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November 6, 2014

Matthew Aufman
NCDENR - Division of Waste Management
217 West Jones Street
Raleigh, North Carolina 27603



Subject: Air Sparge Soil Vapor Extraction Pilot Test Workplan
Engineered Controls International, LLC (ECI)
100 Rego Drive
Elon, Alamance County, North Carolina
Docket No. 13-SF-367

Dear Mr. Aufman:

On behalf of ECI, ERM NC, Inc. (ERM) has prepared this workplan to conduct an air sparge / soil vapor extraction pilot test at the referenced site in Elon, North Carolina. Results of the pilot test will be included in a Remedial Action Plan, when completed for the site. Please do not hesitate if you have any questions on this submittal.

Sincerely,

Edward B. Hollifield, P.G.
Project Manager

Cc: Tom Wilson, P.G. RSM - ERM NC, Inc.
Tim Crater - Engineered Controls International, LLC
Jimmy McCandies - Engineered Controls International, LLC
Peter McGrath - Moore & Van Allen, PLLC
Sarah Broughel - Choate, Hall & Stewart, LLP

REC PROGRAM DOCUMENT CERTIFICATION FORM - PAGE 2 OF 2

IHSB SITE NAME Engineered Controls International LLC - NONCD0002904, Docket Number 13-SF-367 (Elon)

DATE & NAME OF DOCUMENT 2014-11-06_Pilot Test Work Plan

TYPE OF SUBMITTAL (circle all that apply): Report Work plan, Work Phase Comp. Statement, Schedule Change

REGISTERED SITE MANAGER CERTIFICATION OF SIGNATURES

As the Registered Environmental Consultant for the Site for which this filing is made, I certify that the signatures included herewith are genuine and authentic original handwritten signatures and/or true, accurate, and complete copies of the genuine and authentic original handwritten signatures of the persons who purport to sign for this filing. I further certify that I have collected through reliable means the originals and/or copies of said signatures from the persons authorized to sign for this filing who, in fact, signed the originals thereof. Those persons and I understand and agree that any copies of signatures have the same legally binding effect as original handwritten signatures, and I certify that any person for whom I am submitting a copy of their signature has provided me with their express consent to submit said copy. Additionally, I certify that I am authorized to attest to the genuineness and authenticity of the signatures, both originals and any copies, being submitted herewith and that by signing below, I do in fact attest to the genuineness and authenticity of all the signatures, both originals and copies, being submitted for this filing.

Thomas M. Wilson

Name of Registered Site Manager

Thomas M Wilson
Signature of Registered Site Manager

11-6-2014
Date

REGISTERED SITE MANAGER DOCUMENT CERTIFICATION STATEMENT (.0306(b)(1))

"I certify under penalty of law that I am personally familiar with the information contained in this submittal, including any and all supporting documents accompanying this certification, and that the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete and complies with the Inactive Hazardous Sites Response Act N.C.G.S. 130A-310, et seq, and the remedial action program Rules 15A NCAC 13C .0300. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information."

Thomas M Wilson
Name of Registered Site Manager

Thomas M Wilson
Signature of Registered Site Manager

11-6-2014
Date

NOTARIZATION

North Carolina (Enter State)

Mecklenburg COUNTY

I, Debra C Pressley, a Notary Public of said County and State, do hereby certify that

Thomas M Wilson did personally appear and sign before me this day, produced proper

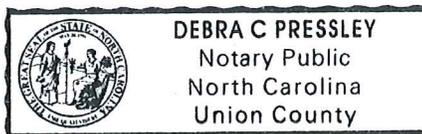
identification in the form of NCDL, was duly sworn or affirmed, and declared that, he or she is the duly authorized environmental consultant of the remediating party of the property referenced above and that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certifications is true and accurate, and he or she then signed these Certifications in my presence.

WITNESS my hand and official seal this 6 day of November, 2014.

Debra C Pressley
Notary Public (signature)

(OFFICIAL SEAL)

My commission expires: 10/29/2017



REC PROGRAM DOCUMENT CERTIFICATION FORM - PAGE 1 OF 2

IHSB SITE NAME Engineered Controls International LLC - NONCD0002904, Docket Number 13-SF-367 (Elon)

DATE & NAME OF DOCUMENT 2014-11-06_Pilot Test Work Plan

TYPE OF SUBMITTAL (circle all that apply): Report, Work plan, Work Phase Comp. Statement, Schedule Change

REMEDIATING PARTY DOCUMENT CERTIFICATION STATEMENT (.0306(B)(2))

"I certify under penalty of law that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this certification, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information."

Mr. Tim Crater (ECI)

Name of Remediating Party

[Handwritten Signature]
Signature of Remediating Party

10/31/14
Date

NOTARIZATION

North Carolina (Enter State)
Alamance COUNTY

I, Patricia T. Hill, a Notary Public of said County and State, do hereby certify that Timothy G. Crater did personally appear and sign before me this day, produced proper identification in the form of personally known, was duly sworn or affirmed, and declared that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certification is true and accurate, and he or she then signed this Certification in my presence.

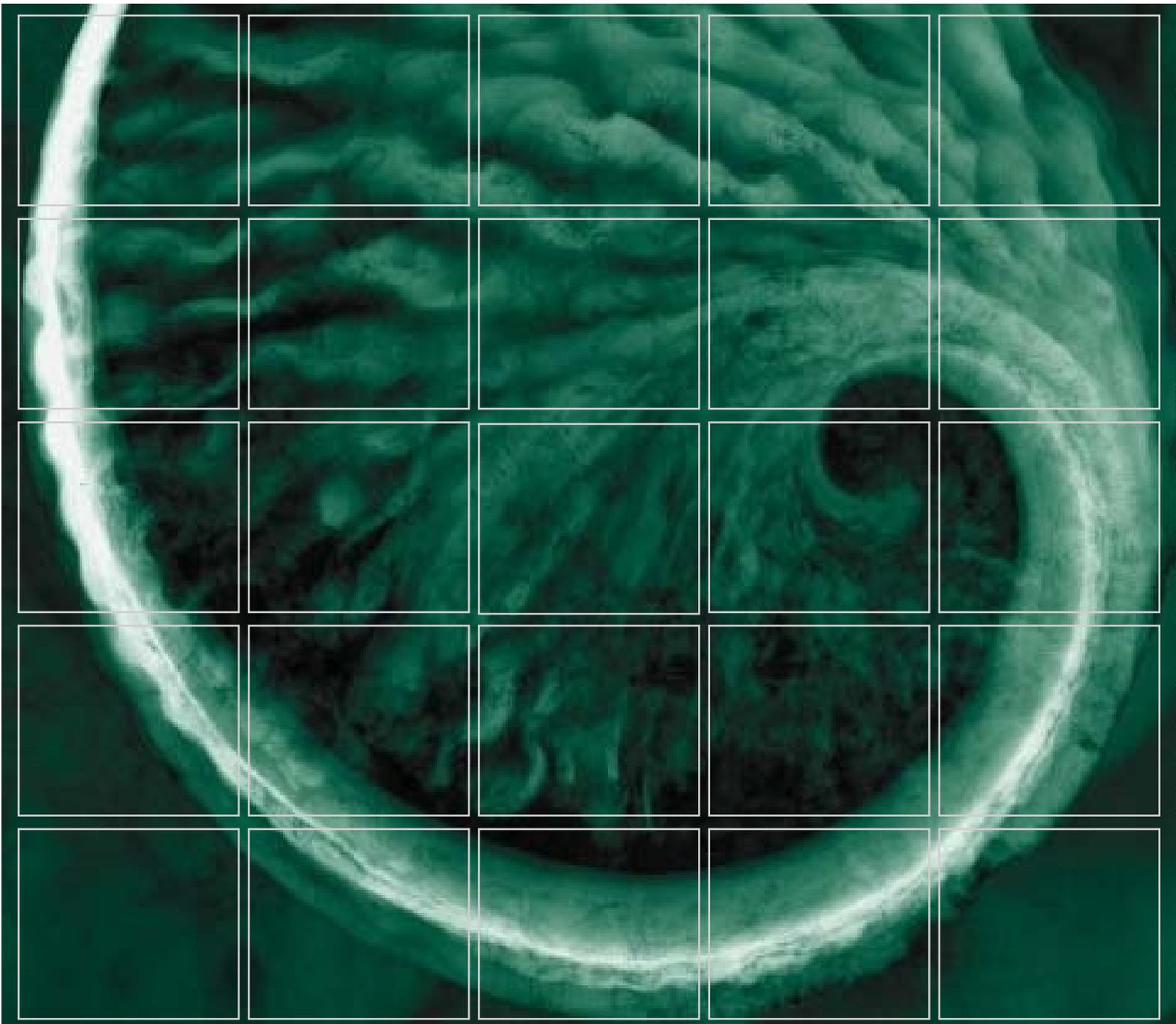
WITNESS my hand and official seal this 31 day of October, 2014

Patricia T. Hill
Notary Public (signature)

(OFFICIAL SEAL)

My commission expires: 2-7-17





Engineered Controls International, LLC

Pilot Test Work Plan

November 2014

Elon Facility

100 Rego Drive,

Elon, Alamance County,

North Carolina

Engineered Controls International LLC

Pilot Test Work Plan

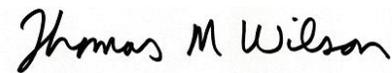
Elon Facility
100 Rego Drive
Elon, Alamance County,
North Carolina
Docket Number 13-SF-367

November 6, 2014

Project No. 0268950



Edward B. Hollifield, P.G.
Project Manager



Thomas M. Wilson, P.G., RSM
Principal-in-Charge

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List of Acronyms

AA	ADMINISTRATIVE AGREEMENT
AOCS	AREAS OF CONCERN
AS	AIR SPARGE
AS/SVE	AIR SPARGING/SOIL VAPOR EXTRACTION
CFM	CUBIC FEET PER MINUTE
COCS	CONTAMINANTS OF CONCERN
DO	DISSOLVED OXYGEN
ECI	ENGINEERED CONTROLS INTERNATIONAL, INC.
FT BLS	FEET BELOW LAND SURFACE
HASP	HEALTH AND SAFETY PLAN
HERA	HEALTH & ENVIRONMENTAL RISK ASSESSMENT
HSL	HAZARDOUS SUBSTANCE LIST
IHSB	INACTIVE HAZARDOUS SITES BRANCH
NCAC	NORTH CAROLINA ADMINISTRATIVE CODE
NCDENR	NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
OB WELL	OBSERVATION WELL
ORP	OXIDATION-REDUCTION POTENTIAL
P&ID	PROCESS AND INSTRUMENTATION DIAGRAM
PID	PHOTOIONIZATION DETECTOR
PSRG	PRELIMINARY SOIL REMEDIATION GOAL
PSI	POUNDS PER SQUARE INCH
PWR	PARTIALLY WEATHERED ROCK
RAP	REMEDIATION ACTION PLAN
REC	REGISTERED ENVIRONMENTAL CONSULTANT
ROI	RADIUS OF INFLUENCE
SESD	SCIENCE AND ECOSYSTEM SUPPORT DIVISION
SSC	SUBSURFACE CLEARANCE
SVE	SOIL VAPOR EXTRACTION
SVOCS	SEMI-VOLATILE ORGANIC COMPOUNDS
UIC	UNDERGROUND INJECTION CONTROL
VOC	VOLATILE ORGANIC COMPOUND
WORK PLAN	PILOT TEST WORK PLAN

1.0 INTRODUCTION

Engineered Controls International, Inc. (ECI) retained ERM NC, Inc. (ERM) to prepare this Pilot Test Work Plan (Work Plan) for the ECI Elon site located at 100 Rego Drive in Elon, Alamance County, North Carolina (hereafter called the "Site" or "subject property") (NONCD0002903). Remedial activities at the Site are being conducted in accordance with the Administrative Agreement (AA) for a voluntary Registered Environmental Consultant (REC) directed assessment and remedial action between the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management Superfund Section and Engineered Controls International, Inc. (the Remediator), Docket Number 13-SF-367 executed on July 23, 2013 and subsequently amended on January 30, 2014.

The purpose of this Work Plan is to document the activities and methods for implementing a pilot-scale system for evaluation of Air Sparging/Soil Vapor Extraction (AS/SVE) technologies that may be proposed to remediate areas of chlorinated solvent-affected soils and groundwater at the Site. The conceptual remedial approach is to treat the source area with AS/SVE technology and simultaneously monitor the effects of source area remediation on the downgradient plume volatile organic compound (VOC) concentrations. Because source area remediation is expected to reduce the source mass discharge (i.e. source mass flux), downgradient VOC plume concentrations are expected to decrease in response to source treatment proportionately.

The Work Plan has been prepared to meet the specific requirements of the current NCDENR's Inactive Hazardous Sites Branch (IHSB) *Registered Environmental Consultant Program Implementation Guidance*, dated December 2013 (the REC guidance).

2.0 BACKGROUND

The site background information for the ECI Elon facility has been presented in previous reports. However, a brief overview of background information is provided below.

2.1 SITE LOCATION

The Site is located at 100 Rego Drive in Elon, Alamance County, North Carolina. The site topographic map is shown in [Figure 1](#) and a site layout map is presented in [Figure 2](#). The ECI Elon facility is situated on approximately 13 acres and includes approximately 100,000 square feet of manufacturing, warehousing and office space. The approximate coordinates of the site are: latitude 36.10118° N; longitude 79.5185° W.

2.2 SITE SETTING

2.2.1 Site Hydrology

Based on the groundwater elevation data collected in May 2014 and as shown on [Figure 3](#), the groundwater flow in the shallow (saprolite) aquifer zone is generally to the northeast and the groundwater flow in the upper bedrock aquifer zone is generally to the north. There is an intermittent creek on the undeveloped eastern portion of the property. Based on Site topography, it appears that overland run-off from the developed portions of the Site drain to the east into the intermittent stream channel that ultimately drains to the north into Travis Creek, located approximately 1.5 miles north of the Site. A small pond is located approximately 0.25 mile north of the Site.

