazards.....	10
6.3 Electrical Utility Hazards.....	11
6.4 Mechanical Hazards.....	12
6.5 Communication.....	12
7.0 SITE MAPS	13

Figures

Figure 1 – Site Location Map

Figure 2 – Site Plan

Appendices

Attachment 1 – Health and Safety Plan Acceptance

Attachment 2 – Safety Data Sheets for Potential Contaminants of Concern

Attachment 3 – Hospital Routes

Attachment 4 – Incident Reporting Guidelines

Attachment 5 – TRC Incident Report

1.0 SITE-SPECIFIC TRAINING

TRC provides training to all its employees whose work entails potential exposure to toxic chemicals or hazardous environments. The training is taught by experienced professionals and promotes safe work conditions through both classroom and field instruction.

TRC provides the following training to its employees:

1. 40-Hour Hazardous Materials Training

Supervisors receive additional training that is geared toward responsibilities and skills in project management.

2. 8-Hour Hazardous Materials Annual Refresher Training
3. Training required under specific OSHA Standards
4. First Aid/CPR

2.0 SITE-SPECIFIC SAFETY PLAN

2.1 Introduction

The following is the Health and Safety Plan (HASP) for the Interim Remedial Measures proposed at PS 96X, located at 650 Waring Avenue, Bronx, New York 10467 (the “Site”) by TRC Engineers, Inc. (TRC). A Site Location Map is shown in the attached Figure 1. Activities to be performed on-site consist of in-situ injection of sodium lactate and groundwater sampling.

The site-specific safety plan was developed from previous Site investigations. Revisions and/or alterations to this HASP may become necessary as more information becomes available. Any proposed changes to this HASP will be approved by the Health & Safety Coordinator prior to implementation. All on-site personnel are required to read, review and strictly comply with the HASP. It is the responsibility of the Project Manager or designee to ensure that the HASP is implemented and enforced.

2.2 Purpose

The purpose of the Interim Remedial Measure (IRM) is to address the elevated concentrations of chlorinated volatile organic compounds in groundwater via groundwater treatment (i.e., in-situ injection of sodium lactate).

2.3 Site Description and History

The Site is located at 650 Waring Avenue (Block 4341, Lot 13) in the Bronx, New York. The Site is located on the city block bordered by Waring Avenue to the north, Olinville Avenue to the east, multi-story residential buildings followed by Thwaites Place to the south, and Barker Avenue to the west. The area surrounding the Site is developed primarily with residential and commercial buildings. A Site Plan is presented in Figure 2.

The Site is an approximately 79,000-square-foot lot improved with a four-story public school building with an unoccupied basement and an asphalt-paved playground that is surrounded to the east, south, and west by a fence.

Based on a review of historical records and prior reports, the Site contained a two-story residential dwelling and two one-story structures constructed on vacant land in 1919. The current original portion of the school building was constructed in 1929. The first of 11 temporary classroom units (TCUs) was constructed in the southern portion of the Site in 2001. The TCUs were later demolished as part of the construction of a four-story Addition to P.S. 96X, which was completed in September 2015. The Addition is located south and east of the original school building.

Prior Investigations

Due diligence investigations performed at the Site between 2009 and 2013 revealed the presence of CVOCs in groundwater and soil vapor at concentrations exceeding the standards, criteria, and guidelines. Following the signing of a Consent Order, an IRM was implemented in 2013 that consisted of in-situ injection of sodium lactate in the footprint of the school addition (prior to construction activities) and related groundwater monitoring. The results of groundwater monitoring activities revealed that sodium lactate injection was effective (i.e., decreased concentrations of parent compounds tetrachloroethene [PCE] and trichloroethene [TCE] and

increase in concentrations of breakdown products [cis-1,2-dichloroethene and vinyl chloride]).

Subsequent groundwater sampling at the Site revealed that elevated concentrations of CVOCs are also present downgradient of the Site to the south and southeast.

3.0 SCOPE OF WORK

The IRM will consist of the following:

- In-situ groundwater treatment consisting of the injection of sodium lactate and hydrogen release compound (HRC®);
- Pre-injection and post-injection monitoring of dissolved oxygen, specific conductivity, temperature, pH, and oxygen reduction potential on a bi-weekly basis prior to injection and two to three months following the injection to document changes in water chemistry; and,
- Collection of groundwater samples for laboratory analysis for volatile organic compounds (VOCs) prior to injection and following post-injection water chemistry monitoring.

A Site Plan depicting the monitoring well locations and locations of permanent groundwater monitoring wells are shown in the attached Figure 2.

4.0 CONTAMINANTS OF CONCERN

Based on previous investigations and the history of the Site, the following chemical hazards have been identified:

- Chlorinated solvents, most notably tetrachloroethene (PCE) and its degradation byproducts trichloroethene (TCE), *trans*-1,2-dichloroethene, *cis*-1,2-dichloroethene, and vinyl chloride.

Safety Data Sheets (SDS) for contaminants of concern are provided in **Attachment 2**.

5.0 EMERGENCY AND TRC CONTACT NUMBERS

5.1 Emergency Contact Information

Ambulance: **911** Fire Department: **911** Police Department: **911**

Hospital: **St. Barnabas Hospital**

Phone No.: **(718) 960-9000**

Hospital Address: **4422 3rd Avenue, Bronx, NY 10457**

HOSPITAL DIRECTIONS:

- | | |
|--|------------------|
| 1. Head East on Waring Ave toward Olinville Ave | 0.1 Miles |
| 2. Turn Right onto Boston Rd | 0.3 Miles |
| 3. Turn Right onto Bronx and Pelham Pkwy | 0.4 Miles |
| 4. Continue onto E. Fordham Rd | 0.9 Miles |
| 5. Turn Left onto 3rd Ave | 0.6 Miles |
- Destination will be on the left

Hospital: **Calvary Hospital**

Phone No.: **(718) 518-2000**

Hospital Address: **1740 Eastchester Road, Bronx, NY 10461**

- | | |
|--|------------------|
| 1. Head East on Waring Ave toward Olinville Ave | 0.6 Miles |
| 2. Turn Right onto Washington Rd | 0.8 Miles |
| 3. Turn Left onto Morris Park Ave | 0.4 Miles |
| 4. Turn Right onto Eastchester Rd | 0.2 Miles |
- Destination will be on the left

NOTE: FOR ANY TYPE OF SERIOUS MEDICAL EMERGENCY, CALL 911 AND REQUEST AN AMBULANCE. NEW YORK CITY STREETS ARE OFTEN CONGESTED DUE TO HEAVY TRAFFIC, CONSTRUCTION AND DOUBLE-PARKED VEHICLES AND IT MAY BE DIFFICULT TO DRIVE TO THE EMERGENCY ROOM.

Refer to **Attachment 3** for Hospital Route Direction with maps.

5.2 TRC Contacts

1. Project Manager

Name: Jenna Raup
Office/Division: New York City
Office Telephone: 212-221-7822 ext 133

2. Certified Industrial Hygienist

Name: Jack Springston, CIH
Office/Division: New York City
Office Telephone: 212-221-7822 ext. 108

3. National Safety Director

Name: Mike Glenn
Office/Division: Irvine, CA
Office Telephone: 949-727-7347

4. WorkCare can provide assistance in providing first aid advice and directing an injured worker to non-emergency medical care. WorkCare is a service that provides 24/7 access to an Occupational Healthcare physician or clinician.

WorkCare Incident Intervention
888-449-7787

5. Human Resource Manager

Name: Suzanne Micallef
Office/Division: Administrative
Office Telephone: 978-656-3628

5.3 Level of Protection

The Project Manager will continually evaluate levels of protection to be utilized by on-site personnel, with assistance from the Health & Safety Coordinator and the Industrial Hygienist. The levels of protection may be downgraded or upgraded, as necessary, with approval by the PM.

5.4 Personal Protective Equipment (PPE)

It is anticipated that only Level D PPE will be required. Level D protection is applicable when no respiratory protection and minimal skin protection is required. Level D can be used in the following circumstances:

- The atmosphere contains no known hazard
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

The Level D recommended equipment for this site includes:

- Work clothes (no shorts or cutoffs)
- Safety boots/shoes
- Safety glasses or chemical splash goggles: Eye protection will be worn when personnel are exposed to flying debris, liquids, chemical vapors or particulates.
- Hard hats: Appropriately rated hard hats will be worn by personnel for protection against overhead hazards, when present.
- Hearing protection: To be worn by all personnel exposed to at least 85 dB of sound during the workday.
- Work gloves or chemically protective gloves when potentially exposed to contaminants (i.e., during soil and groundwater sampling).

If excessive ionizable organic vapors containing of volatile organic compounds (VOCs) are detected at or above the action levels (See Section 6.1), workers will cease work in the area until organic vapor levels decrease for Level D PPE.