2.2.2 Site Geology

The subject property is located within the Piedmont Physiographic Province of North Carolina, which is characterized by metamorphic and igneous rocks of varying age. As reported by previous consultants during historical onsite environmental assessments and confirmed during recent Phase I RI activities, bedrock is present at approximately 60 feet below land surface (ft bls). The bedrock is overlain by a layer of saprolite, a weathered and variably decomposed bedrock, which has the appearance of compact clayey to sandy soil that grades with depth to dense partially weathered rock (PWR). Groundwater at the site occurs within two separate, but interconnected, water-bearing zones. A shallow water-bearing zone occurs within the saprolite/PWR zone and a deeper aquifer zone occurs within the underlying competent bedrock.

2.2.3 Site Hydrogeology

The depth to groundwater varies across the site from 14 ft bls on the east side of the Site to 59 ft bls at the central portion of the Site. Groundwater elevation data collected from the Site monitor wells in May 2014 indicate that groundwater flow in the shallow (saprolite) aquifer is generally to the northeast and groundwater flow in the upper bedrock zone is generally to the north towards Travis Creek which is located approximately 1.5 miles north of the Site. Groundwater elevation data and flow directions are presented in [Figure 3](#). The locations of two hydrogeologic cross sections of the site are depicted on [Figure 4](#). The subsurface hydrogeology is shown on hydrogeologic cross sections ([Figures 5 and 6](#)).

ERM performed slug tests in May 2014 at select saprolite monitor wells (MW-1, MW-4, and MW-7), upper bedrock monitor wells (DW-3, and DW-5), and deeper bedrock monitor well (DW-2). Based on the May 2014 water level gauging and calculated hydraulic conductivities, the average groundwater seepage velocity in the saprolite aquifer zone using a porosity of 35% is approximately 3.0 feet per year. Using a primary porosity of 25% average groundwater seepage velocity of the upper bedrock aquifer zone is approximately 24 feet per year.

2.3 SUMMARY OF PREVIOUS INVESTIGATIONS

Previous investigations at the site were conducted by MACTEC in 2009 and GaiaTech in 2010-2013. A detailed summary of previous environmental activities was provided in the *Remedial Investigation Work Plan* (ERM-April 2014).

Based on a review of the ECI operations history and the results of previous environmental investigations, the following six areas of concern (AOCs) were identified at the Site that warranted additional remedial investigation for the potential release of hazardous substances to soil and groundwater:

- AOC 1: Former Vapor Degreaser;
- AOC 2: Bright Dip Line;
- AOC 3: Former Zinc Plating Line;
- AOC 4: Former Solvent-Based Painting/Storage;
- AOC 5: Abandoned Drum and Debris Piles in Wooded Area; and
- AOC 6: Hazardous Waste Storage Area

Previous significant reports that document environmental assessment and remediation at the ECI Elon site are listed below.

<i>Author/Date</i>	<i>Document Title</i>	<i>Description</i>
MACTEC-March 24, 2009	Phase I Environmental Site Assessment	Summary of Phase I findings. Results indicated that no Recognized Environmental Conditions were found.
GaiaTech - July 2010	Phase I Environmental Site Assessment	Summary of Phase I findings. Results identified Recognized Environmental Conditions including historical use of a TCE vapor degreaser, solvent-based paints, and a zinc plating line. The report identified the following noteworthy issues: potential releases from subgrade pits and sumps, uncertain historical operations associated with cleared areas on the eastern portion of the Site in the 1960s and 1970s, and uncertainty regarding the nature of operations by a prior Site occupant that manufactured cardboard boxes.
GaiaTech - July 29, 2010	Environmental Compliance Review	Summary of limited compliance review. GaiaTech did not identify any significant compliance deficiencies.
GaiaTech - December 2011	Limited Phase II Site Investigation	Summary of Phase II site inspection findings. The assessment identified historic releases of hazardous substances at three apparent source areas: the former vapor degreaser area, the bright dip/WWTP area, and the hazardous waste storage area.
GaiaTech - April 27, 2012	Notification of an Inactive Hazardous Substance or Waste Disposal Site	Based on the results from the 2011 Phase II Limited Site Investigation, ECI submitted a notice of an inactive hazardous substance or waste disposal site.
GaiaTech - December 21, 2012	Soil Vapor Investigation Activities	Summary of findings regarding the initial assessment of potential vapor intrusion issues. Based on sub-slab soil vapor testing results, it was determined that indoor air testing was needed.
GaiaTech - March 27, 2013	Summary Memorandum: Additional Phase II Investigations	Summary of site inspection findings. The purpose of these supplemental activities was to delineate impacts to soils and groundwater resulting primarily from historic releases at three apparent source areas identified during the 2011 assessment. Indoor Air Assessment Activities were also summarized.
GaiaTech - September 2013	Phase I Environmental Site Assessment	Summary of Phase I findings. Results indicated that a Recognized Environmental Condition was found: Releases from Historical Operations and various levels of further assessment were suggested for the site.
GaiaTech - September 2013	Limited Environmental Compliance Review	Summary of limited compliance review. GaiaTech did not identify any significant compliance deficiencies.
ERM - February 7, 2014	Vapor Intrusion Assessment Work Plan	Summary of planned activities for an indoor air vapor intrusion assessment that mimics the February and March 2013 sampling events to verify the VOC concentrations in indoor air in the main onsite building.

<i>Author/Date</i>	<i>Document Title</i>	<i>Description</i>
ERM – April 17, 2014	Remedial Investigation Work Plan	Summary of previous investigative and monitoring activities at the site. Presents the plan to delineate the extent of VOC concentrations in soil and groundwater. ERM identifies three potential AOCs at the Site that warrant remedial investigation for releases of hazardous substances: (1) Former Vapor Degreaser System, (2) Bright Dip Line, (3) Former Zinc Plating Line, (4) Former Solvent-Based Paint Storage Area, (5) Abandoned Drum and Debris Piles in Eastern Wooded Area, and (6) Hazardous Waste Storage Area.
ERM – August 2014	Draft Phase I Remedial Investigation Report	Summary of the soil and groundwater assessment activities. A residual VOC source mass in soils was characterized and delineated at the Former Vapor Degreaser Area (AOC 1). Only two soil samples, both located beneath the concrete floor, contained VOC concentrations above the industrial PSRGs.
ERM – September 23, 2014	Remedial Investigation Work Plan Addendum	Summary of planned additional groundwater assessment activities at the site.

2.4 NATURE & EXTENT OF CONTAMINATION

2.4.1 Soil

Based on the historical and the 2014 Phase I RI assessment results, the major findings of the remedial investigation at the Site include the following:

- A residual VOC source mass in soils has been characterized and delineated at the Former Vapor Degreaser Area (AOC 1). The affected soils are attributed to historical releases related to the former use of trichloroethene (TCE) at AOC 1. As required, the extent of the VOC-affected soils has been delineated to the unrestricted/residential Preliminary Soil Remediation Goal (PSRG) of 880 micrograms per kilogram ($\mu\text{g}/\text{kg}$) TCE. Only two soil samples, both located beneath the concrete floor, contain VOC concentrations above the industrial PSRG. A soil isoconcentration map is provided as [Figure 7](#).
- Based on the soil assessment results, there are no apparent releases of TCE or other site-related hazardous substances at the five other AOCs at the Site: Bright Dip Line (AOC 2), Former Zinc Plating Line (AOC 3), Former Solvent-Based Painting/Storage Area (AOC 4), Drum & Debris Piles (AOC 5) and Hazardous Waste Storage Area (AOC 6).
- In accordance with IHSB guidance, a site specific protection of groundwater remediation goal for TCE affected soil of 330 $\mu\text{g}/\text{kg}$ has been calculated for the affected soils in AOC 1.
- The detected metals concentrations in site soils are determined to be within naturally occurring background concentrations (arsenic and manganese), are

sporadic and isolated in occurrence (mercury and nickel) and/or are not site related (selenium).

- Based on soil sampling, semi-volatile organic compounds (SVOCs) are not compounds of concern at the site.

2.4.2 *Groundwater*

- TCE is the primary COC in Site groundwater with the highest concentration of 3,030 micrograms per liter ($\mu\text{g}/\text{l}$) being detected in the samples collected from MW-7, installed in the immediate downgradient vicinity of the Former Vapor Degreaser Area (AOC 1). The VOC-affected groundwater extends from AOC 1 to the northeast in the shallow saprolite aquifer and in the upper bedrock aquifer. A TCE isoconcentration map for the saprolite aquifer zone is provided as [Figure 8](#).
- The lateral extent of the VOC-affected groundwater in the shallow saprolite aquifer is delineated within the property boundary. The lateral extent of the VOC-affected groundwater in the upper bedrock aquifer is not fully delineated, but appears to be near the northern property boundary. Additional RI activities to define the lateral extent of impact in upper bedrock is pending upon gaining access to the offsite Elon University property immediately north and downgradient of the subject site.
- Based on analyses of groundwater samples from DW-2, the VOC-affected groundwater extends into the intermediate-depth bedrock aquifer zone and the vertical extent is delineated by recently installed monitor well DW-2D.
- Based on results of natural attenuation analysis, site groundwater conditions appear generally favorable to natural attenuation by reductive dechlorination with respect to nitrate, nitrite, and sulfate. The capacity for natural attenuation appears to be limited with respect to total organic carbon and oxidation reduction potential.
- Metals are not considered to be constituents of concern in groundwater at the site. A possible exception is elevated copper, manganese and nickel in groundwater at monitor well GP-2 located at the Former Vapor Degreaser Area. Additional groundwater sampling is necessary to determine if the detected metals are related to the source area release or GP-2 well construction.

2.4.3 *Sensitive Receptor Survey*

- The area in the vicinity of the site is served by the Town of Elon public water supply system.
- Based on a water supply well survey performed in 2014 within 1/2-mile of the subject property, two inactive water wells are located on separate residential

properties to the north (hydraulically downgradient) of the site on West Haggard Avenue. Both properties are served by the Town of Elon public water supply system. The nearest active water supply well is located approximately 300 feet northwest and sidegradient from the northwest property corner of the Site at a commercial business at West Haggard Avenue.

3.0 OBJECTIVES & PROJECT TEAM

The following subsections present the objectives for this Work Plan as well as the prescribed pilot testing. A summary of the project team is also presented below.

3.1 OBJECTIVES OF THE AS/SVE PILOT TEST

The AS/SVE pilot test is designed to evaluate the efficacy of the individual and combined remedial technologies for use within the COC-impacted source area vadose zone soils and underlying impacted groundwater. This Work Plan was prepared to describe the scope, schedule and project personnel required for the execution of the pilot test activities and subsequent data evaluation and reporting. Through the pilot testing, optimal design parameters will be evaluated to be applied to a full-scale remediation system, if deemed appropriate.

The pilot test will be performed to determine optimal operating parameters for a full-scale AS/SVE system. In particular, the air sparge flow rate, vapor extraction rate, VOC recovery rate, respective pressures/vacuums, and the resulting radii of influence, are critical. Key parameters to be measured include the following:

- The air extraction rate that is achievable from a Soil Vapor Extraction (SVE) well under a given vacuum;
- The sub-surface vacuum induced at varying distances from an SVE well (to evaluate the zone of vacuum influence);
- An estimate of the VOC emissions that initially occur through the use of an SVE system;
- The concentrations of VOCs in extracted vapors with time during the test and after SVE pilot testing ceases;
- The air injection rate that is achievable from an Air Sparge (AS) system under a given pressure;
- A measure of groundwater dissolved oxygen (DO) and mounding at varying distances from the air sparge well;
- A measure of the VOC emissions with the introduction of air sparging.

The effectiveness of AS/SVE will be measured by monitoring the DO and VOC concentrations in air extracted from the vadose zone before operating the SVE system and comparing these data to measurements taken after 1) SVE is initiated, 2) AS is initiated, 3) upon initiation of the combined AS/SVE approach, and 4) following cessation of the pilot test activities.

3.2 OBJECTIVES OF THE WORK PLAN

The objectives of this Work Plan are to provide trained project and field personnel with the following:

- System construction details,
- Startup requirements,
- Operation requirements,
- Health and safety plan,
- A schedule and sequence of pilot test activities,
- Data evaluation criteria, and
- Reporting requirements.

A site-specific Health and Safety Plan (HASP) was prepared and is included as [Appendix A](#). The HASP contains safety protocols and potential risks associated with well installation and sampling tasks similar to those described in this Work Plan. Additional tasks included in this Work Plan were added to the existing HASP, specifically hazards related to:

- Electrical components (e.g. lockout/tag-out procedures for operation of the blower);
- Leakage of extracted soil vapor (e.g. air monitoring near discharge piping);
- Fueling of SVE/AS system mechanical components (if needed); and
- Working with pressurized air lines.

Field activities will be carried out according to protocols outlined in the HASP, which will be provided to and signed by all field personnel (both ERM and all subcontractors) prior to beginning work. The purpose of the HASP is to:

- Assure that appropriate personal protective equipment is available and properly used by ERM and subcontractor field personnel.
- Help ensure that personnel are aware of the potential hazards involved in field activities and are instructed in safe work practices and emergency procedures.
- Provide guidelines by which a site safety officer conducts onsite monitoring of personnel hazards (chemical and physical) prior to initiation of and during field activities. This includes calibration instructions for monitoring equipment.
- Provide measures to protect the surrounding community from potential exposure to hazardous substances that may be generated by the pilot test activities. The goal is to ensure the health and safety of all persons on and off property will not be adversely affected by the remedial activity

- Establish lines of communication with all on-site and off-site personnel in the event there is an emergency or dangerous site condition.

3.3 PROJECT TEAM FOR PILOT TESTING ACTIVITIES

The project team includes the following key personnel:

<i>Title</i>	<i>Name</i>	<i>Responsibilities</i>
<i>ECI, Inc.</i>		
Client Contact	Jimmy McCandies	Overall project administration for ECI
<i>ERM</i>		
Partner-in-Charge	Tom Wilson, P.G.	Overall project supervision Client support, point-of-contact
Project Manager	Ed Hollifield, P.G	Overall project execution/Client point-of-contact
Project Geologist / Field Safety Officer	Frans Lowman or Thomas Naumann, P.G.	Subsurface clearance oversight Well installation oversight Pilot test system construction oversight Assist with pilot test startup, operation, and data collection
Project Engineer	Joshua Fell, P.E.	Design and technical support Data reduction and interpretation
Project Health & Safety Advisor	Don Hall, CSP	Provide H&S advisory services before and during the pilot testing activities. Support project execution in compliance with ERM and client H&S protocol
<i>Geologic Exploration</i>		
Project Manager	Matt Tischler	Project supervision for AS/SVE pilot test equipment operation
Field Crew	To Be Determined	AS/SVE Pilot Test Equipment Operation

4.0 PILOT TEST DETAILS

A pilot test will be conducted to evaluate the effectiveness of AS/SVE technology to reduce the mass of COCs in source area soil and groundwater and estimate design parameters for full-scale remediation system design, if selected.

4.1 TECHNOLOGY BACKGROUND

4.1.1 Soil Vapor Extraction

During SVE operation, a vacuum is applied through a network of SVE wells near the source of soil contamination, which creates a negative pressure gradient that causes movement of soil vapors toward these wells. As VOCs volatilize, the vapors are drawn toward the extraction wells.

In low permeability regions, subsurface flow is relatively low. As such, a concentration gradient is created between the high and low permeability regions. The concentration gradient causes COCs to diffuse into the higher permeability areas (i.e. the lower concentration regions) and be removed by the SVE system through advection.

The increased air flow through the subsurface can also stimulate biodegradation of some COCs, especially those that are less volatile.

Select factors that determine SVE effectiveness include:

- Soil permeability;
- Soil structure and stratification;
- Soil moisture;
- Depth to groundwater; and
- Vapor pressure of the VOC.

Data collected during the pilot test will be used to evaluate the air permeability of the soil, which in turn will be used to estimate a radius of influence (ROI) for SVE at different flow rates and distances from an extraction point. The ROI is defined as the greatest distance from an extraction well at which a vapor flow can be induced to adequately enhance volatilization and extraction of COCs in the soil.

4.1.2 Air Sparge

AS is an in situ remedial technology that reduces the concentrations of VOCs in the adsorbed, dissolved, and non-aqueous phases through phase transfer. Contaminant-free air is injected into the subsurface saturated zone, enabling a

phase transfer of VOCs from the adsorbed, dissolved, or non-aqueous phases to the vapor phase. The VOC-laden vapors then enter the unsaturated zone and are captured by SVE. AS can also be applied in the unsaturated zone to enable adsorbed, dissolved (e.g. infiltrating water), or non-aqueous phase transfers to the vapor phase and subsequent removal by SVE.

The introduction of oxygen to the saturated and overlying vadose zones can also stimulate biodegradation of some of the COCs, especially those that are less volatile.

Air sparging is usually combined with SVE. The SVE system creates a negative pressure in the unsaturated zone through a series of extraction wells to capture the injected air and limit vapors escaping to the environment.

Select factors that influence AS effectiveness include:

- Water-bearing zone thickness and submerged depth of the AS well-screen;
- Permeability of the soil; and
- VOC phase-partitioning.

In general, AS is more effective for constituents with greater volatility and lower solubility and for soils with higher permeability. Soil characteristics will also determine the preferred zones of vapor flow in the vadose zone, thereby indicating the ease with which vapors can be controlled and extracted using SVE.

The data collected during the pilot test will be used to evaluate the air permeability of soil and the ROI of injected air (as measured by groundwater mounding and changes in dissolved oxygen and VOC concentrations) in the saturated zone. These data will be used to evaluate the ROI for AS at different flow rates and distances from the AS well.

4.2 *PILOT TEST LAYOUT*

The pilot test will be conducted along the exterior east-central portion of the facility and immediately downgradient of the former vapor degreaser source area and will be completed with individual AS and SVE wells that will potentially be incorporated into the final AS/SVE remedial design.

The AS and SVE wells will be positioned within the exterior of the loading dock area on the east-central side of the ECI facility building. Lateral heterogeneities and horizontal anisotropy will be evaluated using monitoring points installed in two directions (i.e. monitoring legs) positioned at varying distances from the AS/SVE wells. Each monitoring point will consist of one groundwater observation well (OB well) screened below the water table. The monitoring points will be used to estimate AS and SVE ROI.

A plan view of the SVE and AS wells and monitoring points is presented on [Figure 2](#). The actual location of the monitoring points, SVE, and AS wells will be determined in the field based on accessibility for drilling equipment and the results of ERM's subsurface clearance (SSC) protocol which will be conducted to avoid underground utilities.

4.3 SVE/AS WELL INSTALLATION

4.3.1 Air Sparge Well

One air sparge well (AS-1) will be installed at the facility to use during the pilot test. The AS well boring will be completed using traditional rotary hollow stem auger (RHSA) drilling equipment advancing 4 1/4-inch inside diameter hollow stem augers producing an approximately 8-inch borehole to a total depth of 60 feet bls.

The AS well will be constructed as a Type II (single-cased) well with 5 feet of 0.010" slotted screen and 55 feet of riser. For the subgrade portions of the well, two-inch inner diameter, schedule 40 PVC will be used. A washed silica sand filter pack will be used to fill the annular space between the borehole wall and the AS well screen. Schedule 80 PVC will be used above grade as a safety precaution related to the pressurized line. The well head will be finished approximately 3 inches below grade with a locking expandable cap. The AS well head will be fitted with a flush-mount surface completion within a traffic-rated well vault. A schematic of the proposed AS well is presented as [Figure 9](#).

The total depth and screened interval stated above are anticipated based on lithologic and monitoring well data in the immediate vicinity. However, the actual total depth and screened interval will be determined in the field by a project geologist or other qualified staff based on soil logging observations during drilling.

Following installation, the AS well will be developed using a submersible pump, bailer, or surge block. A minimum of three borehole volumes of groundwater will be removed during development. Parameter measurements of groundwater pH, specific conductivity, and temperature will be recorded after each borehole volume is removed to evaluate well stability. The AS well will be considered stable (i.e., development completed) after these parameters stabilize within ± 0.1 standard units for pH, $\pm 3\%$ for conductivity, $\pm 0.5^\circ\text{C}$ for temperature, and visual clarity of the water does not continue to improve. This development procedure will enhance air flow into the surrounding saturated zone by removing fine-grained materials from the filter pack and surrounding formation.

4.3.2 SVE Well

One SVE well (SVE-1) will be installed for the pilot test. The boring will be completed as with the AS well using traditional RHSA drilling methods to a total depth of 30 feet bls.

The SVE well will be constructed as a Type II (single-cased) well with 20 feet of 0.010" slotted screen. Four-inch inner diameter, schedule 40 PVC will be used for the well screen and riser. A washed silica sand filter pack (#1 grade) will be used to fill the annular space between the borehole wall and the SVE well screen. The SVE well will be completed at land surface within a traffic-rated well vault. A schematic of the proposed SVE well is presented as [Figure 10](#).

The total depths and screened intervals stated above are anticipated based on lithologic and monitoring well data in the immediate vicinity. However, the actual total depths and screened intervals will be determined in the field by a project geologist or other qualified staff based on soil logging observations.

4.3.3 Observation Wells

Influence achieved during the pilot test by the AS and SVE wells will be evaluated by monitoring the water levels and field parameters (pressures, DO, etc.) in two observation points. AS/SVE influence will be evaluated using existing (MW-7) and proposed (OB-1 and OB-2) monitoring points. The two proposed observation wells will be installed as nested wells each containing a SVE monitoring well and an AS monitoring well. The 1-inch diameter SVE monitoring well will be installed to a total depth of 30 feet bls with 20 feet of 0.010" slotted one-inch internal diameter Schedule 40 PVC well screen and 10 feet of solid PVC riser. The nested well will also contain an AS observation point installed to a total depth of 60 feet bls with 15 feet of 0.010" slotted one-inch internal diameter Schedule 40 PVC well screen and 45 feet of solid PVC riser. A schematic of the proposed observation wells is presented as Figure 11.

4.3.4 Residuals Management

Wastes generated during boring installation may include soil cuttings, decontamination and purge water or other materials which have come into contact with affected media (e.g., personal protective equipment). Solid and liquid waste materials will be placed in separate 55-gallon steel drums, labeled as to their contents, and staged at a location designated by the facility manager pending characterization and disposal.

4.4 PILOT TEST SPECIFICATIONS & EQUIPMENT

This section lists the major components and specifications for the AS/SVE pilot test. The following provides potential equipment to be used for the testing; however, the actual equipment is subject to change based on rental equipment availability. At a minimum, the performance requirements presented below will be achieved or exceeded.

The SVE and AS wells will be located in proximity to each other, in the exterior portions of the loading dock area on the east-central side of the ECI facility building (see Figure 2). ERM anticipates using a combination AS/SVE rental trailer unit to perform the testing.

4.4.1 SVE Equipment Details

Equipment specifications for the SVE test system are based, in part, on achieving a balance with the AS system components or based on conservative estimates relative to performance at sites with similar geologic conditions. The primary components of the SVE system include the following:

- Regenerative air blower,
- Exhaust stack,
- Manifold assembly including flow control valves and dilution ports to control flow to the SVE well,
- Muffler,
- Vacuum and flow monitoring gauges and connections,
- Moisture knockout tank,
- Sample port(s),
- Associated piping and fittings, and
- Safety shutdown switch.

Schedule 40 PVC fittings and pipe will be used to connect the blower to the SVE extraction well. An in-line ball valve and dilution valve, located between the blower and the vapor extraction well, will control the SVE vacuum and flow rate.

ERM assumes a flow rate of up to 40 cubic feet per minute (cfm) from the SVE well. This flow, in part, is based on a minimum ratio of 4:1 for SVE recovery to AS supply. This ratio will promote effective capture of vapors and limit the potential for vapor intrusion during the test. Using conservative estimates for system friction losses, the pilot test requires a minimum flow of 40 cfm at 80 inches of H₂O.

4.4.2 AS Equipment Details

The primary components of the AS test system include the following:

- Inlet silencer,
- Flow control devices, (valves, fittings, etc.)
- Pressure and flow monitoring gauges and connections,
- Oil-free air compressor (e.g. rotary claw),
- Influent particulate filter,
- Associated piping and pressure rated hose, and
- Safety shutdown switch.

An air injection rate of up to 10 cfm is assumed for the test. To overcome the expected hydrostatic, formation and friction forces, the air compressor must be capable of delivering in excess of 10 cfm at a pressure of 25 psi. Galvanized steel fittings and 1-inch pressure reinforced hose will connect the air compressor system to the single AS well. An in-line regulator between the compressor and the AS well will control the sparging pressure and air flow rate.

Electricity will be provided from a generator included with the AS/SVE test package or from the facility power source. Design calculations for the AS/SVE pilot test system are presented as [Appendix B](#). A process and instrumentation diagram (P&ID) for the pilot test system is presented as [Figure 12](#).

4.4.3 *Testing and Monitoring Equipment Summary*

During the pilot test, ERM personnel will collect data to evaluate system performance. Data collected during the test will include:

- AS flow rate
- Water table elevations within the observation wells,
- AS pressure,
- VOC concentrations at the SVE exhaust,
- SVE vacuums,
- Groundwater field measurements within the observation wells and nearby monitoring wells,
- Effluent temperatures, and
- SVE extraction rates.

Testing equipment specifications are based on achieving the conservative estimates of the test ranges or meeting material and operating compatibility with other testing components. The equipment performance specifications are matched to the anticipated test conditions. These conditions are either calculated or inferred from site lithology and expected constituent concentrations (as described above). The equipment package is selected to provide flexibility

throughout the pilot test to adjust for unanticipated field conditions. Anticipated monitoring equipment and miscellaneous parts for monitoring the AS/SVE system are listed below:

- Photoionization detector (PID),
- Water level meter,
- Water quality meters (pH, temperature, conductivity, DO, Oxidation-Reduction Potential (ORP)),
- Peristaltic or submersible pump,
- Differential pressure meter or manometer and pitot tubes,
- Thermometer,
- Groundwater sampling supplies and laboratory-supplied bottles, and
- Air sampling equipment (e.g. tedlar bags or summa canisters).

4.5 PILOT TEST OPERATION

The AS/SVE test will involve measuring the effects of applying multiple injected air flow rates to the subsurface on the displacement (i.e., mounding) of groundwater and the distribution of VOCs, DO, and ORP. Likewise, multiple SVE vacuums will be evaluated, individually and in concert with the AS activities, to determine favorable operational parameters to maximize system influence and VOC recovery. Field parameters will be recorded during the pilot test activities for review and during the data reduction phase of the project.

The AS/SVE pilot test will occur in the following stages:

<i>Stage</i>	<i>Operating Well(s)</i>
1	SVE
2	AS
3	AS and SVE

The first stage will allow estimation of the vacuum ROI due to SVE. At the same time, baseline soil vapor recovery concentrations will be measured. The second stage will allow estimation of the ROI due to the AS. The third stage will allow estimation of combined SVE and AS ROIs, potential vapor contributions from groundwater, and resulting vapor recovery performance. The preliminary estimated duration of each stage is 4 to 6 hours.

Prior to the test and at appropriate intervals (e.g. every 15 minutes for the first hour and then every half hour thereafter) during the SVE stages of the pilot test, the following operational and effluent parameters (at a minimum) will be monitored:

- Effluent airflow rate (cfm),
- SVE vacuum (in H₂O),
- Effluent VOC concentrations using a PID (ppm),
- Depth to water in observation points,
- Effluent temperature (°F),
- Vacuum measurements from the observation wells (inches of H₂O), and
- Well vapor VOC concentrations,

During the AS stages of the pilot test, the following operational and effluent parameters (at a minimum) will be monitored on an appropriate schedule:

- AS pressure at well head (psi),
- AS flow rate (cfm),
- Induced pressure in the nearby observation and monitoring wells (in H₂O),
- Dissolved oxygen in nearby observation and monitoring points,
- Depth to water in nearby observation and monitoring points, and
- Soil vapor VOC concentrations (ppm).

[Table 1](#) presents a summary of field measurements to be collected as part of the pilot test and an example pilot test field data forms are included in [Appendix D](#).