6.0 ON-SITE OPERATION

Chemical hazards are expected to be low. These chemical hazards potentially can include chlorinated solvent related VOCs.

First Aid Procedures for Chemical Exposures

EYE: If any chemicals come in contact with eyes, immediately wash the eyes with large amounts of water, occasionally lifting lower and upper lids. Get medical attention immediately.

BREATH: If person breathes large amounts of any chemicals, remove person to fresh air. If breathing has stopped, perform artificial respiration. Keep affected person warm and rested. Get medical attention as soon as possible.

SKIN: If any chemicals except those listed below come in contact with the skin, immediately wash skin with soap and water. Get medical attention promptly. If chemical penetrates clothing, immediately remove clothing and wash with soap and water.

Soap should not be used if the following chemicals (sample preservatives) potentially encountered at the site contact skin or clothing, **water wash only:**

Hydrochloric acid
Nitric acid
Sodium hydroxide
Sulfuric acid

Special attention must be paid to not using soap with these chemicals in particular.

SWALLOW: If any chemicals are swallowed get medical attention immediately.

6.1 Biological Hazards

No biological hazards are anticipated for any of the tasks.

6.2 Physical Hazards

The physical hazards are anticipated to be low and are outlined in Table A-1 below.

**TABLE A-1
PHYSICAL HAZARDS**

HAZARD TYPE	KNOWN	POTENTIAL
Heat Stress/Cold Stress		X
Severe Weather (lightning, snow, sleet)		X
Excessive Noise		X
Facility Operations (machinery, structures)		X
Unstable ground (wet areas)		X
Site Operations (drilling, hand and power tool use, steam cleaning)	X	
Heavy lifting/moving	X	
Hazardous materials use & storage		X
Fire		X
Slips, trips, and falls		X
Cuts, punctures		X

TRC personnel can avoid most of the hazards listed above including hand tools, hazardous materials use, slips, trips and falls, and punctures and cuts by remaining alert and performing safe work practices during all site activities. Other proper work practices are outlined below.

1. To avoid falling objects:
 - a. Do not walk or stand under suspended/overhead loads (including scaffolding).
 - b. Be aware of falling objects in the work area.
 - c. Secure overhead objects.
2. When using hand tools:
 - a. Hand tools will meet the manufacturer's safety standards.
 - b. Hand tools will not be altered in any way.
 - c. Makeshift tools will not be used.
 - d. At a minimum, eye protection will be used when working with hand tools.

-
- e. Wrenches, including adjustable, pipe, end and socket wrenches, will not be used when jaws are sprung to the point that slippage occurs.
 - f. Impact tools such as drift pins, wedges and chisels, will be kept free of mushroom heads.
 - g. Wooden handles will be free of splinters or cracks and secured tightly to the tool.
3. Overhead Wires:
- If contact is possible (i.e., ladder, equipment, crane lift, etc.) one or more of the following will be done:
- Power sources will be disconnected by the utility;
 - Power sources will be shielded by the utility; and
 - Object will get no closer than 12' to prevent arcing.
4. Slips, Trips and Falls:
- a. Proper lighting will be maintained at all times.
 - b. Walkways will remain clear and unobstructed at all times.
 - c. When possible, cords, hose lines, etc., will be raised to reduce or eliminate trip hazards.

Noise

Approved hearing protection will be required in work areas involving heavy equipment, impact tools, drilling, etc. In general, hearing protection should be worn if an individual cannot be heard in a normal speaking voice at a distance of two feet.

6.3 Electrical Utility Hazards

TRC will implement the following subsurface utility clearance procedure:

- TRC will review available site plans for work involving activities at or near utilities.
- For environmental drilling, TRC's utility mark-out subcontractor will conduct a geophysical survey around all proposed sampling locations to identify subsurface electric utilities and mark the centerline of underground lines.
- The drilling contractor will notify the NYC One Call Center at (800) 272-4480, in accordance with Code 753, a minimum of 5 working days prior to any drilling on streets and sidewalks.

6.4 Mechanical Hazards

The mechanical hazards are anticipated to be low and are associated with use of a submersible pump.

6.5 Communication

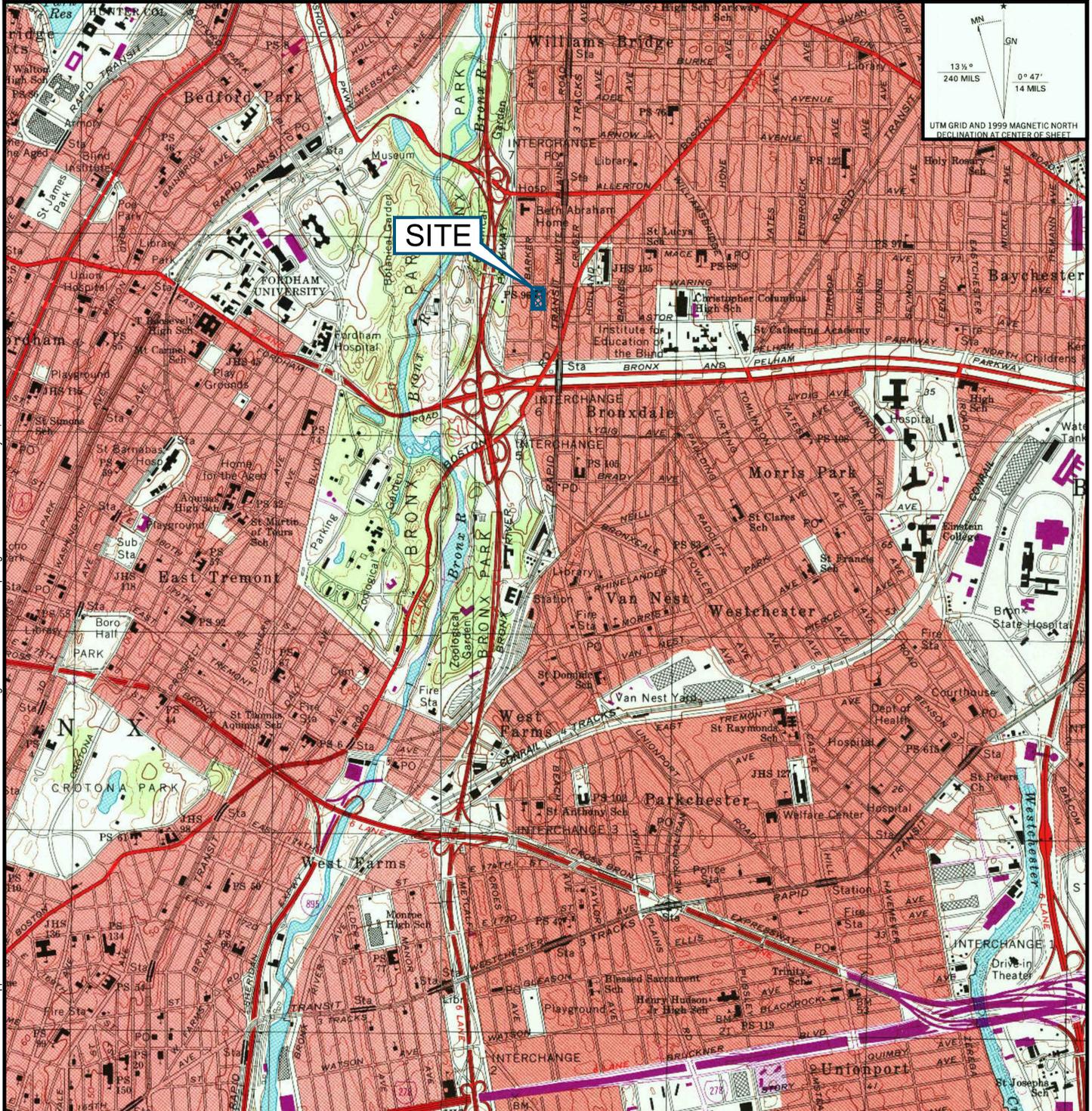
TRC team-sampling members shall be equipped with cellular telephones. If an emergency occurs, and the team members are not in close proximity to each other, communication will occur via telephone.

7.0 SITE MAPS

A Site Location Map is provided in the attached Figure 1. A Site Plan depicting the proposed monitoring well locations is shown in the attached Figure 2.

Figures

DRAWING NAME: \\INTAPLAN\NYCP\Projects\NYOSCA Contract C000014345\297653 - X096 BCP\BCP Application\Work Plan for IRW Under BCP\Attachments\Attachments Figure 1 - Site Location Map.dwg -- PLOT DATE: February 20, 2018 - 5:35PM -- LAYOUT: 8.5x11

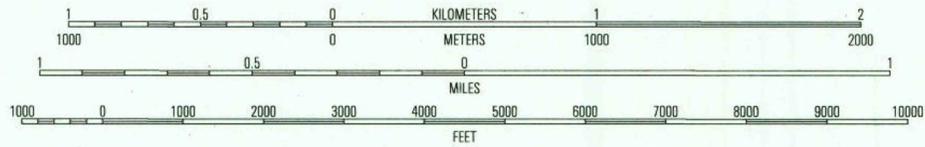


13 1/2° 0' 47"

 240 MILS 14 MILS

 UTM GRID AND 1999 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE: 1:2400



NEW YORK

 QUADRANGLE LOCATION

 MAP INCLUDES INFORMATION FROM THE FOLLOWING MAP SHEET(S):

 TP, FLUSHING, NY, 7.5 MINUTE, DATED 1995.

 W, CENTRAL PARK, NY, NJ, 7.5 MINUTE, DATED 1995.

 MAP OBTAINED THROUGH USE OF MAPTECH TERRAIN NAVIGATOR PRO SOFTWARE.

1430 Broadway
 10th Floor
 New York, NY 10018
 Phone: 212.221.7822

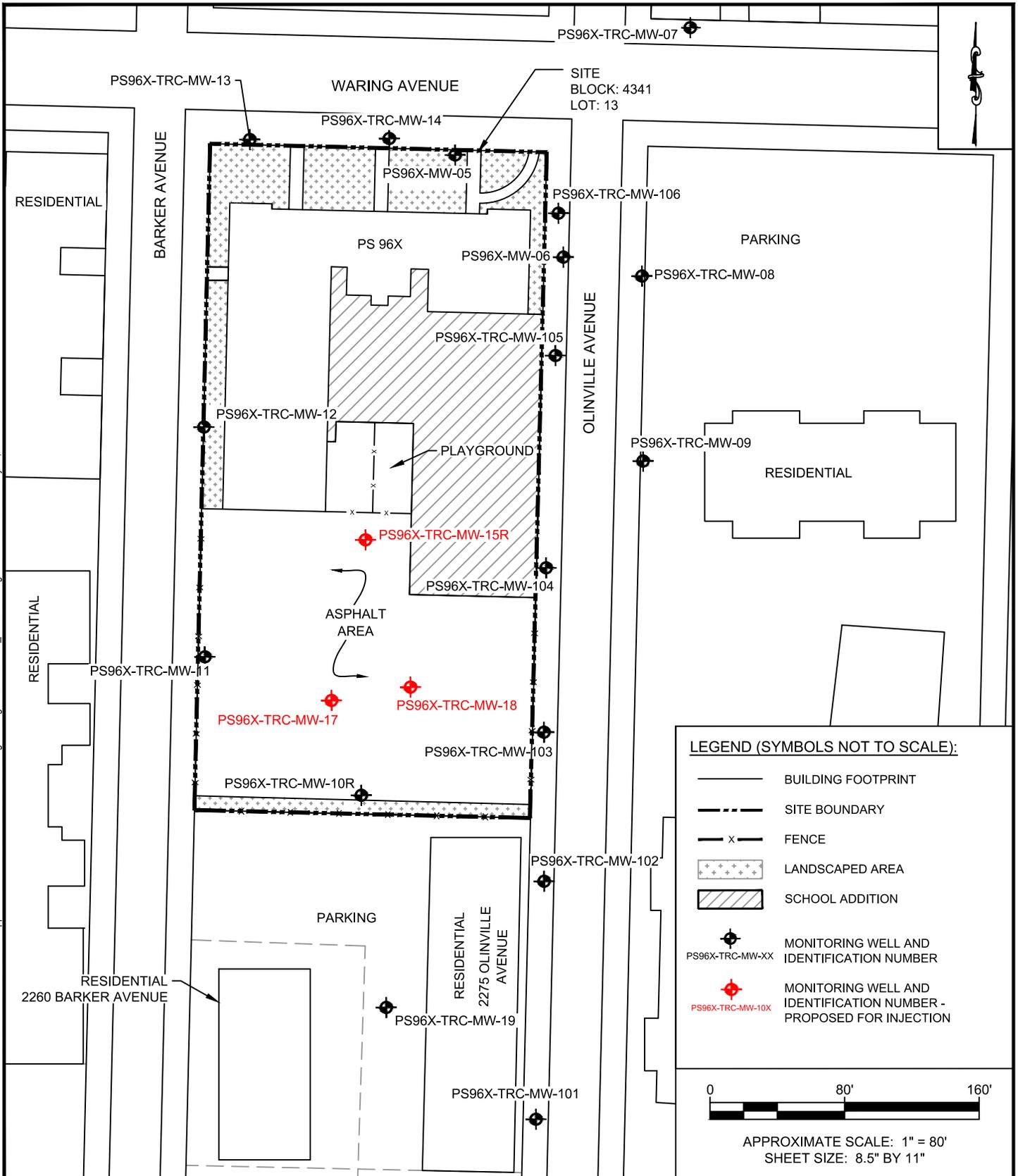
PROJECT:
NEW YORK CITY SCHOOL CONSTRUCTION AUTHORITY
P.S. 96X - 650 WARING AVENUE - BLOCK: 4341, LOT: 13
BRONX, NEW YORK 10467

TITLE:
SITE LOCATION MAP

DRAWN BY:	H. DELGADO
CHECKED BY:	J. RAUP
APPROVED BY:	D. GLASS
DATE:	MARCH 2018
PROJ. NO.:	297653
FILE:	Figure 1 - Site Location Map.dwg

FIGURE 1

DRAWING NAME: \\INTAP\A-NY\Projects\NYOSCA Contract C000014345\297653 - X096 BCP\BCP Application\Work Plan for IRM Under BCP\Figures\ Figure 2 - Site Plan_2.16.2018.dwg -- PLOT DATE: February 20, 2018 - 5:31PM -- LAYOUT: 8.5X11P



1430 Broadway
10th Floor
New York, NY 10018
Phone: 212.221.7822

PROJECT:
**NEW YORK CITY SCHOOL CONSTRUCTION AUTHORITY
P.S. 96X - 650 WARING AVENUE
BRONX, NEW YORK 10467**

TITLE:
SITE PLAN

DRAWN BY:	H. DELGADO
CHECKED BY:	J. RAUP
APPROVED BY:	D. GLASS
DATE:	MARCH 2018
PROJ. NO.:	297653.0000.0000
FILE:	Figure 2 - Site Plan_2.16.2018.dwg

FIGURE 2

Attachment 1
Health and Safety Plan Acceptance

Attachment 2
Safety Data Sheets for Potential Contaminants of Concern

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: TRANS-1,2-DICHLOROETHYLENE

TRADE NAMES/SYNONYMS:

MTG MSDS 196; TRANS-ACETYLENE DICHLORIDE; TRANS-DICHLOROETHYLENE; TRANS-1,2-DICHLOROETHENE; 1,2-DICHLOROETHYLENE; RCRA U079; C2H2CL2; MAT23670; RTECS KV9400000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989

REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: TRANS-1,2-DICHLOROETHYLENE
CAS NUMBER: 156-60-5
PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=2



EMERGENCY OVERVIEW:

COLOR: colorless

PHYSICAL FORM: liquid

ODOR: pleasant odor

MAJOR HEALTH HAZARDS: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

PHYSICAL HAZARDS: Flammable liquid and vapor. Vapor may cause flash fire. May react on contact with air, heat, light or water.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: irritation, nausea, vomiting, drowsiness, symptoms of drunkenness

LONG TERM EXPOSURE: no information on significant adverse effects

SKIN CONTACT:

SHORT TERM EXPOSURE: irritation

LONG TERM EXPOSURE: same as effects reported in short term exposure

EYE CONTACT:

SHORT TERM EXPOSURE: irritation

LONG TERM EXPOSURE: same as effects reported in short term exposure

INGESTION:

SHORT TERM EXPOSURE: symptoms of drunkenness

LONG TERM EXPOSURE: no information on significant adverse effects

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN: For ingestion, consider gastric lavage. Consider oxygen.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

EXTINGUISHING MEDIA: regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any

discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Water may be ineffective.

FLASH POINT: 36 F (2 C) (CC)

LOWER FLAMMABLE LIMIT: 9.7%

UPPER FLAMMABLE LIMIT: 12.8%

AUTOIGNITION: 860 F (460 C)

FLAMMABILITY CLASS (OSHA): IB

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

TRANS-1,2-DICHLOROETHYLENE:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

200 ppm (790 mg/m³) OSHA TWA

200 ppm ACGIH TWA

200 ppm (790 mg/m³) NIOSH recommended TWA 10 hour(s)

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye

wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

2000 ppm

Any supplied-air respirator operated in a continuous-flow mode.

Any powered, air-purifying respirator with organic vapor cartridge(s).

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.

Any self-contained breathing apparatus with a full facepiece.

Any supplied-air respirator with a full facepiece.