4.5.1 Test Flow Rates and Pressures

The SVE portion of the test will begin at a vacuum of between approximately 20 to 30 inches of water and then increase to a minimum target vacuum of 40 inches of water at the SVE well head. Vacuum levels may be adjusted based on VOC recovery rates, achievable flow rates, and induced vacuum measurements within the monitoring probes.

Air injection pressures have been determined by the static water head above the sparge point and pressure required to overcome resistance within the geologic formation. A minimum sparging pressure of 9 psi has been estimated. Injected air flow rates will begin at approximately 2-4 cfm and then increase beyond 10 cfm as accepted by the formation and within the limits of the supplied equipment.

4.5.2 Field Parameter Monitoring Procedures

For the pilot test, individual field data sets will be collected for the AS and SVE, as well as a combined field data set for AS and SVE.

The SVE physical and chemical parameters will be monitored prior to (baseline monitoring), during and after the SVE testing. The testing equipment will be calibrated in accordance with manufacturer’s instructions to help ensure the accuracy of field parameter measurements

The SVE system will be started and SVE measurements will be taken periodically (e.g. approximately every 15 minutes) until equilibrium is achieved. Should the duration to achieve SVE equilibrium extend beyond a 3-hour period, measurements may be recorded less frequently as deemed appropriate based on field conditions.

Once the SVE parameters have stabilized, the SVE vacuum will be terminated and the subsurface will be allowed to return to natural or static conditions. The AS system will be started and monitoring will begin. AS physical and chemical parameters will be monitored prior to (baseline monitoring) and during air sparge testing.

Upon stabilization of the AS parameters, the SVE system will be restarted and monitoring can begin for the combined SVE/ AS pilot test. SVE and AS physical and chemical parameters will be monitored prior to (baseline monitoring) and during combined SVE/ AS testing with baseline sampling for VOCs in groundwater conducted within one week prior to pilot testing.

Baseline groundwater geochemical parameters monitored include depth-to-water, DO levels, pH, temperature, ORP, and specific conductivity within the monitoring and observation wells.

A summary of the field parameter monitoring to be conducted before, during, and following the pilot test is presented below:

<i>Parameter</i>	<i>Monitoring Location</i>	<i>Measurement Device</i>	<i>Sample Port Location</i>
<i>Prior to Testing</i>			
VOCs (soil gas)	SVE-1, OB-1, OB-2, & MW-11	PID	wellhead
Pressure	SVE-1, AS-1, OB-1, OB-2& MW-11	Manometer	wellhead
Depth to water	AS-1, OB-1, OB-2 & MW-11	Water level meter or pressure transducer	wells
Water Quality	AS-1, OB-1, OB-2 & MW-11	Multi-meter	wells
<i>During Testing</i>			
VOCs (soil gas)	SVE-1	PID	wellhead
Pressure	SVE-1, AS-1, OB-1, OB-2 & MW-11	Manometer	wellhead, blower outlet
Temperature	SVE-1 & AS-1	Thermometer	wellhead, blower outlet
Air flow rate	SVE-1 and AS-1	Pitot tube	wellhead, blower outlet

<i>Parameter</i>	<i>Monitoring Location</i>	<i>Measurement Device</i>	<i>Sample Port Location</i>
Depth to water	OB-1, OB-2 & MW-11	Water level meter	wells
Water Quality	OB-1, OB-2 & MW-11	Multi-meter	wells
<i>After Testing</i>			
VOCs (soil gas)	SVE-1, OB-1, OB-2 & MW-11	PID	wellhead
Pressure	SVE-1, AS-1, OB-1, OB-2 & MW-11	Manometer	wellhead
Depth to water	AS-1, OB-1, OB-2 & MW-11	Water level meter	wells
Water Quality	AS-1, OB-1, OB-2 & MW-11	Multi-meter	wells

4.6 ANALYTICAL LABORATORY SAMPLING & ANALYSIS

Soil vapor and groundwater samples will be collected during the SVE/ AS pilot test for laboratory analysis. Table 2 presents a summary of the planned analytical sampling activities. The following subsections detail the groundwater and soil vapor sampling scope.

4.6.1 Groundwater Sampling

The AS well (AS-1) and observation/ monitoring wells (MW-7, OB-1, and OB-2) will be utilized for pre-test and post-test groundwater quality sampling. Analytical laboratory samples will be collected for analysis of VOCs. The pre-test samples will be collected within 1 week prior to AS testing and the post-test samples will be collected within 24 hours of test completion. The groundwater samples will be collected consistent with EPA Region IV Science and Ecosystem Support Division (SESD) low-flow sampling methodologies.

Using low-flow sampling procedures, standard groundwater field analyses will be conducted. Groundwater will be pumped through a flow cell, which will house water quality measurement probes. A water quality meter (e.g. YSI 556) will be used to measure DO, temperature, pH, specific conductivity, and ORP.

The laboratory provided sample containers will be labeled, stored on ice, and shipped via overnight delivery to an NCDENR-certified laboratory for analysis. The groundwater samples collected during pilot testing will be analyzed for VOCs via SW-846 EPA Method 8260.

The same analytical methods will be used during the pilot test as would be used during full-scale remediation. The effects of air sparging on VOC concentration reduction will be evaluated by pre-and post-testing groundwater samples, as well as measurements of DO, ORP and VOC concentrations during testing. Overall AS testing time is estimated at no longer than 4 to 6 hours; therefore, a profound effect on groundwater quality is not anticipated.

4.6.2 *Soil Vapor Sampling*

Soil vapor samples collected during pilot testing at the Site will be analyzed for VOCs via EPA Method TO-15 by an approved analytical laboratory. The soil vapor analytical methods used during the pilot test are the same as those expected to be used during full-scale remediation. The samples collected for laboratory analysis will be collected in appropriate media and either shipped to the laboratory via overnight delivery or transported directly by ERM. The soil gas samples will be protected during handling and transport by storing in a sealed plastic cooler or other approved sample shipping device.

It is anticipated that the following soil vapor analytical samples will be collected during pilot test activities:

- One vapor sample from the SVE extraction well following pressure/flow stabilization; and
- Up to three vapor samples from the SVE extraction flow during key steps in the combined AS/SVE testing.

4.7 *DATA REDUCTION*

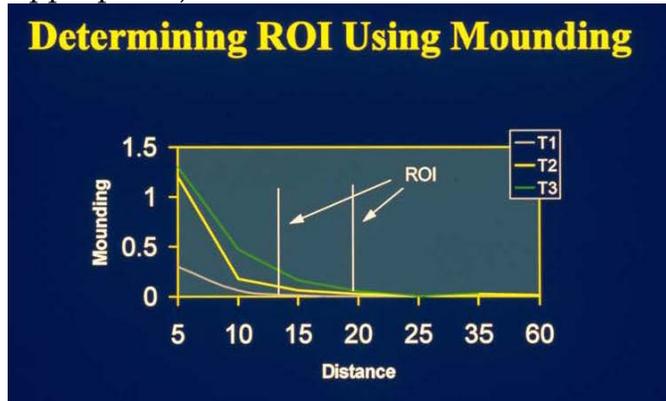
The results from the field analysis and laboratory samples will be reviewed for quality and tabulated for use in the data evaluation. ERM will review the pilot test results and field data to assess the overall efficacy of AS and SVE (independently and combined) as source area remedial technologies. This determination will be made based on the results of physical parameter and chemical testing conducted during the pilot test. Optimum operating parameters for each system component (e.g. ROI, air injection rate, vapor extraction rate, respective pressures/vacuums, etc.) will be estimated. The optimal design parameters will be evaluated to be applied to a full-scale remediation system, if deemed appropriate.

A critical component of the test data will be the relationship of operational parameters (e.g. flow rates and pressures) to the laboratory and field sampling results. Data summary graphs of key relationships will be generated to provide meaningful information about the ROI and optimal SVE/AS conditions.

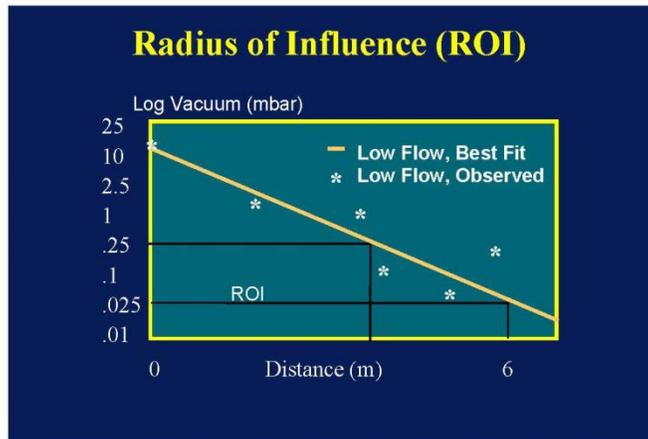
Example key relationships are as follows:

- Mounding versus Distance and Flow;
- DO versus Distance and Time;
- VOC levels versus Distance and Time;
- Pressure versus Distance;
- SVE exhaust VOC levels versus Time with and without sparging; and
- Pressure versus Radius of influence.

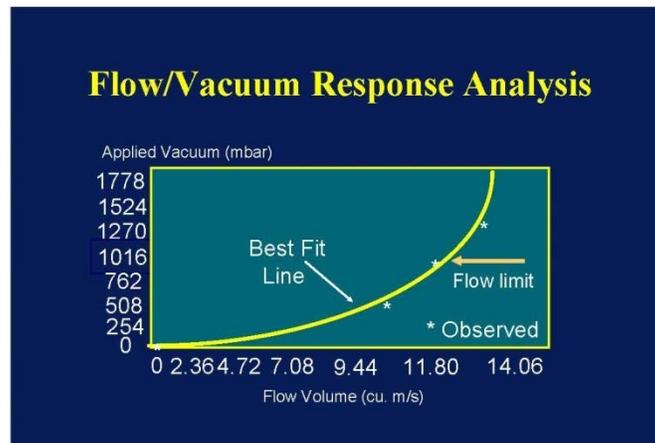
The following figures present examples of summary graphs that will be generated (as appropriate):



Example Pressure/Distance Plot (ROI evaluation)



Example Pressure/Flow Plot (Optimal Pressure/Flow Evaluation)



The air flow and vacuum data collected during the field pilot test will be evaluated to calculate intrinsic air permeability values (k) for subsurface soil. The air permeability, physical characteristics of the vapor extraction wells and vapor probe network, vacuum data, and the air flow rates measured during field pilot testing will be used as input to calculate:

- ROI for the full-scale system;
- Necessary vapor extraction rates;
- AS and SVE well spacing; and
- Mass removal rate estimates.

5.0 PERMITTING, SCHEDULING & REPORTING

This section describes the necessary permitting activities, field sequencing plan and associated data reduction and reporting activities for the pilot test.

5.1 PERMITTING

The air sparge injections at the Site do not require an individual permit under the NCDENR Underground Injection Control (UIC) program because they qualify for “permitting by rule” under 15A NCAC 02C .0200 as a small-scale air injection operation. Notification must be made to the NCDENR UIC program at least two weeks in advance of the air sparge injection. A copy of the UIC notification documentation is included in [Appendix C](#).

AS/SVE pilot test wells will be installed by a North Carolina licensed well driller and in accordance with the North Carolina well construction standards under 15A NCAC 2C.0100.

5.2 SCHEDULE

The following table presents a general schedule of anticipated events. This is an anticipated schedule which may also change due to weather, facility activities and contractor/equipment availability. The system construction, pilot test operations, data reduction, and reporting activities will be performed as summarized below.

<i>Activity</i>	<i>Completion Date</i>
Submit AS/SVE Pilot Test Workplan to NCDENR	November 6
Install AS and SVE wells and Observation wells	November 24 through 26
Complete AS & SVE Pilot Testing	December 8 through 11
Reduce data/evaluate operational parameters	January 30, 2015

5.3 REPORTING

Upon completion of the pilot test field activities, ERM will complete data reduction and provide a summary of test results and recommendations to the ECI project stakeholders. It is anticipated that the pilot test results will be incorporated into a Remedial Action Plan (RAP) for future submittal to the NCDENR.

6.0 REFERENCES

Registered Environmental Consultant Program Implementation Guidance – North Carolina
Department of Environment and Natural Resources, December 2013.

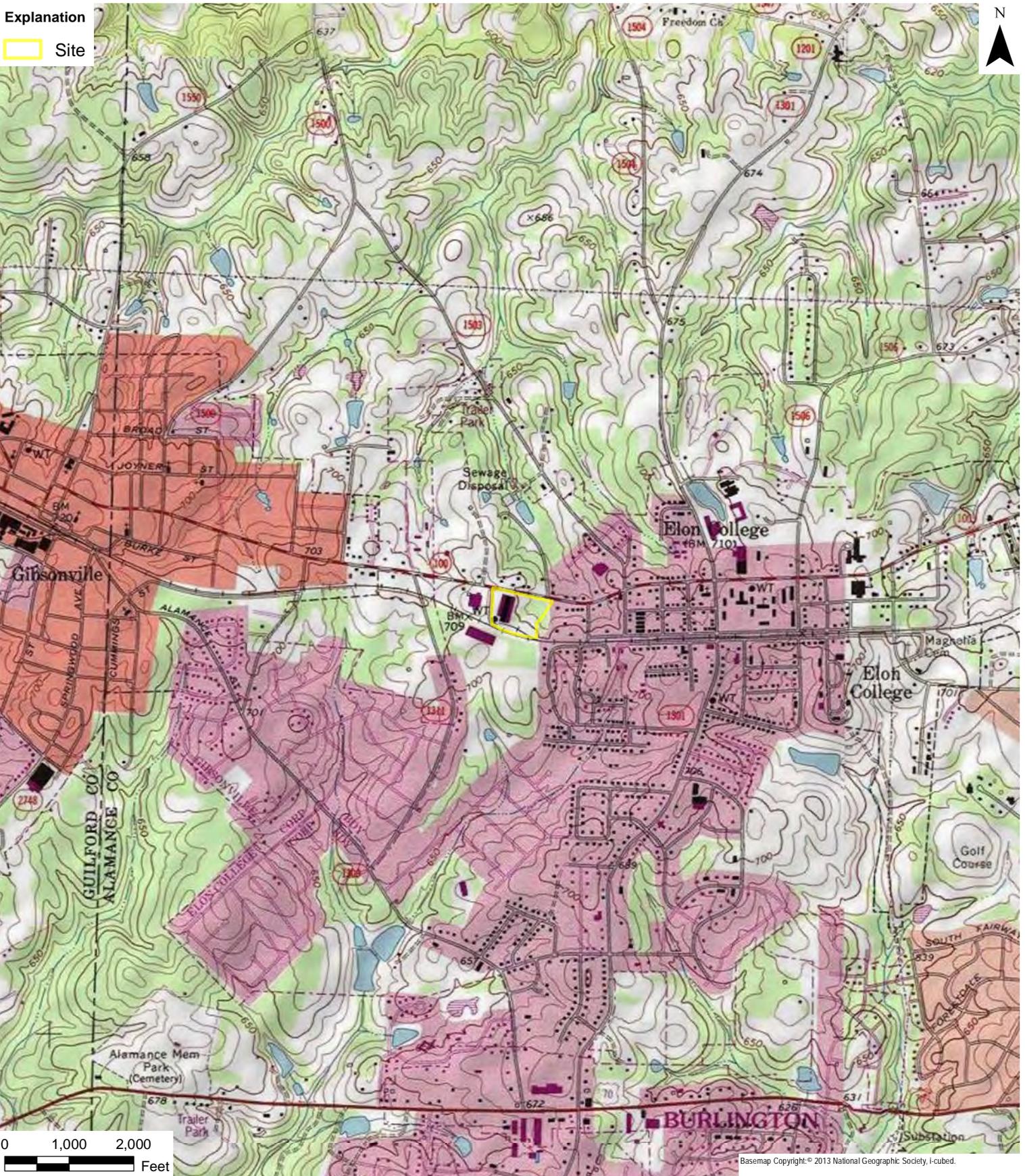
Remedial Investigation Work Plan, ECI Elon Facility, Elon, North Carolina –
ERM NC, Inc., April 17, 2014.