Emergency or planned entry into unknown concentrations or IDLH conditions -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Escape -

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid

COLOR: colorless

ODOR: pleasant odor

MOLECULAR WEIGHT: 96.94

MOLECULAR FORMULA: C₂H₂CL₂

BOILING POINT: 118 F (48 C)

FREEZING POINT: -58 F (-50 C)

VAPOR PRESSURE: 400 mmHg @ 31 C

VAPOR DENSITY (air=1): 3.34

SPECIFIC GRAVITY (water=1): 1.2565

WATER SOLUBILITY: slightly soluble

PH: Not available

VOLATILITY: Not available

ODOR THRESHOLD: Not available

EVAPORATION RATE: Not available

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:

Soluble: ethanol, ether

10. STABILITY AND REACTIVITY

REACTIVITY: May decompose on contact with air, light, moisture, heat or storage and use above room temperature. Releases toxic, corrosive, flammable or explosive gases.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES: bases, metals, combustible materials, oxidizing materials, acids

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

POLYMERIZATION: May polymerize. Avoid contact with incompatible materials.

11. TOXICOLOGICAL INFORMATION

TRANS-1,2-DICHLOROETHYLENE:

IRRITATION DATA: 500 mg/24 hour(s) skin-rabbit moderate; 10 mg eyes-rabbit moderate

TOXICITY DATA: 24100 ppm inhalation-rat LC50; >5 gm/kg skin-rabbit LD50; 1235 mg/kg oral-rat LD50

LOCAL EFFECTS:

Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL:

Moderately Toxic: ingestion

Slightly Toxic: inhalation

TARGET ORGANS: central nervous system

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory disorders

MUTAGENIC DATA: Available.

REPRODUCTIVE EFFECTS DATA: Available.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

INVERTEBRATE TOXICITY: <110000 ug/L 48 hour(s) (Mortality) Water flea (Daphnia magna)

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U079.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Trichlorobenzenes, liquid
ID NUMBER: UN2321
HAZARD CLASS OR DIVISION: 6.1
PACKING GROUP: III
LABELING REQUIREMENTS: 6.1



CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Trichlorobenzenes, liquid
UN NUMBER: UN2321
CLASS: 6.1
PACKING GROUP/CATEGORY: III

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):

ACUTE: Yes
CHRONIC: No
FIRE: Yes
REACTIVE: Yes
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
1,2-DICHLOROETHYLENE (ALL ISOMERS)

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

STATE REGULATIONS:

California Proposition 65: Not regulated.

CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: Not determined.

NATIONAL INVENTORY STATUS:

U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDL): Not determined.

16. OTHER INFORMATION

“RTECS®” is a United States trademark owned and licensed under authority of the U.S. Government, by and through Symyx Software, Inc. Portions ©Copyright 2001, U.S. Government. All rights reserved.

©Copyright 1984-2009 ChemADVISOR, Inc. All rights reserved.

MATHESON TRI-GAS, INC. MAKES NO EXPRESS OR IMPLIED WARRANTIES, GUARANTEES OR REPRESENTATIONS REGARDING THE PRODUCT OR THE INFORMATION HEREIN, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE. MATHESON TRI-GAS, INC. SHALL NOT BE LIABLE FOR ANY PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE, WHETHER COMPENSATORY, CONSEQUENTIAL, EXEMPLARY, OR OTHERWISE, RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: TETRACHLOROETHYLENE

TRADE NAMES/SYNONYMS:

MTG MSDS 238; PERCHLOROETHYLENE; 1,1,2,2-TETRACHLOROETHYLENE; ETHYLENE TETRACHLORIDE; PERC; TETRACHLORETHYLENE; PERCHLORETHYLENE; TETRACHLOROETHENE; PCE; RCRA U210; UN 1897; C2Cl4; MAT22900; RTECS KX3850000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989

REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: TETRACHLOROETHYLENE
CAS NUMBER: 127-18-4
PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=0



EMERGENCY OVERVIEW:

COLOR: colorless

PHYSICAL FORM: volatile liquid

ODOR: faint odor, sweet odor

MAJOR HEALTH HAZARDS: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression, cancer hazard (in humans)

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: irritation, nausea, vomiting, chest pain, difficulty breathing, irregular

heartbeat, headache, drowsiness, dizziness, disorientation, mood swings, loss of coordination, blurred vision, lung congestion, kidney damage, liver damage

LONG TERM EXPOSURE: irritation, nausea, stomach pain, loss of appetite, headache, drowsiness, dizziness, disorientation, sleep disturbances, pain in extremities, loss of coordination, blurred vision, hormonal disorders, internal bleeding, heart damage, liver damage, birth defects, brain damage, tumors, cancer

SKIN CONTACT:

SHORT TERM EXPOSURE: irritation (possibly severe)

LONG TERM EXPOSURE: irritation

EYE CONTACT:

SHORT TERM EXPOSURE: irritation

LONG TERM EXPOSURE: irritation

INGESTION:

SHORT TERM EXPOSURE: same as effects reported in short term inhalation

LONG TERM EXPOSURE: same as effects reported in long term inhalation

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN: For inhalation, consider oxygen. For ingestion, consider gastric lavage. Consider oxygen.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard.

EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Cool containers with water spray until well after the fire is out. Stay away from the ends

of tanks. For tank, rail car or tank truck, evacuation radius: 800 meters (1/2 mile).

FLASH POINT: No data available.

6. ACCIDENTAL RELEASE MEASURES

SOIL RELEASE:

Dig holding area such as lagoon, pond or pit for containment. Dike for later disposal. Absorb with sand or other non-combustible material.

WATER RELEASE:

Absorb with activated carbon. Remove trapped material with suction hoses. Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Small liquid spills: Absorb with sand or other non-combustible material. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Store in a cool, dry place. Store in a well-ventilated area. Avoid heat, flames, sparks and other sources of ignition. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

TETRACHLOROETHYLENE:

TETRACHLOROETHYLENE (PERCHLOROETHYLENE):

100 ppm OSHA TWA

200 ppm OSHA ceiling

300 ppm OSHA peak (5 minutes in any 3 hours)

25 ppm (170 mg/m³) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)

25 ppm ACGIH TWA

100 ppm ACGIH STEL

NIOSH TWA (lowest feasible concentration)

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

At any detectable concentration -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Escape -

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid

APPEARANCE: clear

COLOR: colorless

PHYSICAL FORM: volatile liquid

ODOR: faint odor, sweet odor

MOLECULAR WEIGHT: 165.83

MOLECULAR FORMULA: C₁₂-C-C-C₁₂

BOILING POINT: 250 F (121 C)

FREEZING POINT: -2 F (-19 C)

VAPOR PRESSURE: 14 mmHg @ 20 C

VAPOR DENSITY (air=1): 5.83

SPECIFIC GRAVITY (water=1): 1.6227

WATER SOLUBILITY: 0.015%

PH: Not available

VOLATILITY: Not available

ODOR THRESHOLD: 50 ppm

EVAPORATION RATE: 2.8 (butyl acetate=1)

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:

Soluble: alcohol, ether, benzene, chloroform, oils

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: acids, metals, bases, oxidizing materials, combustible materials

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

TETRACHLOROETHYLENE:

IRRITATION DATA: 810 mg/24 hour(s) skin-rabbit severe; 500 mg/24 hour(s) skin-rabbit mild; 162 mg eyes-rabbit mild; 500 mg/24 hour(s) eyes-rabbit mild

TOXICITY DATA: 4100 ppm/6 hour(s) inhalation-rat LC50; >10000 mg/kg skin-rabbit LD50 (Dow); 2629 mg/kg oral-rat LD50

CARCINOGEN STATUS: NTP: Anticipated Human Carcinogen; IARC: Human Limited Evidence, Animal Sufficient Evidence, Group 2A; ACGIH: A3 -Confirmed Animal Carcinogen; EC: Category 2

LOCAL EFFECTS:

Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL:

Moderately Toxic: ingestion

Slightly Toxic: inhalation

TARGET ORGANS: central nervous system

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: eye disorders, heart or cardiovascular disorders, kidney disorders, liver disorders, nervous system disorders, skin disorders and allergies

TUMORIGENIC DATA: Available.

MUTAGENIC DATA: Available.

REPRODUCTIVE EFFECTS DATA: Available.