DRAFT Phase I Remedial Investigation Report, ECI Elon Facility, Elon, North Carolina
ERM NC, Inc., August 20, 2014.

FIGURES

Explanation

Site



ERM NC, Inc.

FIGURE 1
Site Location Map

Engineered Controls International, LLC.
100 Rego Drive
Elon, Alamance County, North Carolina

DATE: 11/6/2014 SCALE: AS SHOWN DRAWN: A Freeman

FILE: T:\Projects A to MEC\01 - Elon\6. Maps, Figures, Photographs\Elon\GIS\MXD\2014-10_AS-SVE Work Plan\Figure 1_SLM.mxd

Explanation

-  Site
-  Parcels
-  Railroad ROW
-  Areas of Concern (AOCs)

Existing Groundwater Sample Locations

-  Saprolite Monitor Well
-  Upper Bedrock Monitor Well
-  Intermediate Bedrock Monitor Well
-  Lower Bedrock Monitor Well

Proposed Pilot Test Wells

-  Air Sparge Well
-  Soil Vapor Extraction Well
-  Observation Nested Well Pair

*Proposed well locations are estimated
(Exact locations will be determined in the field based on subsurface utility locations)*



Basemap NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board.



ERM NC, Inc.

SCALE: AS SHOWN DRAWN: A Freeman DATE: 11/6/2014

FIGURE 2
Proposed Pilot Test Wells and Layout
 Enginedered Controls International, LLC.
 100 Rego Drive
 Elon, Alamance County, North Carolina

Explanation

- Site
- Parcels
- Railroad Tracks
- Railroad Right-of-Way

Groundwater Monitor Wells

- ▲ Saprolite Monitor Well Location
- Upper Bedrock Monitor Well Location
- Intermediate Bedrock Monitor Well
- Lower Bedrock Monitor Well

Proposed Pilot Test Wells

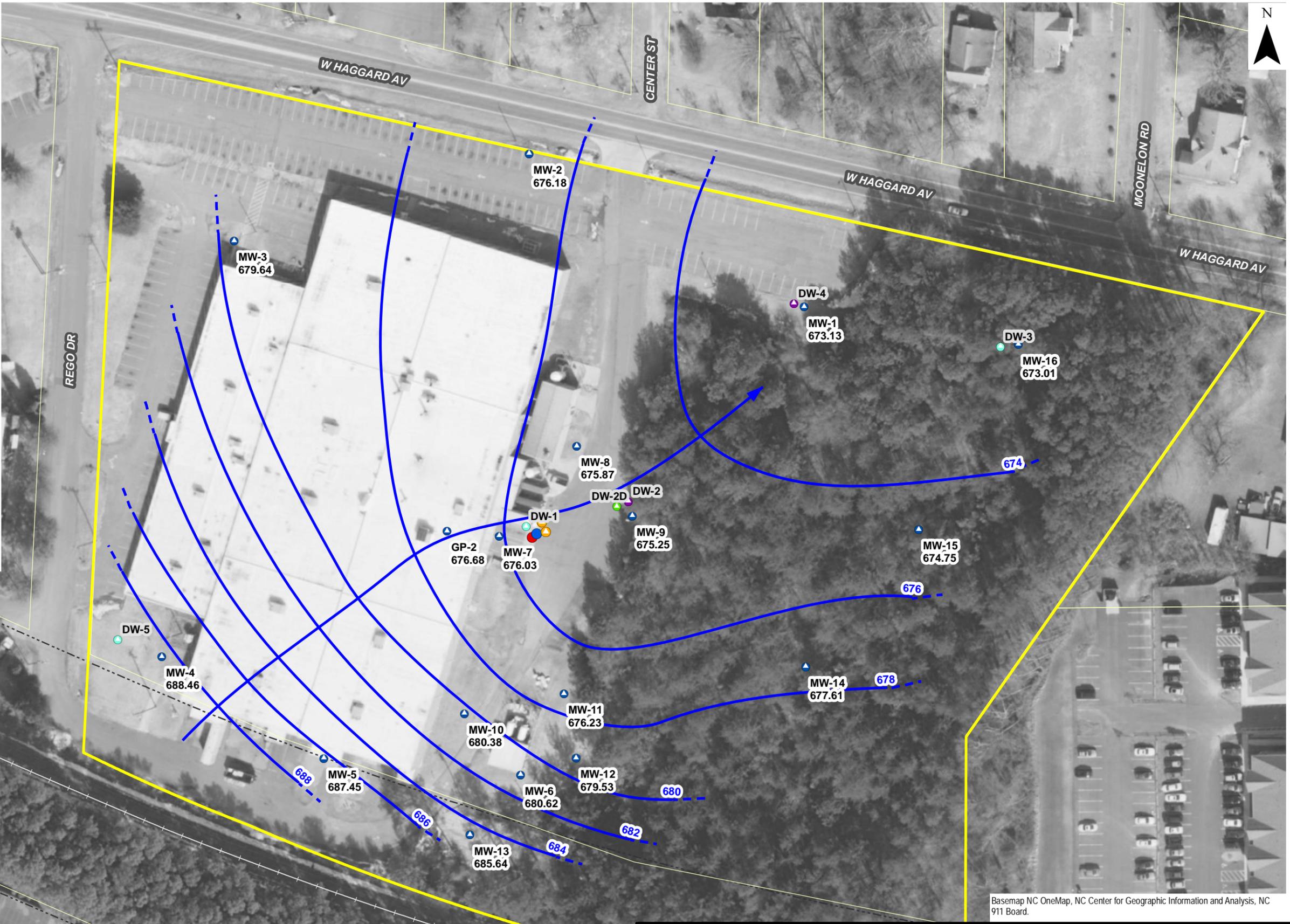
- Air Sparge Well
- Soil Vapor Extraction Well
- Observation Nested Well Pair

Groundwater Elevation (May 2014)

- Groundwater Flow Direction
- Groundwater Elevation Contour (Saprolite Aquifer Zone)
- - - (Dashed in areas of less certainty)

680.00 Groundwater Elevation
(feet above mean sea level)

*Proposed well locations are estimated
(Exact locations will be determined in the
field based on subsurface utility locations)*



Basemap NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board.



ERM NC, Inc.

SCALE: AS SHOWN DRAWN: A Freeman DATE: 11/6/2014

FIGURE 3
Potentiometric Surface Map
Saprolite Aquifer Zone - May 2014
 Engineered Controls International, LLC.
 100 Rego Drive
 Elon, Alamance County, North Carolina

- Explanation**
- Site
 - Parcels
 - Railroad Tracks
 - Railroad Right-of-Way
 - Saprolite Monitor Well
 - Upper Bedrock Monitor Well
 - Intermediate Bedrock Monitor Well
 - Lower Bedrock Monitor Well
 - Temporary Soil/Groundwater Sample Location
 - Hand Auger Soil Sample Location

Transect Locations

- A-A' Transect
- B-B' Transect

Proposed Pilot Test Wells

- Air Sparge Well
- Soil Vapor Extraction Well
- Observation Nested Well Pair

*Proposed well locations are estimated
(Exact locations will be determined in the field based on subsurface utility locations)*



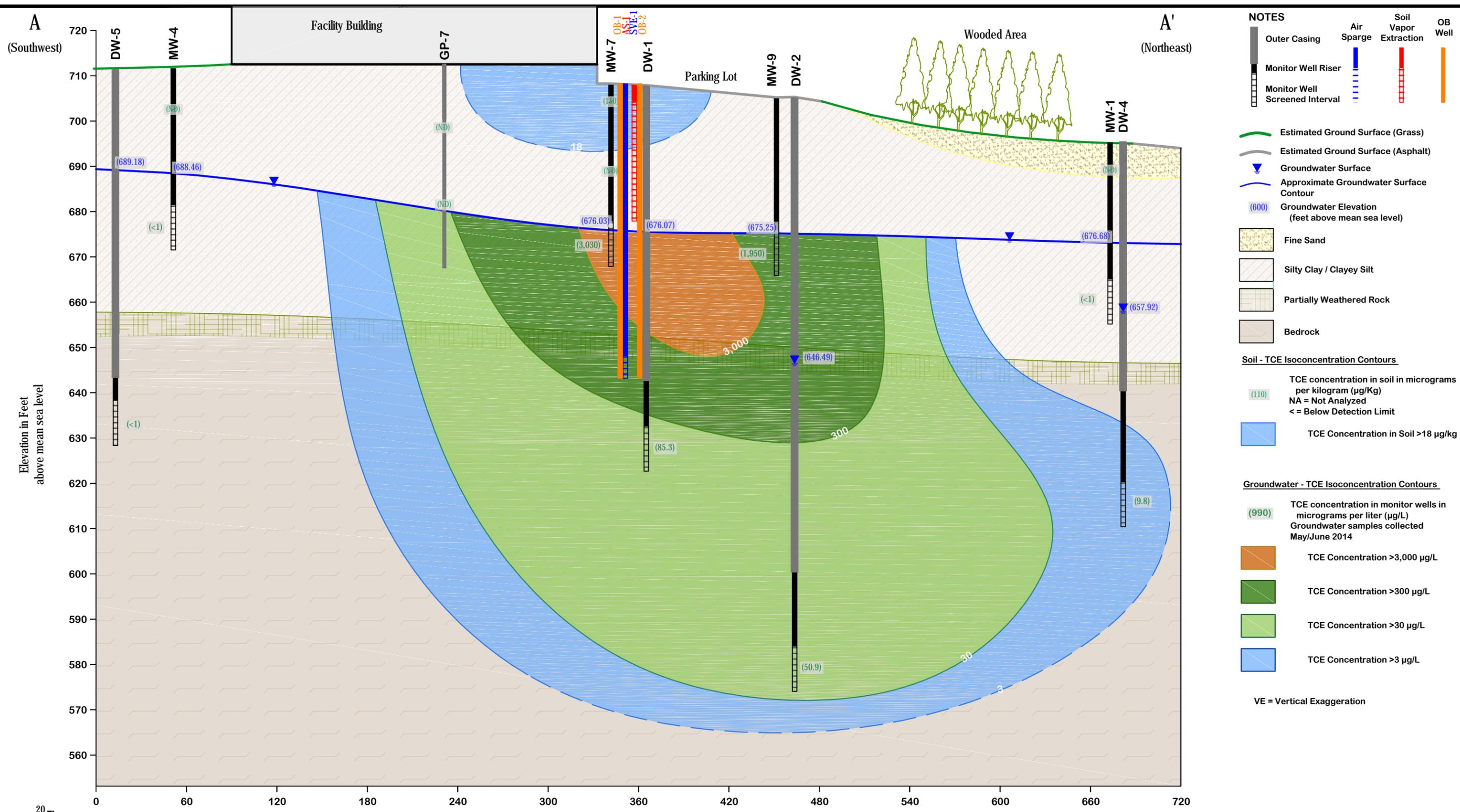
Basemap NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board.



ERM NC, Inc.