ADDITIONAL DATA: May be excreted in breast milk. Alcohol may enhance the toxic effects. Stimulants such as epinephrine may induce ventricular fibrillation.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

FISH TOXICITY: 8430 ug/L 96 hour(s) LC50 (Mortality) Flagfish (*Jordanella floridae*)

INVERTEBRATE TOXICITY: 7500 ug/L 48 hour(s) EC50 (Immobilization) Water flea (*Daphnia magna*)

ALGAL TOXICITY: 509000 ug/L 96 hour(s) EC50 (Photosynthesis) Diatom (*Skeletonema costatum*)

FATE AND TRANSPORT:

BIOCONCENTRATION: 49 ug/L 1-21 hour(s) BCF (Residue) Bluegill (*Lepomis macrochirus*) 3.43 ug/L

13. DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U210. Hazardous Waste Number(s): D039. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 0.7 mg/L. Dispose in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Tetrachloroethylene

ID NUMBER: UN1897

HAZARD CLASS OR DIVISION: 6.1

PACKING GROUP: III

LABELING REQUIREMENTS: 6.1

MARINE POLLUTANT: TETRACHLOROETHYLENE



CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Tetrachloroethylene

UN NUMBER: UN1897

CLASS: 6.1

PACKING GROUP/CATEGORY: III

15. REGULATORY INFORMATION

U.S. REGULATIONS:

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

TETRACHLOROETHYLENE (PERCHLOROETHYLENE): 100 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart

C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):

ACUTE: Yes

CHRONIC: Yes

FIRE: No

REACTIVE: No

SUDDEN RELEASE: No

**SARA TITLE III SECTION 313 (40 CFR 372.65):
TETRACHLOROETHYLENE (PERCHLOROETHYLENE)**

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

STATE REGULATIONS:

California Proposition 65:

Known to the state of California to cause the following:

TETRACHLOROETHYLENE (PERCHLOROETHYLENE)

Cancer (Apr 01, 1988)

CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: D2

NATIONAL INVENTORY STATUS:

U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

“RTECS®” is a United States trademark owned and licensed under authority of the U.S. Government, by and through Symyx Software, Inc. Portions ©Copyright 2001, U.S. Government. All rights reserved.

©Copyright 1984-2009 ChemADVISOR, Inc. All rights reserved.

MATHESON TRI-GAS, INC. MAKES NO EXPRESS OR IMPLIED WARRANTIES, GUARANTEES OR REPRESENTATIONS REGARDING THE PRODUCT OR THE INFORMATION HEREIN, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE. MATHESON TRI-GAS, INC. SHALL NOT BE LIABLE FOR ANY PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE, WHETHER COMPENSATORY, CONSEQUENTIAL, EXEMPLARY, OR OTHERWISE, RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.



**MATHESON
TRI•GAS**

ask. . .The Gas Professionals™

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: CIS-1,2-DICHLOROETHYLENE

TRADE NAMES/SYNONYMS:

CIS-ACETYLENE DICHLORIDE; 1,2-DICHLOROETHYLENE; C₂H₂CL₂; MAT05125; RTECS
KV9420000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989

REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: CIS-1,2-DICHLOROETHYLENE

CAS NUMBER: 156-59-2

PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=2



EMERGENCY OVERVIEW:

COLOR: colorless

PHYSICAL FORM: liquid

ODOR: pleasant odor

MAJOR HEALTH HAZARDS: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

PHYSICAL HAZARDS: Flammable liquid and vapor. Vapor may cause flash fire. May react on contact with air, heat, light or water.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: irritation, nausea, vomiting, drowsiness, symptoms of drunkenness

LONG TERM EXPOSURE: no information on significant adverse effects

SKIN CONTACT:

SHORT TERM EXPOSURE: irritation

LONG TERM EXPOSURE: same as effects reported in short term exposure

EYE CONTACT:

SHORT TERM EXPOSURE: irritation

LONG TERM EXPOSURE: same as effects reported in short term exposure

INGESTION:

SHORT TERM EXPOSURE: symptoms of drunkenness

LONG TERM EXPOSURE: no information on significant adverse effects

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN: For ingestion, consider gastric lavage. Consider oxygen.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Moderate explosion hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

EXTINGUISHING MEDIA: regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any

discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Water may be ineffective.

FLASH POINT: 39 F (4 C) (CC)

LOWER FLAMMABLE LIMIT: 9.7%

UPPER FLAMMABLE LIMIT: 12.8%

FLAMMABILITY CLASS (OSHA): IB

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry.

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

CIS-1,2-DICHLOROETHYLENE:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

200 ppm (790 mg/m³) OSHA TWA

200 ppm ACGIH TWA

200 ppm (790 mg/m³) NIOSH recommended TWA 10 hour(s)

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

2000 ppm

Any supplied-air respirator operated in a continuous-flow mode.

Any powered, air-purifying respirator with organic vapor cartridge(s).

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.

Any self-contained breathing apparatus with a full facepiece.

Any supplied-air respirator with a full facepiece.

Emergency or planned entry into unknown concentrations or IDLH conditions -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Escape -

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid

COLOR: colorless

ODOR: pleasant odor

MOLECULAR WEIGHT: 96.94

MOLECULAR FORMULA: C₂H₂CL₂

BOILING POINT: 140 F (60 C)

FREEZING POINT: -114 F (-81 C)

VAPOR PRESSURE: 400 mmHg @ 41 C

VAPOR DENSITY (air=1): 3.34

SPECIFIC GRAVITY (water=1): 1.2837

WATER SOLUBILITY: insoluble

PH: Not available

VOLATILITY: Not available

ODOR THRESHOLD: Not available

EVAPORATION RATE: Not available

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:

Soluble: acetone, benzene, ether, alcohol

10. STABILITY AND REACTIVITY

REACTIVITY: May decompose on contact with air, light, moisture, heat or storage and use above room temperature. Releases toxic, corrosive, flammable or explosive gases.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES: bases, metals, combustible materials, oxidizing materials, acids

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

POLYMERIZATION: May polymerize. Avoid contact with incompatible materials.

11. TOXICOLOGICAL INFORMATION

CIS-1,2-DICHLOROETHYLENE:

TOXICITY DATA: 13700 ppm inhalation-rat LC50

LOCAL EFFECTS:

Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL:

Slightly Toxic: inhalation

TARGET ORGANS: central nervous system

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory disorders

MUTAGENIC DATA: Available.

12. ECOLOGICAL INFORMATION

Not available

13. DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001. Dispose in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: 1,2-Dichloroethylene
ID NUMBER: UN1150
HAZARD CLASS OR DIVISION: 3
PACKING GROUP: II
LABELING REQUIREMENTS: 3



CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: 1,2-Dichloroethylene
UN NUMBER: UN1150
CLASS: 3
PACKING GROUP/CATEGORY: II

15. REGULATORY INFORMATION

U.S. REGULATIONS:

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):

ACUTE: Yes

CHRONIC: No

FIRE: Yes

REACTIVE: Yes

SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
1,2-DICHLOROETHYLENE (ALL ISOMERS)

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

STATE REGULATIONS:

California Proposition 65: Not regulated.

CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: BD2

NATIONAL INVENTORY STATUS:

U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

“RTECS®” is a United States trademark owned and licensed under authority of the U.S. Government, by and through Symyx Software, Inc. Portions ©Copyright 2001, U.S. Government. All rights reserved.

©Copyright 1984-2009 ChemADVISOR, Inc. All rights reserved.

MATHESON TRI-GAS, INC. MAKES NO EXPRESS OR IMPLIED WARRANTIES, GUARANTEES OR REPRESENTATIONS REGARDING THE PRODUCT OR THE INFORMATION HEREIN, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE. MATHESON TRI-GAS, INC. SHALL NOT BE LIABLE FOR ANY PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE, WHETHER COMPENSATORY, CONSEQUENTIAL, EXEMPLARY, OR OTHERWISE, RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: VINYL CHLORIDE

TRADE NAMES/SYNONYMS:

MTG MSDS 97; 1-CHLOROETHYLENE; 1-CHLOROETHENE; CHLOROETHYLENE;
CHLOROETHENE; CHLORETHENE; CHLORETHYLENE; ETHYLENE MONOCHLORIDE;
MONOCHLOROETHYLENE; MONOCHLORO ETHENE; MONOCHLOROETHENE; VINYL
CHLORIDE MONOMER; VINYL CHLORIDE, INHIBITED; VINYL C MONOMER; RCRA U043; UN
1086; C2H3Cl; MAT24940; RTECS KU9625000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989

REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: VINYL CHLORIDE

CAS NUMBER: 75-01-4

PERCENTAGE: >99.9

COMPONENT: PHENOL

CAS NUMBER: 108-95-2

PERCENTAGE: <0.1

COMPONENT: INHIBITORS

CAS NUMBER: Not assigned.

PERCENTAGE: <0.1

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=4 REACTIVITY=1



EMERGENCY OVERVIEW:

COLOR: colorless

PHYSICAL FORM: gas

ODOR: faint odor, sweet odor

MAJOR HEALTH HAZARDS: harmful if swallowed, skin irritation, eye irritation, central nervous system depression, cancer hazard (in humans)

PHYSICAL HAZARDS: Flammable gas. May cause flash fire. May polymerize. Containers may rupture or explode.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: irritation, nausea, difficulty breathing, irregular heartbeat, headache, drowsiness, dizziness, disorientation, joint pain, loss of coordination, hearing loss, lung congestion

LONG TERM EXPOSURE: impotence, bluish skin color, blood disorders, liver damage, cancer

SKIN CONTACT:

SHORT TERM EXPOSURE: irritation, blisters

LONG TERM EXPOSURE: irritation, blisters

EYE CONTACT:

SHORT TERM EXPOSURE: irritation, eye damage

LONG TERM EXPOSURE: irritation, eye damage

INGESTION:

SHORT TERM EXPOSURE: frostbite

LONG TERM EXPOSURE: cancer

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

SKIN CONTACT: If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115 F; 41-46 C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

EYE CONTACT: Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.