SCALE: AS SHOWN DRAWN: A Freeman DATE: 11/6/2014

FIGURE 4
Cross Section Location Map
 Engineered Controls International, LLC.
 100 Rego Drive
 Elon, Alamance County, North Carolina



- NOTES**
- Outer Casing
 - Monitor Well Risers
 - Monitor Well Screened Interval
 - Air Sparge
 - Soil Vapor Extraction
 - OB Well

- Estimated Ground Surface (Grass)
- Estimated Ground Surface (Asphalt)
- Groundwater Surface
- Approximate Groundwater Surface Contour
- Groundwater Elevation (feet above mean sea level)
- Fine Sand
- Silty Clay / Clayey Silt
- Partially Weathered Rock
- Bedrock

- Soil - TCE Isoconcentration Contours**
- TCE concentration in soil in micrograms per kilogram (µg/Kg)
 - NA = Not Analyzed
 - <= Below Detection Limit
 - TCE Concentration in Soil >18 µg/kg

- Groundwater - TCE Isoconcentration Contours**
- TCE concentration in monitor wells in micrograms per liter (µg/L)
 - Groundwater samples collected May/June 2014
 - TCE Concentration >3,000 µg/L
 - TCE Concentration >300 µg/L
 - TCE Concentration >30 µg/L
 - TCE Concentration >3 µg/L

VE = Vertical Exaggeration

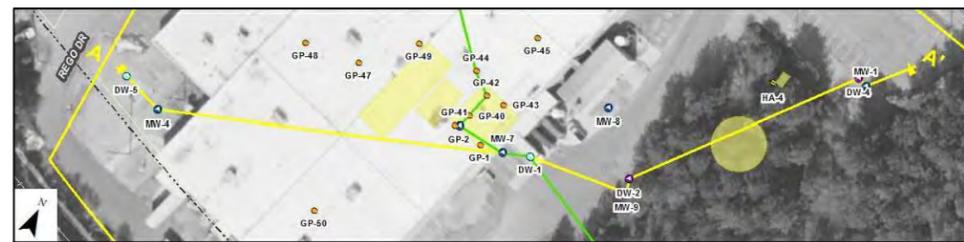
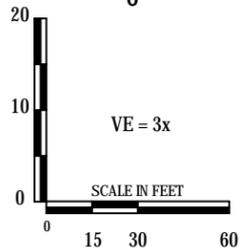
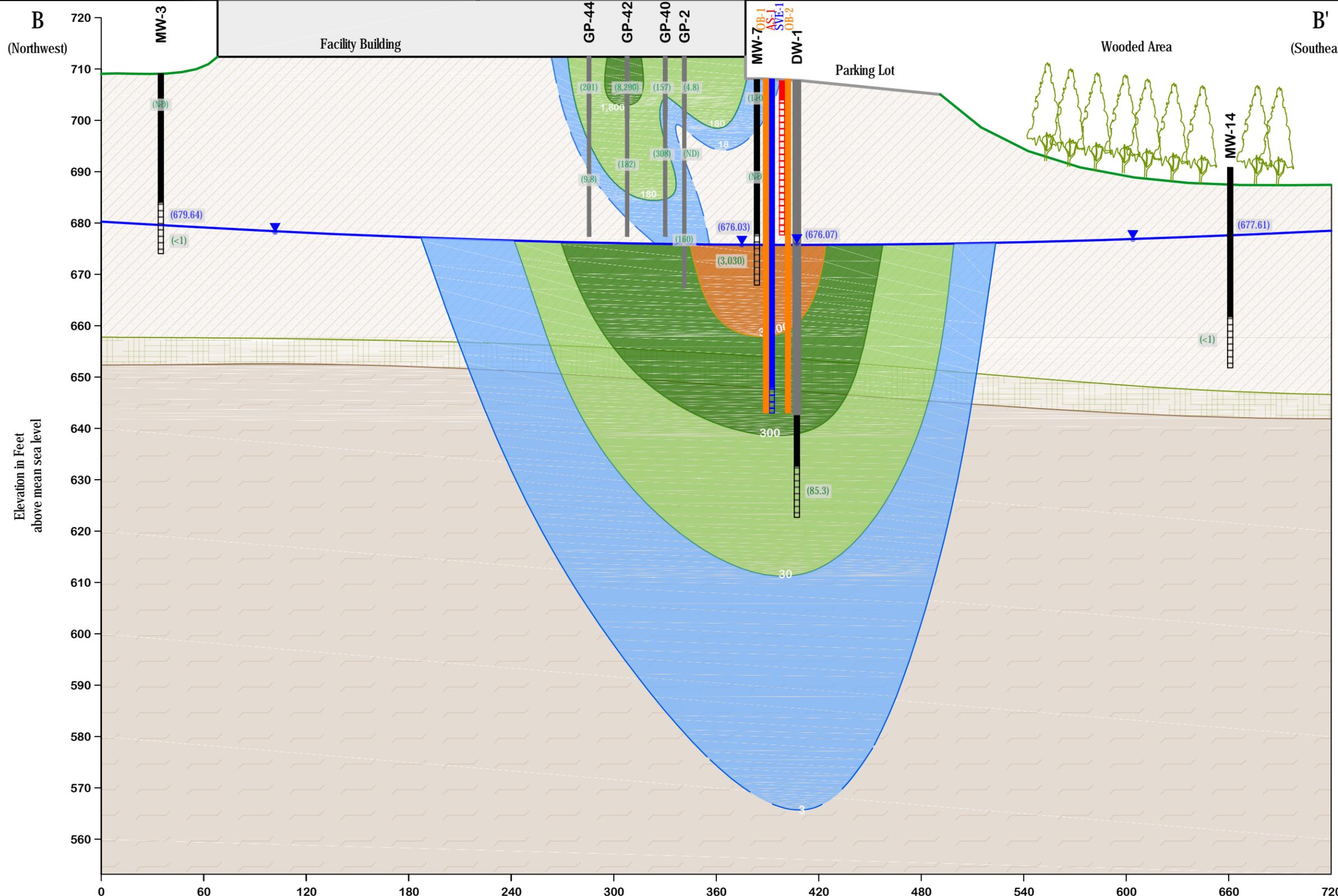


FIGURE 5
 Hydrogeologic Cross Section A-A'
 with AS/SVE Pilot Test Locations
 Engineered Controls International, LLC.
 100 Rego Drive
 Elon, Alamance County, North Carolina



- NOTES**
- Outer Casing
 - Monitor Well Riser
 - Monitor Well
 - Screened Interval
 - Air Sparge
 - Soil Vapor Extraction
 - OB Well
- Estimated Ground Surface (Grass)
 Estimated Ground Surface (Asphalt)
 Groundwater Surface
 Approximate Groundwater Surface Contour
 (600) Groundwater Elevation (feet above mean sea level)
 Silty Clay / Clayey Silt
 Partially Weathered Rock
 Bedrock
- Soil - TCE Isoconcentration Contours**
- TCE concentration in soil in micrograms per kilogram ($\mu\text{g}/\text{kg}$)
 NA = Not Analyzed
 <= Below Detection Limit
- TCE Concentration in Soil >1,800 $\mu\text{g}/\text{kg}$
 - TCE Concentration in Soil >180 $\mu\text{g}/\text{kg}$
 - TCE Concentration in Soil >18 $\mu\text{g}/\text{kg}$
- Groundwater - TCE Isoconcentration Contours**
- TCE concentration in monitor wells in micrograms per liter ($\mu\text{g}/\text{L}$)
 Groundwater samples collected May/June 2014
- TCE Concentration >3,000 $\mu\text{g}/\text{L}$
 - TCE Concentration >300 $\mu\text{g}/\text{L}$
 - TCE Concentration >30 $\mu\text{g}/\text{L}$
 - TCE Concentration >3 $\mu\text{g}/\text{L}$
- VE = Vertical Exaggeration

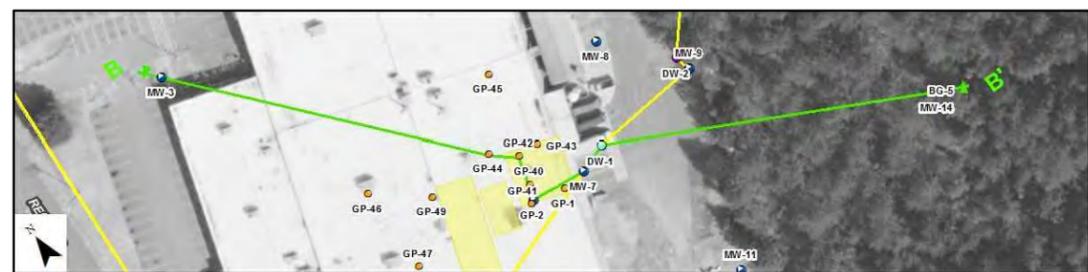
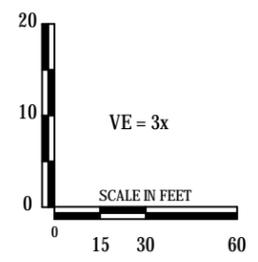


FIGURE 6
 Hydrogeologic Cross Section B-B'
 with AS/SVE Pilot Test Locations
 Engineered Controls International, LLC.
 100 Rego Road
 Elon, Alamance County, North Carolina

Explanation

Sample Type (Maximum TCE Result in $\mu\text{g}/\text{kg}$)

- Background Soil Sample Location
- Direct Push Soil Sample Location
- ⊕ Hand Auger Soil Sample Location
- Monitor Well Soil Sample Location
- Lateral Extent of TCE above Site Specific SRG

Concentration of TCE in Soil ($\mu\text{g}/\text{kg}$)

- $>1,800 \mu\text{g}/\text{kg}$ TCE
- $>180 \mu\text{g}/\text{kg}$ TCE
- $>18 \mu\text{g}/\text{kg}$ TCE

Trichloroethene (TCE) concentrations in micrograms per kilogram ($\mu\text{g}/\text{kg}$)

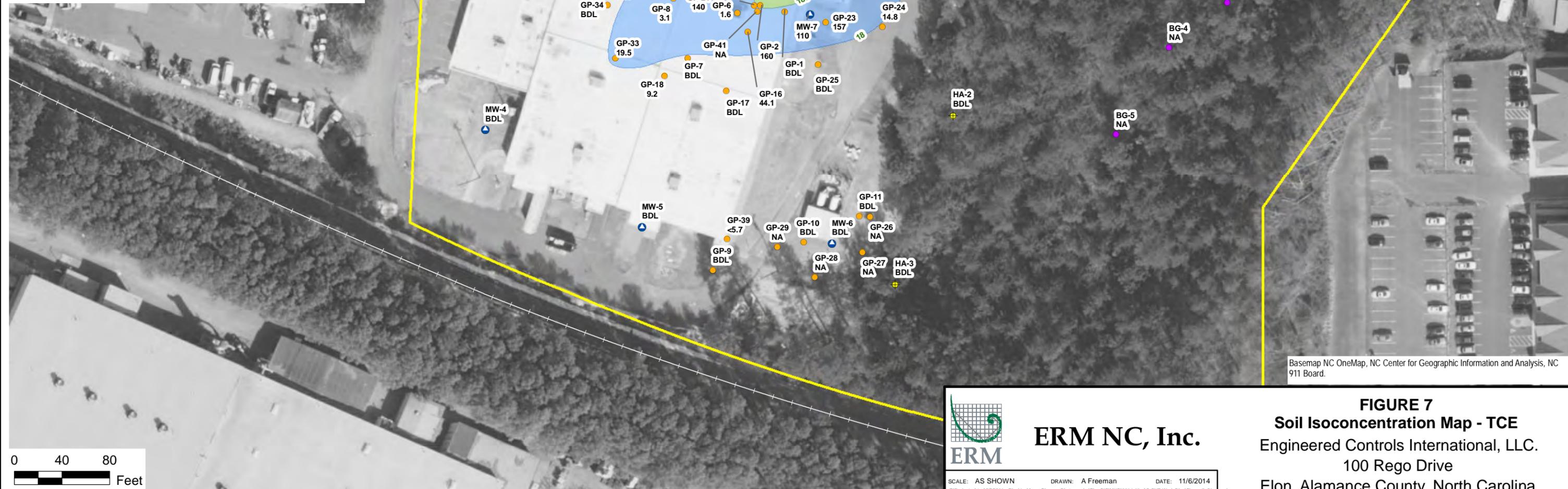
Vertical maximum concentration shown at each location

NA - Not Analyzed
BDL - Below Detection Limits

NC Protection of Groundwater Screening Threshold for TCE = $18 \mu\text{g}/\text{kg}$

NC Delineation Standard for TCE = $880 \mu\text{g}/\text{kg}$

Site Specific Soil Remediation Goal (SRG) for TCE = $330 \mu\text{g}/\text{kg}$



Basemap NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board.



ERM NC, Inc.

SCALE: AS SHOWN DRAWN: A Freeman DATE: 11/6/2014
 T:\Projects A to M\EC\01 - Elon6. Maps, Figures, Photographs\ElonGISMXD\2014-10_AS-SVE Work Plan\Figure 7_Site.mxd

FIGURE 7
Soil Isoconcentration Map - TCE
 Engineered Controls International, LLC.
 100 Rego Drive
 Elon, Alamance County, North Carolina

Explanation

- Site
- Parcels
- Railroad Tracks
- Railroad Right-of-Way

Sample ID (TCE Concentration (µg/L))

- Saprolite Monitor Well Location
- Upper Bedrock Well Location
- Intermediate Bedrock Well Location
- Temporary Well Location
- Historical Temporary Well Location

TCE in the Saprolite Aquifer (May 2014)