INGESTION: If a large amount is swallowed, get medical attention.

NOTE TO PHYSICIAN: For inhalation, consider oxygen.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Severe explosion hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables. Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 500 meters (1/3 mile). Consider downwind evacuation if material is leaking.

FLASH POINT: -108 F (-78 C) (CC)

LOWER FLAMMABLE LIMIT: 3.6%

UPPER FLAMMABLE LIMIT: 33%

AUTOIGNITION: 882 F (472 C)

6. ACCIDENTAL RELEASE MEASURES

WATER RELEASE:

Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Keep unnecessary people away, isolate hazard area and deny entry. Remove sources of ignition. Ventilate closed spaces before entering. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Protect from physical damage. Store outside or in a detached building. Inside storage: Store in a cool, dry place. Store in a

well-ventilated area. Avoid heat, flames, sparks and other sources of ignition. Grounding and bonding required. Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. See original container for storage recommendations. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

VINYL CHLORIDE:

1.0 ppm OSHA TWA

5 ppm OSHA STEL 15 minute(s)

0.5 ppm OSHA action level 8 hour(s)

1 ppm ACGIH TWA

NIOSH TWA (lowest feasible concentration)

VENTILATION: Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: For the gas: Wear appropriate chemical resistant gloves. For the liquid: Wear insulated gloves.
OSHA REGULATED SUBSTANCES: U.S. OSHA 29 CFR 1910.1017.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

OSHA Standard:

Respirator selection should comply with 29 CFR 1910.134, 29 CFR 1910.1017, and the final rule published in the Federal Register on August 24, 2006.

NIOSH Recommendations:

At any detectable concentration -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Escape -

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted canister providing protection against the compound of concern.

Any appropriate escape-type, self-contained breathing apparatus.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: gas

COLOR: colorless

ODOR: faint odor, sweet odor

MOLECULAR WEIGHT: 62.50

MOLECULAR FORMULA: C-H₂-C-H-Cl

BOILING POINT: 9 F (-13 C)

FREEZING POINT: -245 F (-154 C)

VAPOR PRESSURE: 2515.6 mmHg @ 21.1 C

VAPOR DENSITY (air=1): 2.2

SPECIFIC GRAVITY (water=1): 0.9106

WATER SOLUBILITY: 0.25%

PH: Not applicable

VOLATILITY: Not applicable

ODOR THRESHOLD: 260 ppm

EVAPORATION RATE: Not applicable

VISCOSITY: 0.01072 cP @ 20 C

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable

SOLVENT SOLUBILITY:

Soluble: alcohol, ether, carbon tetrachloride, benzene

10. STABILITY AND REACTIVITY

REACTIVITY: May polymerize. Avoid contact with light or storage and use above room temperature.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: metal carbide, metals, oxidizing materials, peroxides

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: halogenated compounds, oxides of carbon, phosgene

POLYMERIZATION: May polymerize. Avoid contact with heat, light, air, water or incompatible materials. Closed containers may rupture violently.

11. TOXICOLOGICAL INFORMATION

VINYL CHLORIDE:

TOXICITY DATA: 18 pph/15 minute(s) inhalation-rat LC50; 500 mg/kg oral-rat LD50

CARCINOGEN STATUS: OSHA: Carcinogen; NTP: Known Human Carcinogen; IARC: Human Sufficient Evidence, Animal Sufficient Evidence, Group 1; ACGIH: A1 -Confirmed Human Carcinogen;

EC: Category 1

LOCAL EFFECTS:

Irritant: skin, eye

ACUTE TOXICITY LEVEL:

Toxic: ingestion

Relatively Non-toxic: inhalation

TARGET ORGANS: central nervous system

TUMORIGENIC DATA: Available.

MUTAGENIC DATA: Available.

REPRODUCTIVE EFFECTS DATA: Available.

ADDITIONAL DATA: Stimulants such as epinephrine may induce ventricular fibrillation. May cause birth defects.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

FISH TOXICITY: 388000 ug/L 10 month(s) LETH (Mortality) Northern pike (Esox lucius)

INVERTEBRATE TOXICITY: 41.74 ug/L 72 day(s) (Residue) Mosquito (Culex pipiens quinquefasciata)

ALGAL TOXICITY: 41.74 ug/L 72 day(s) (Residue) Green algae (Oedogonium cardiacum)

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Hazardous Waste Number(s): D043. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 0.2 mg/L. U043.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Vinyl chloride, stabilized

ID NUMBER: UN1086

HAZARD CLASS OR DIVISION: 2.1

LABELING REQUIREMENTS: 2.1

QUANTITY LIMITATIONS:

PASSENGER AIRCRAFT OR RAILCAR: Forbidden

CARGO AIRCRAFT ONLY: 150 kg



CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Vinyl chloride, stabilized

UN NUMBER: UN1086

CLASS: 2.1

15. REGULATORY INFORMATION

U.S. REGULATIONS:

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

Vinyl chloride: 1 LBS RQ

PHENOL: 1000 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):

ACUTE: Yes

CHRONIC: Yes

FIRE: Yes

REACTIVE: Yes

SUDDEN RELEASE: Yes

SARA TITLE III SECTION 313 (40 CFR 372.65):

Vinyl chloride

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

STATE REGULATIONS:

California Proposition 65:

Known to the state of California to cause the following:

Vinyl chloride

Cancer (Feb 27, 1987)

CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: ABD2

NATIONAL INVENTORY STATUS:

U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

“RTECS®” is a United States trademark owned and licensed under authority of the U.S. Government, by and through Symyx Software, Inc. Portions ©Copyright 2001, U.S. Government. All rights reserved.

©Copyright 1984-2009 ChemADVISOR, Inc. All rights reserved.

MATHESON TRI-GAS, INC. MAKES NO EXPRESS OR IMPLIED WARRANTIES, GUARANTEES OR REPRESENTATIONS REGARDING THE PRODUCT OR THE INFORMATION HEREIN, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE. MATHESON TRI-GAS, INC. SHALL NOT BE LIABLE FOR ANY PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE, WHETHER COMPENSATORY, CONSEQUENTIAL, EXEMPLARY, OR OTHERWISE, RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.

Material Safety Data Sheet



Vinyl Chloride (Chloroethylene)

Section 1. Chemical product and company identification

Product name	: Vinyl Chloride (Chloroethylene)
Supplier	: AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	: Synthetic/Analytical chemistry.
Synonym	: Ethylene, chloro-; Chloroethene; Chloroethylene; Monochloroethylene; Vinyl chloride; Vinyl chloride monomer; Vinyl C monomer; C2H3Cl; Ethylene monochloride; Monochloroethene; Chlorethene; Chlorethylene; Chlorure de vinyle; Cloruro di vinile; Rcra waste number U043; Trovidur; UN 1086; VC; VCM; Vinile; Vinylchlorid; Vinyl chloride, inhibited; Vinyle(chlorure de); Winylu chlorek; 1-Chloroethylene
MSDS #	: 001067
Date of Preparation/Revision	: 4/27/2010.
In case of emergency	: 1-866-734-3438

Section 2. Hazards identification

Physical state	: Gas. [COLORLESS GAS OR LIQUID (BELOW 7 F) WITH A PLEASANT ODOR AT HIGH CONCENTRATIONS. [NOTE: SHIPPED AS A LIQUEFIED COMPRESSED GAS.]]
Emergency overview	: WARNING! FLAMMABLE GAS. MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CANCER HAZARD - CAN CAUSE CANCER. CONTENTS UNDER PRESSURE. Keep away from heat, sparks and flame. Do not puncture or incinerate container. Do not ingest. May cause target organ damage, based on animal data. Risk of cancer depends on duration and level of exposure. Use only with adequate ventilation. Wash thoroughly after handling. Keep container closed. Contact with rapidly expanding gases can cause frostbite.
Target organs	: May cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, eyes, central nervous system (CNS).
Routes of entry	: Inhalation
Potential acute health effects	
Eyes	: Irritating to eyes.
Skin	: Irritating to skin.
Inhalation	: Acts as a simple asphyxiant.
Ingestion	: Ingestion is not a normal route of exposure for gases
Potential chronic health effects	: CARCINOGENIC EFFECTS: Classified A1 (Confirmed for humans.) by ACGIH, 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH, 1 (Proven for humans.) by European Union. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available.
Medical conditions aggravated by over-exposure	: Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Vinyl Chloride (Chloroethylene)	75-01-4	100	ACGIH TLV (United States, 1/2009). TWA: 1 ppm 8 hour(s). OSHA PEL (United States, 11/2006). STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s). OSHA PEL 1989 (United States, 3/1989). STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Flammable.
- Auto-ignition temperature** : 471.85°C (881.3°F)
- Flash point** : Open cup: -79.15°C (-110.5°F).
- Flammable limits** : Lower: 4% Upper: 22%
- Products of combustion** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
halogenated compounds
- Fire-fighting media and instructions** : In case of fire, use water spray (fog), foam or dry chemical.
- In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.
- Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Do not ingest. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- Storage** : Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Personal protection

- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
- The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

vinyl chloride

ACGIH TLV (United States, 1/2009).