- > 3,000 µg/L
- > 300 µg/L
- > 30 µg/L
- > 3 µg/L

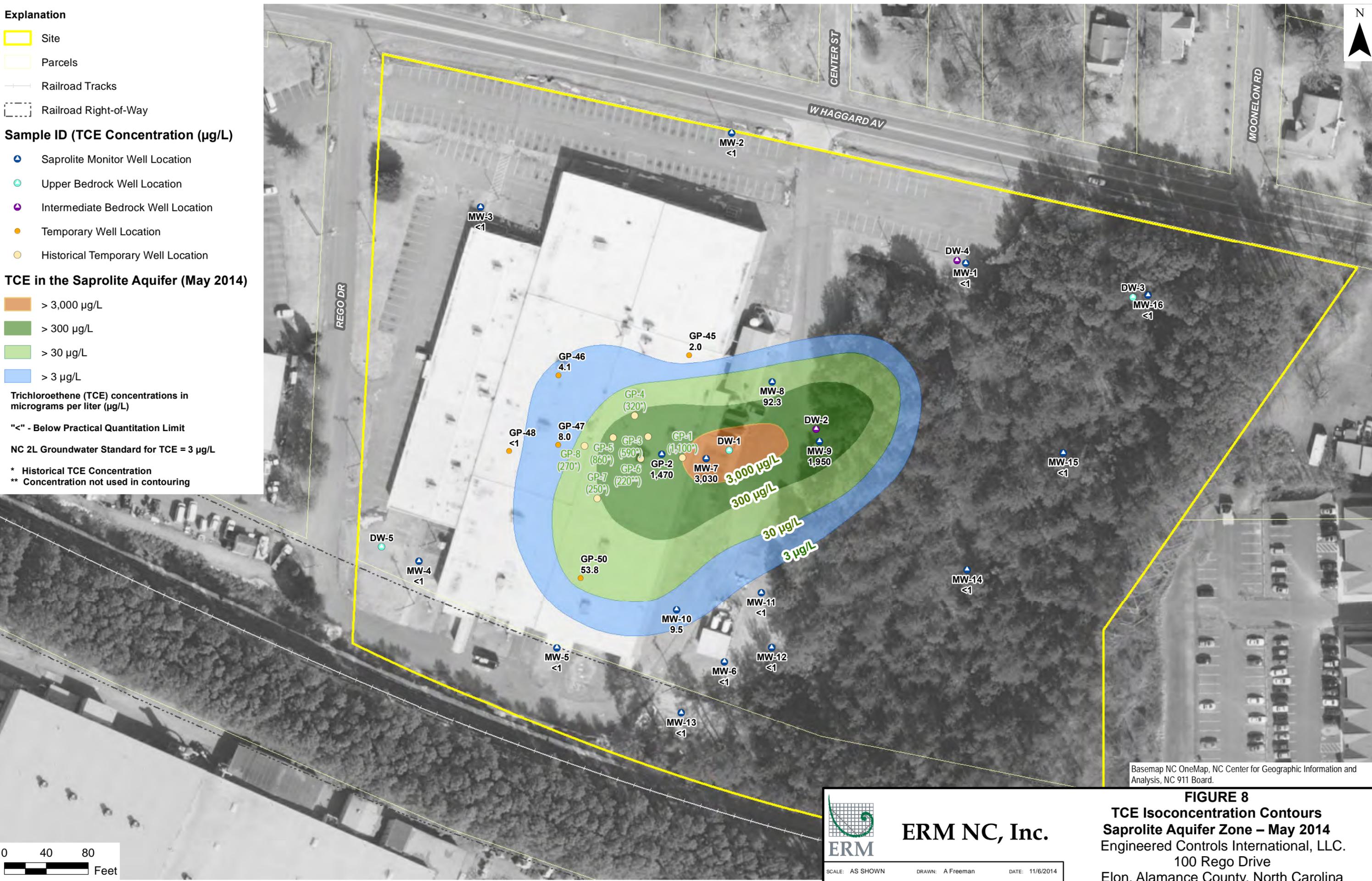
Trichloroethene (TCE) concentrations in micrograms per liter (µg/L)

"<" - Below Practical Quantitation Limit

NC 2L Groundwater Standard for TCE = 3 µg/L

* Historical TCE Concentration

** Concentration not used in contouring



Basemap NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board.



ERM NC, Inc.

SCALE: AS SHOWN DRAWN: A Freeman DATE: 11/6/2014

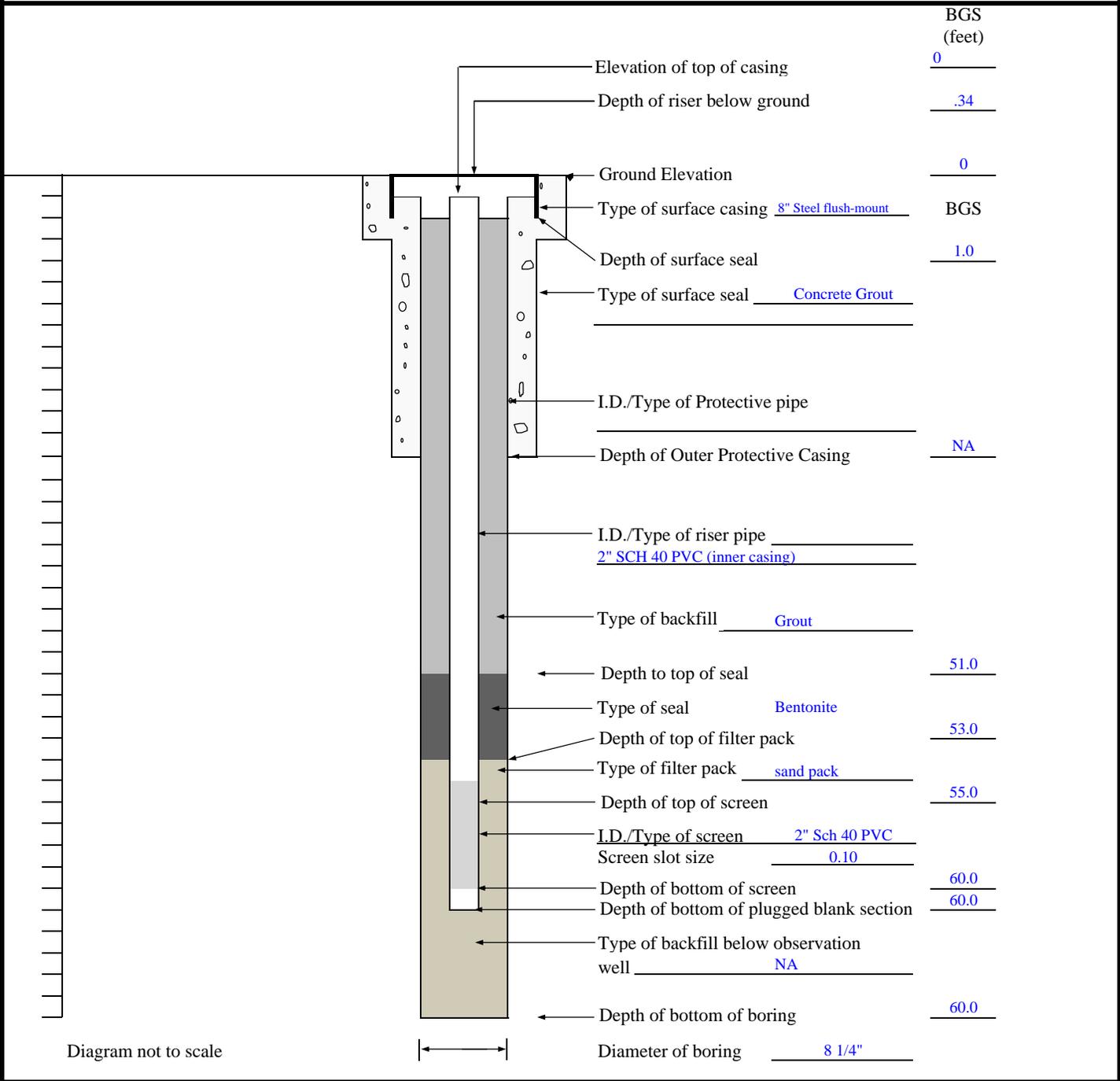
FIGURE 8
TCE Isoconcentration Contours
Saprolite Aquifer Zone – May 2014
 Engineered Controls International, LLC.
 100 Rego Drive
 Elon, Alamance County, North Carolina

TYPE II MONITORING WELL CONSTRUCTION LOG

FIGURE 9

Project Name ECI
 Location 100 Rego Drive, Elon, NC
 Installed By Geologic Exploration Inc.
 Inspected By _____
 Method of Installation Air Rotary
 Remarks _____

Piez./Well No. AS-1
 Project No. 0268950.01
 Date TBD Time TBD

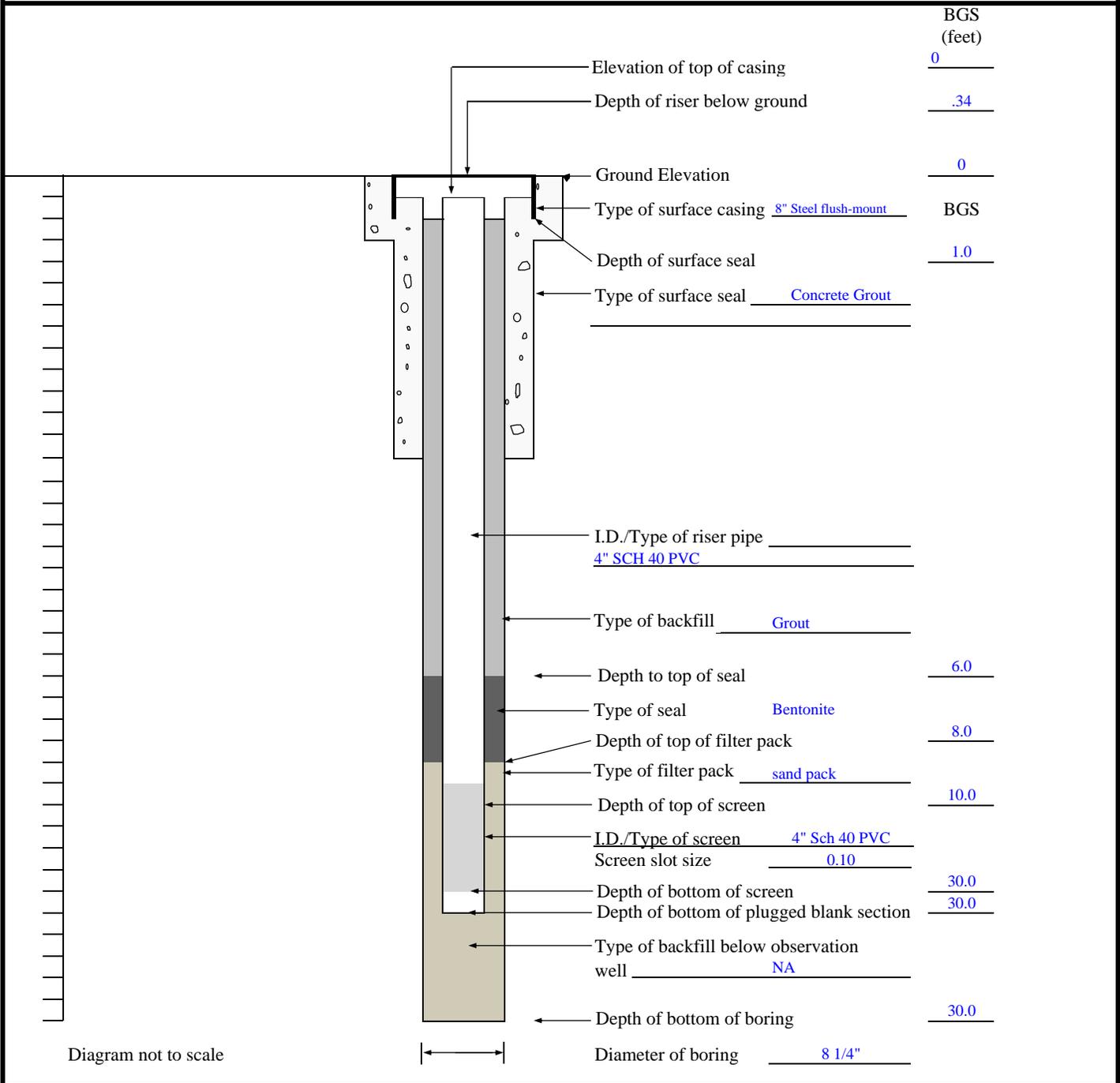


TYPE II MONITORING WELL CONSTRUCTION LOG

FIGURE 10

Project Name ECI
Location 100 Rego Drive, Elon, NC
Installed By Geologic Exploration Inc.
Inspected By _____
Method of Installation Air Rotary
Remarks _____

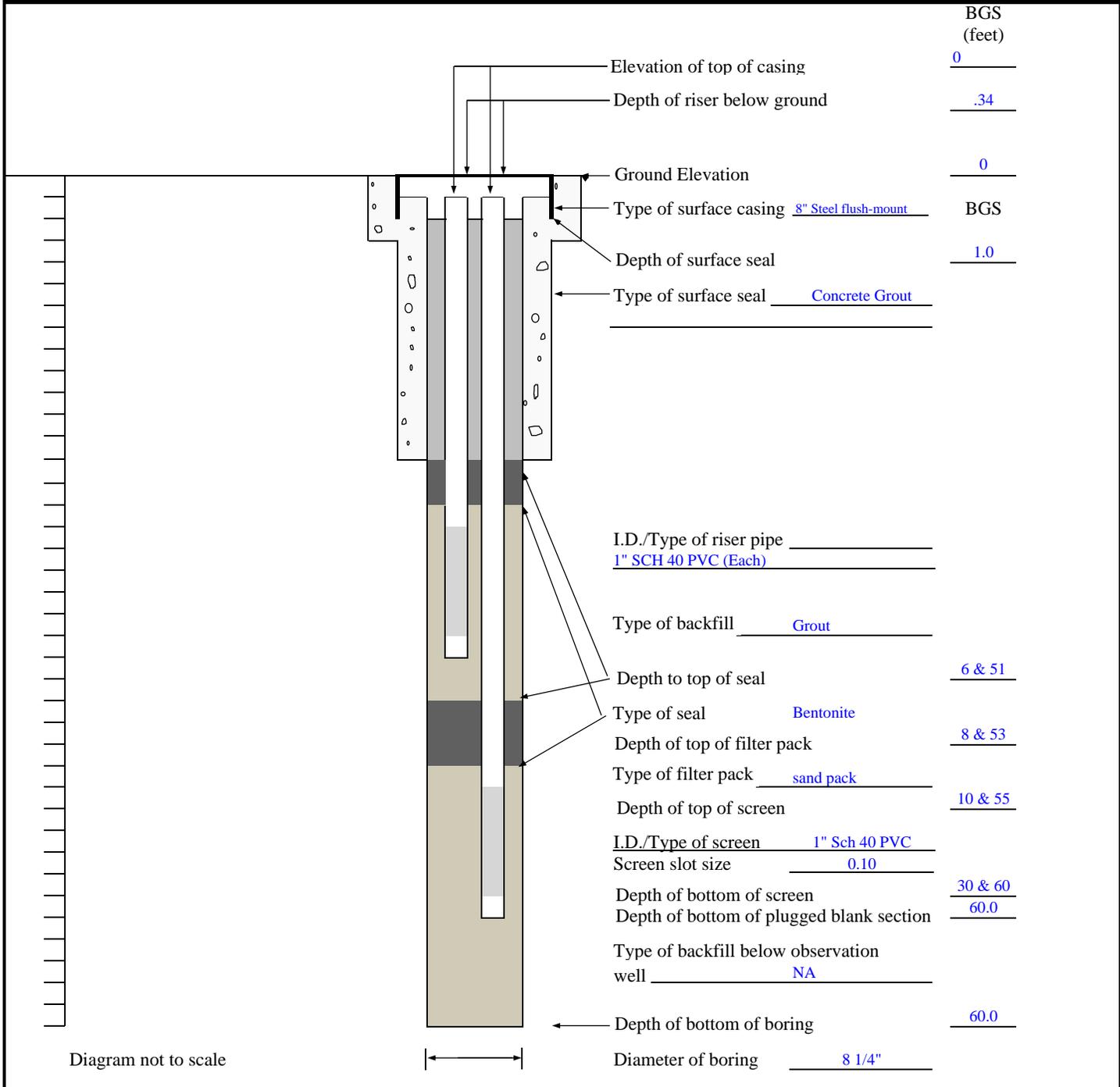
Piez./Well No. SVE-1
Project No. 0268950.01
Date TBD **Time** TBD