TWA: 1 ppm 8 hour(s).

OSHA PEL (United States, 11/2006).

STEL: 5 ppm 15 minute(s).

TWA: 1 ppm 8 hour(s).

OSHA PEL 1989 (United States, 3/1989).

STEL: 5 ppm 15 minute(s).

TWA: 1 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight	: 62.5 g/mole
Molecular formula	: C ₂ H ₃ Cl
Boiling/condensation point	: -13.8°C (7.2°F)
Melting/freezing point	: -160°C (-256°F)
Critical temperature	: 158.5°C (317.3°F)
Vapor density	: 2.21 (Air = 1)
Specific Volume (ft³/lb)	: 6.25
Gas Density (lb/ft³)	: 0.16

Section 10. Stability and reactivity

Stability and reactivity	: The product is stable.
Incompatibility with various substances	: Extremely reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
vinyl chloride	LD50 Oral	Rat	500 mg/kg	-
	LC50 Inhalation Gas.	Rat	18 pph	15 minutes
	LC50 Inhalation Gas.	Rat	5000 ppm	1 hours

Chronic effects on humans : **CARCINOGENIC EFFECTS**: Classified A1 (Confirmed for humans.) by ACGIH, 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH, 1 (Proven for humans.) by European Union. May cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, eyes, central nervous system (CNS).

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects	: Can cause cancer. Risk of cancer depends on duration and level of exposure.
Mutagenic effects	: No known significant effects or critical hazards.
Reproduction toxicity	: No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation	: Products of degradation: carbon oxides (CO, CO ₂) and water, halogenated compounds.
Environmental fate	: Not available.
Environmental hazards	: No known significant effects or critical hazards.
Toxicity to the environment	: Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		<p>Reportable quantity 1 lb. (0.454 kg)</p> <p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden.</p> <p>Cargo aircraft Quantity limitation: 150 kg</p> <p>Special provisions 21, B44, T50</p>
TDG Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		<p>Explosive Limit and Limited Quantity Index 0.125</p> <p>ERAP Index 3000</p> <p>Passenger Carrying Road or Rail Index Forbidden</p>
Mexico Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		-

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

- U.S. Federal regulations** : **United States inventory (TSCA 8b)**: This material is listed or exempted.
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: vinyl chloride
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: vinyl chloride: Fire hazard, reactive, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard
Clean Water Act (CWA) 307: vinyl chloride
Clean Water Act (CWA) 311: No products were found.
Clean Air Act (CAA) 112 accidental release prevention: vinyl chloride
Clean Air Act (CAA) 112 regulated flammable substances: vinyl chloride
Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

SARA 313

	<u>Product name</u>	<u>CAS number</u>	<u>Concentration</u>
Form R - Reporting requirements	: Vinyl Chloride (Chloroethylene)	75-01-4	100
Supplier notification	: Vinyl Chloride (Chloroethylene)	75-01-4	100

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

- State regulations** : **Connecticut Carcinogen Reporting**: This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

- California Prop. 65** : **WARNING**: This product contains a chemical known to the State of California to cause cancer.

<u>Ingredient name</u>	<u>Cancer</u>	<u>Reproductive</u>	<u>No significant risk level</u>	<u>Maximum acceptable dosage level</u>
Vinyl Chloride (Chloroethylene)	Yes.	No.	Yes.	No.

Canada

- WHMIS (Canada)** : Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

Vinyl Chloride (Chloroethylene)

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements

: FLAMMABLE GAS.
MAY CAUSE FLASH FIRE.
HARMFUL IF SWALLOWED.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CANCER HAZARD - CAN CAUSE CANCER.
CONTENTS UNDER PRESSURE.

Canada

Label requirements

: Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

Hazardous Material Information System (U.S.A.)

Health	*	2
Flammability		4
Physical hazards		2

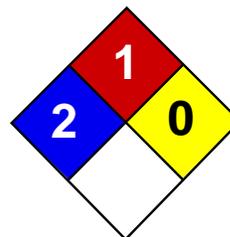
National Fire Protection Association (U.S.A.)



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.



Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C₂HCl₃

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH.

MUTAGENIC EFFECTS: Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO₂), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m³) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:

Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:

Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:54 PM

Last Updated: 11/01/2010 12:00 PM

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

Attachment 3
Hospital Routes

 650 Waring Ave, Bronx, NY 10467

-
1. Head **east** on **Waring Ave** toward **Olinville Ave** go 0.1 mi
total 0.1 mi
 -  2. Turn right onto **Boston Rd** go 0.3 mi
total 0.4 mi
About 58 secs
 -  3. Turn right onto **Bronx and Pelham Pkwy** go 0.4 mi
total 0.8 mi
About 47 secs
 4. Continue onto **E Fordham Rd** go 0.9 mi
total 1.7 mi
About 58 secs
 -  5. Turn left onto **3rd Ave** go 0.6 mi
total 2.3 mi
Destination will be on the left
About 3 mins

 St. Barnabas Hospital, 4422 3rd Avenue, New York, NY 10457

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2012 Google

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

Attachment 4
Incident Reporting Guidelines



TRC Accident Reporting Guidelines

Incident Response:

1. For life threatening injuries and medical emergencies call 911 or go to the closest emergency room.
2. An injured worker must report an injury to their supervisor immediately.
3. Supervisor is required to complete an "Accident Report" within 24 hours of the reported accident and forward to Bill Russell at Sargent & Associates.

Bill Russell – Sargent & Associates
Office: 978-256-7459; Fax: 978-256-4941
bill@sargentandassociates.com

Ron Severson, Safety Director
Office: 860-298-6352; Mobile: 860-906-4656
rseverson@trcsolutions.com

4. WorkCare can provide assistance in providing first aid advice and directing an injured worker to non-emergency medical care. WorkCare is a service that provides 24/7 access to an Occupational Healthcare physician or clinician.

WorkCare Incident Intervention
888-449-7787

Return to Work:

1. The injured worker is responsible for providing the Supervisor with a copy of the doctor's note detailing the injury and "return to work" status within 24 hours of the doctor's visit. The supervisor must fax or email the completed Accident Report and Doctor's notes to Sargent & Associates.
2. Sargent & Associates will contact the injured worker and the Supervisor to confirm the facts surrounding the injury.
3. Sargent & Associates will report the injury to the workers' compensation insurance carrier, The Hartford Insurance Co.
4. The Hartford may contact the injured worker and supervisor to conduct an accident investigation.
5. Sargent & Associates will maintain communication with all parties in order to monitor the medical treatment, and the injured worker's return to work status. They will act as liaison between the injured worker, TRC, and The Hartford.
6. Sargent & Associates will work with TRC's Health & Safety, Human Resources, and/or Supervisors to determine if modified duty work is an option, until the injured worker is able to return to full duty work activities.



Incident Investigation:

1. All incidents that result in injuries that require reporting for OSHA recordkeeping purposes and all high potential first aid and near miss events require an incident investigation.
2. The Supervisor with assistance from the Safety Director and/or Safety Coordinator, must complete the incident investigation report/root cause analysis within 7 days of the incident and must develop a corrective action plan within 14 days of the incident.

Attachment 5
TRC Incident Report (Blank)



TRC Incident Report Form

(To be completed immediately after an Injury, Illness, Incident, Accident or Significant Near Miss by Employee's Supervisor and Employee involved)

Incident Category	
<input type="checkbox"/> Employee Injury/Illness <input type="checkbox"/> Near Miss/Loss <input type="checkbox"/> Property Damage <input type="checkbox"/> Vehicle Accident <input type="checkbox"/> Fire <input type="checkbox"/> Other: Specify	
1	Incident Location:
2	Site Identification/Project No.:
3	Site Address:
4	Date Incident Occurred:
5	Time Incident Occurred:
6	Date Incident Reported to Supervisor:
7	Date Report Completed:
8	Was WorkCare Contacted? <input type="checkbox"/> Yes <input type="checkbox"/> No
9	Client:

TRC Employee Information	
10	Name:
11	Address:
12	Employee Phone:
13	Title or Occupation:
14	Sector/Practice:
15	Supervisor Name/Phone:

TRC Employee Information (to be completed by Worker's Compensation Claims Administrator)	
16	Employee Date of Birth:
17	Employee Social Security Number:
18	Employee Marital Status: <input type="checkbox"/> Married <input type="checkbox"/> Single
19	Number of Dependant under the age of 18:
20	Date of Hire:
21	Rate of Pay: Hours per week:

Type of Employee Injury or Illness (To be determined by Safety Director)	
22	<input type="checkbox"/> First Aid Only 20 <input type="checkbox"/> Extended Time Away From Work (3 days or more)
23	<input type="checkbox"/> Medical Treatment Only 21 <input type="checkbox"/> Fatality
24	<input type="checkbox"/> Restricted Work-case 22 <input type="checkbox"/> Other (specify):
25	<input type="checkbox"/> Lost Workday
26	Estimated Number of Days on Restricted Work:
27	Estimated Number of Days Away from Work:

Employee Injury or Illness Description	
28	Describe the Injury or Illness:
29	First Aid/Medical Treatment Administered:
30	Name of Doctor's Office, Clinic, or Hospital: Concentra
31	Address and Phone Number:

Incident Description	
32	Equipment Involved:
33	Site Description:
34	What task was being performed at time of incident?
35	Describe Incident in Detail :
36	Conditions at time of Incident: (weather, lighting, etc.):
37	Motor Vehicle Accident:
38	TRC Vehicle ID:

39	Year/Make/Model:	
<input type="checkbox"/> DOT Regulated Vehicle <input type="checkbox"/> Towed From Scene <input type="checkbox"/> Airbag Deployed <input type="checkbox"/> Seatbelt in Use <input type="checkbox"/> TRC Fleet <input type="checkbox"/> Rental <input type="checkbox"/> Personal Vehicle		
40	Other Vehicle License Plate	
41	Other Vehicle Year/Make/Model	
42	Other Vehicle Driver Name	
43	Other Vehicle Year/Make/Model	
44	Other Injured Parties	<input type="checkbox"/> Yes <input type="checkbox"/> No
43	Description of other injuries:	

Subcontractor Involvement / Description of Incident	
44	Subcontractor Involved: <input type="checkbox"/> Yes <input type="checkbox"/> No
45	Name of Company:
46	Address:
47	Contact Name and Phone Number:
48	Subcontractor Description of Incident:

Witness Involvement / Description of Incident	
49	Witnesses to Incident: <input type="checkbox"/> Yes <input type="checkbox"/> No
50	Name(s) and Address(s):
51	Phone Number(s):
52	Witness Description of Incident:

Personal Protective Equipment (PPE)	
53	List PPE required to complete the task: (glasses, gloves, shoes, hard hat, respirator, hearing protection, etc.)
54	Was the employee using the proper PPE at the time of the Incident?

Immediate Corrective Actions	
55	Describe the immediate corrective actions taken:
56	Immediate Supervisor: _____ Signature: _____ Date: _____
57	Employee: _____ Signature: _____ Date: _____

Supervisor's Post-Incident Review and Recommendations	
Safety Violation <input type="checkbox"/> Yes <input type="checkbox"/> No	
58	State the company safety rule, OSHA regulation, or specific training that was violated:
59	Describe the training the employee received to prevent this violation:

#	Root Cause Factors (RCF)
1	Lack of skill or knowledge
2	In the past, did not follow procedures or acceptable practices and no incident occurred (injury, product quality incident, equipment damage, regulatory assessment or production delay)
3	Doing the job according to procedures or acceptable practices takes more time/effort
4	Short-cutting procedures or acceptable practices are positively reinforced or tolerated
5	Lack of or inadequate operational procedures
6	Inadequate communication of expectations regarding procedures or acceptable practices
7	Inadequate tools or equipment (available, operable and safely maintained, proper task and workplace design)
8	External factors

60	Root Cause(s)	Identified Root Cause(s):							
		#1	#2	#3	#4	#5	#6	#7	#8
A		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

61	Conclusion: Why did the Incident Occur?

62	Item No.	RCF No.	Recommended Corrective Action(s) How to Prevent Incident from Reoccurring	Responsible Person	Due Date	Completed (date)	Verified/Validated (date)

Supervisor: _____ Signature: _____ Date: _____
TRC Safety Director: _____ Signature: _____ Date: _____

ATTACHMENT 3
DOSAGE CALCULATIONS AND RELATED INFORMATION

**650 WARING AVENUE
DOSAGE CALCULATIONS AND RELATED INFORMATION**

650 WARING AVENUE DOSAGE CALCULATIONS AND RELATED INFORMATION

Objective

The chlorinated VOCs tetrachloroethene (PCE), trichloroethene (TCE), and 1,1,1-trichloroethane (TCA) are present in Site groundwater. The objective of the in-situ injection of sodium lactate is to accelerate the rate and efficiency of anaerobic degradation of chlorinated VOCs in the groundwater at the Site. Groundwater sampling results have indicated that the chlorinated VOCs are naturally degrading under current site conditions based on the following:

- Partially degraded (dechlorinated) daughter compounds for each of the parent compounds have been detected in groundwater and the daughter to parent concentration ratios increase with distance from PS96X-TRC-MW-15R. The increasing daughter to parent concentration ratios are a strong indication the naturally occurring degradation process can be accelerated to completion by enhancing the aquifer conditions to favor anaerobic reduction processes.
- Typically, anaerobic degradation rates are increased through the addition of a substrate or carbon source to the aquifer. Based on Site conditions, sodium lactate and Hydrogen Release Compound (HRC®) would be a favorable substrate for batch injection into the aquifer.

Review of Amendment Composition

TRC reviewed data obtained during the Supplemental Investigation as well as the previous groundwater sampling event conducted in January 2017 to determine an appropriate amendment composition and dosage. Groundwater surface elevation contour maps generated after installation of PS96X-TRC-MW-19 (installed in December 2016) and Supplemental Investigation monitoring wells (installed in September 2017) indicated a groundwater gradient steeper than observed previously, demonstrating periodic and short-duration changes in groundwater velocities. Based on the potential for variation in groundwater gradient, the composition of the amendment that was previously utilized (i.e., 60% sodium lactate solution and water) should be modified to consist of a solution of sodium lactate and HRC® in water. HRC® (manufactured by Regenesis Remediation Products) is a stabilized lactate that is more persistent in the environment, and therefore is expected to perform better under the potentially diluting conditions resulting from periodic groundwater gradient fluctuation beneath the Site.

Calculated Substrate Demand

Groundwater sampling results indicate that there are two major parameters that impact substrate demand in the Site aquifer, chlorinated VOCs and sulfate concentrations. The substrate demand is calculated based on the estimated mass of these compounds in the Site groundwater and aquifer matrix. Sulfate demand is driven by sulfate-reducing bacteria (SRBs) that are ubiquitous in most groundwater matrices.

- The mass of sulfate required is estimated using the average parameter concentrations and volume of groundwater in the targeted treatment zone. Basis:
 - Targeted treatment zone is approximately 100' by 200' by 12 feet thick.
 - Estimated volume of groundwater, using a porosity of 1.1%, is 19,750 gallons.
 - Average concentration of sulfate is 400 milligrams per liter (mg/l), with a calculated estimated mass of 66 pounds.
 - Substrate demand by SRB is approximately 8 times the mass of sulfate, or 528 pounds of sodium lactate.

**650 WARING AVENUE
DOSAGE CALCULATIONS AND RELATED INFORMATION**

- Mass of CVOCs is calculated from the mass of dissolved phase CVOCs and an estimated mass of available CVOCs contained within the aquifer matrix. The estimated available matrix mass of CVOCs is approximately 10 times the dissolved phase mass of CVOCs. Basis:
 - Targeted treatment zone is approximately 100' by 200' by 12 feet thick.
 - Average concentration of CVOCs was estimated (conservatively) from historic groundwater results; an average concentration of 1 mg/l of total CVOCs was estimated.
 - Estimated mass of dissolved phase CVOCs was calculated as 0.17 pounds.
 - Mass of matrix available CVOCs is estimated to be 1.7 lbs
 - Substrate demand by dechlorinating microbes is estimated to be approximately 4 times the available mass of CVOCs or 7 pounds.

- A dilute solution of sodium lactate and Hydrogen Release Compound (HRC®) in water is the selected composition to meet the demand of SRBs and CVOCs (535 pounds sodium lactate).
 - The dosage composition that is provided in the table below will be mixed with 990 gallons of water prior to equally distributing via gravity into PS96X-TRC-MW-15R, PS96X-TRC-MW-17, and PS96X-TRC-MW-18.

Component	Composition (% sodium lactate)	Substrate Demand Mass (lbs)	Dosage Volume (gallons)	Injection Volume of Water (gallons)
Sodium Lactate	60	385	59	990
HRC	Undisclosed	150	23	