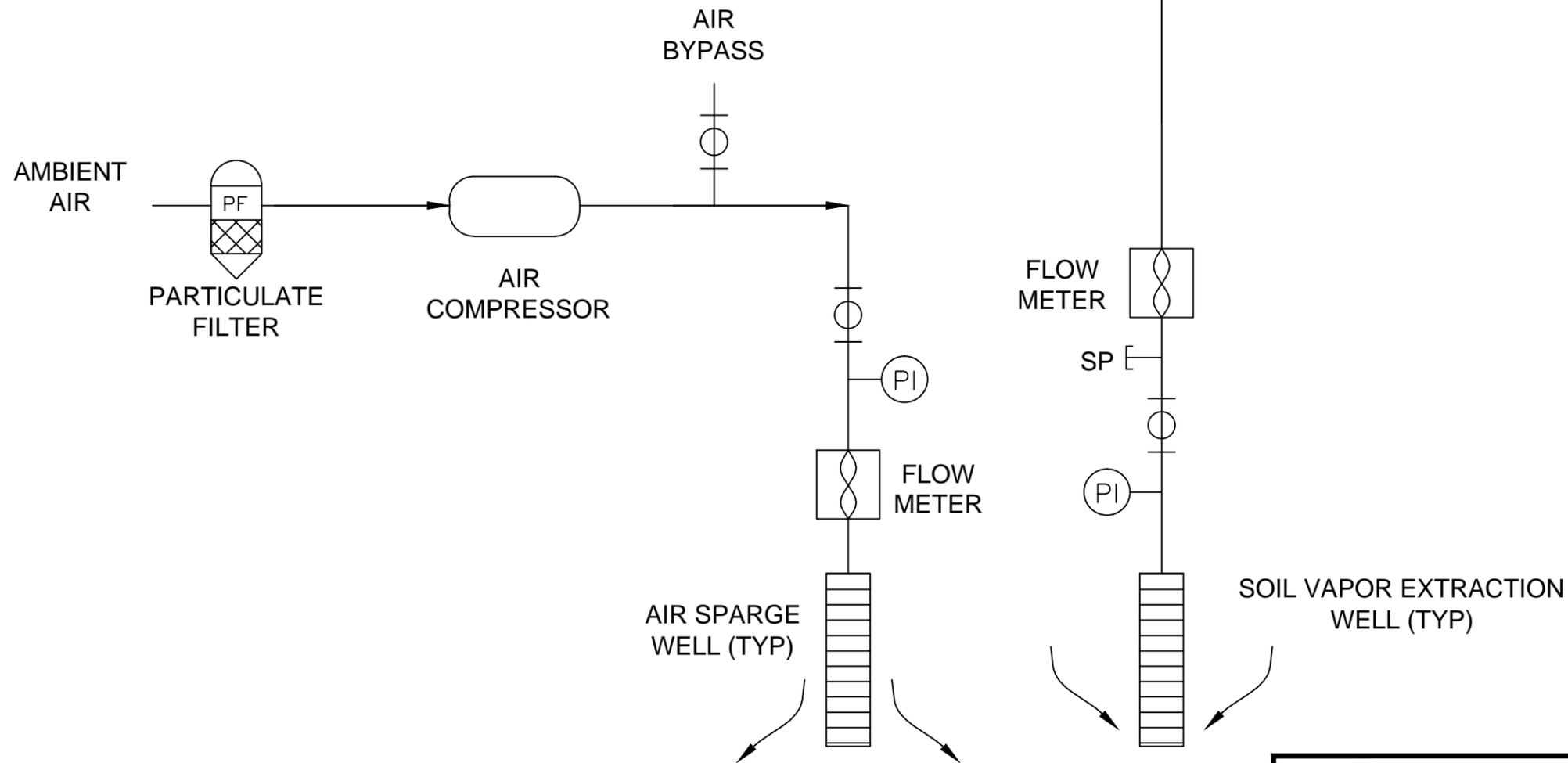
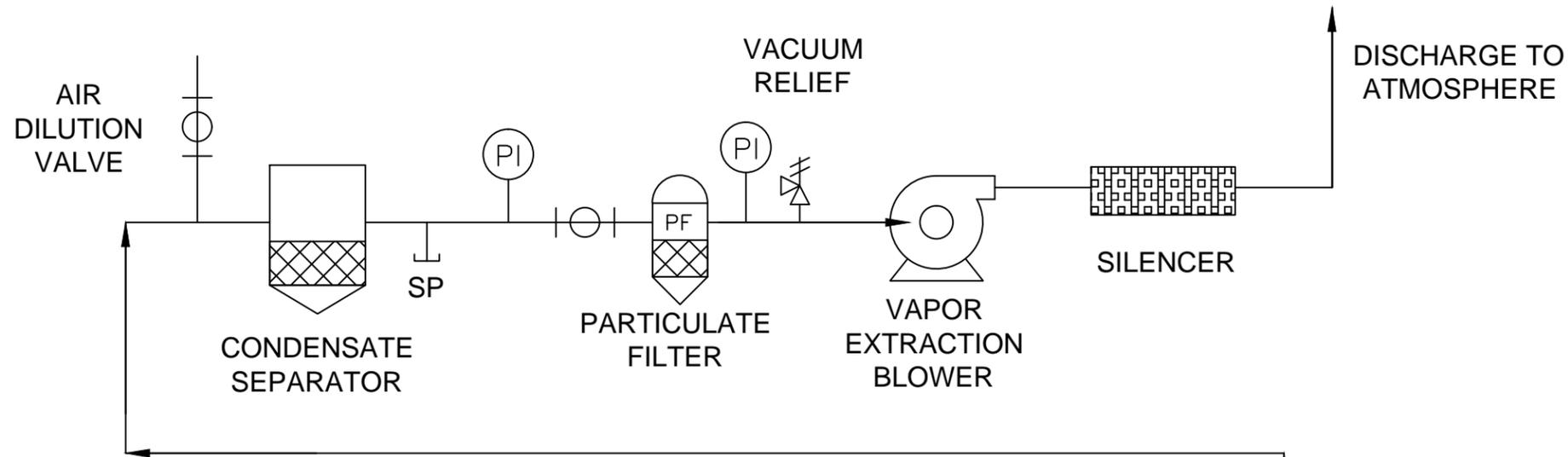


TYPE II MONITORING WELL CONSTRUCTION LOG

Project Name ECI
 Location 100 Rego Drive, Elon, NC
 Installed By Geologic Exploration Inc.
 Inspected By _____
 Method of Installation Air Rotary
 Remarks _____

Piez./Well No. OB-1 & 2
 Project No. 0268950.01
 Date TBD Time TBD





LEGEND

- PI PRESSURE INDICATOR
- SP SAMPLING PORT
- |○| FLOW CONTROL VALVE
- ∞ FLOW METER
- ↷ DIRECTION OF AIR FLOW



ERM NC, Inc.

FIGURE 12
Pilot Test Process & Instrumentation Diagram

Engineered Controls International, LLC.
100 Rego Road
Elon, Alamance County, North Carolina

TABLES

Table 1
Summary of Pilot Test Field Measurements
ECl Elon Facility
Whitsett, North Carolina

Stage #	Stage Description	Monitoring Locations					
		OB-1	OB-2	MW-7	DW-1	SVE-1 Exhaust	AS-1/Air Compressor
		Screen Depths (ft bgs)					
10-30	50-65	30-40	75 -85	-	-		
1	SVE	Pressure, VOC concentration, DTW, DO, ORP	Pressure, VOC concentration, DTW, DO, ORP	Pressure, VOC concentration, DTW, DO, ORP	Pressure, DTW, DO, ORP	Pressure, temp, VOCs, flow rate	DTW, DO, ORP
2	AS	Pressure, VOC concentration, DO, ORP, DTW	Pressure, VOC concentration, DO, ORP, DTW	Pressure, VOC concentration, DO, ORP, DTW	Pressure, DO, ORP, DTW	-	Temp, pressure, flow rate
3	AS & SVE	Pressure, VOC concentration, DTW, DO, ORP	Pressure, VOC concentration, DTW, DO, ORP	Pressure, VOC concentration, DTW, DO, ORP	Pressure, DTW, DO, ORP	Pressure, temp, VOCs, flow rate	Temp, pressure, flow rate

Notes:

OB = observation well

MW = monitoring well

SVE = soil vapor extraction

AS = air sparging

DTW = depth to water

DO = dissolved oxygen (collected with submersible *in situ* probe)

VOCs = volatile organic compounds (measured with a photo-ionization detector)

Elevation = water table measurements (collected with pressure transducer or water level meter)

* Pressure readings under SVE conditions may be negative, indicating a vacuum.

* VOC measurements will be collected at the beginning and end of each stage (i.e. not during each stage)

* This table presents a summary of anticipated measurements. However, actual measurements may vary based on site conditions and test responses.

Table 2
Summary of Anticipated Analytical Samples
ECl Elon Facility
Whitsett, North Carolina

Stage #	Stage Description	OB-1	OB-2	MW-7	DW-1	AS-1	SVE-1
-	Baseline	VOCs	VOCs	VOCs	VOCs	VOCs	-
1	SVE	-	-	-	-	-	VOCs (air sample)
2	AS	-	-	-	-	-	-
3	AS & SVE	-	-	-	-	-	VOCs (air sample)
-	Post-test	VOCs	VOCs	VOCs	VOCs	VOCs	-

Notes:

sparge

SVE = soil vapor extraction

VOCs = volatile organic compounds including 1,4-dioxane (aqueous = EPA SW-846 method 8260; Vapor = EPA Method TO-15).

- At the time of aqueous sample collection, field measurements will be collected for dissolved oxygen, temperature, pH, conductivity, and oxidation reduction potential.

APPENDIX A

Health & Safety Plan



LEVEL 2 WARN
HEALTH AND SAFETY PLAN
GMS Project # 0268950

This Level 2 Work Activity Risk Assessment (WARN) Health & Safety Plan (HASP) is intended to provide health and safety guidelines for project field work meeting ONE OR MORE OF the following criteria:

- **Some likelihood of physical and/or chemical hazard exposure (e.g., sampling)**
- **Number of job tasks is five or greater**
- **Use of subcontractors**
- **Fieldwork is being performed on an active or abandoned mining site**
- **“High-hazard” work to be performed, including but not limited to:**
 - **Excavations and trenching**
 - **Confined Spaces**
 - **Hot Work**
 - **Subsurface Clearance (*must complete and attach Subsurface Clearance Project Plan*)**
 - **Hazardous Energy Control Operations**
 - **Work at heights**
 - **Overhead Utilities/Proximity Hazards**
 - **Lifting Operations**
 - **Construction**
 - **Decommissioning, Decontamination and Demolition (DDD) Operations**
 - **Injection Well Operations**

If NONE of the above applies, an e-mail or Level 1 HASP template may be used. For more complex sites with significant client health and safety requirements, the project team may consider use of a long-form Level 3 WARN HASP.

This HASP should be developed with input from the project team, and reviewed with all ERM project personnel (including subcontractors). A signed copy of the HASP must be maintained at the project site during work and in the project files.

H&S Team review is required for the Level 2 WARN HASP. This HASP must be reviewed by the Project Manager and Partner-in-Charge (PIC) and updated as warranted to address changes in scope, hazards present, project personnel, etc. At a minimum, HASPs must be reviewed annually or if the scope of work changes. Updated HASPs should also be sent to the H&S Team and PIC for approval.

Administrative Information This document has been developed for the sole use of ERM staff. Subcontractors and other project participants must develop their own HASP. This document is valid for a maximum time period of one year after initial completion. This document must be reviewed if the scope of work or nature of site hazards changes and updated as warranted. All on-site personnel must be appropriately trained and qualified for the planned scope of work to be performed.	Site Name and Location: Engineered Controls Intl., Elon, NC	
	Client Contact and Phone: Jimmy McCandies 336-449-7707	
	Project Name: ECI Elon AS/SVE Pilot Test	
	Health & Safety Plan Date: 11/06/14	Revision Number and Date: N/A
	Field Work Start Date: 11/24/14	Anticipated Field Work End Date 12/11/14
	Project Manager (<i>responsible for implementing the site health and safety program on this project</i>) Ed Hollifield	Partner In Charge (<i>responsible for overall site health and safety performance on this project</i>). Thomas Wilson
Field Safety Officer (<i>responsible for all health & safety activities, recordkeeping and delegation of duties to any other project team members</i>) Greg Kanellis	Additional ERM personnel on site Tommy Fisher Tom Naumann	
H&S Team Review	Review Date	Signature
Site Setting Include relevant background information regarding the site, such as location, size, type of facility, topography, weather, infrastructure, security, previous site use, etc. Describe nature and extent of any soil/air/water/groundwater contamination. Describe any other aspects of the site that may potentially affect the health, safety, or security of on-site personnel.	Site: The ECI Elon facility is located at 100 Rego Drive, Elon, Alamance County, North Carolina. The approximate coordinates of the Site are: latitude 36.10118° N; longitude 79.5185° W. This <u>active facility</u> has a TCE plume near the loading dock area on the east-central side of the building and underneath the building. A residual VOC source mass in soils has been characterized and delineated at the Former Vapor Degreaser Area (AOC 1). The affected soils are attributed to historical releases related to the former use of TCE at AOC 1. As required, the extent of the VOC-affected soils has been delineated to the unrestricted/residential Preliminary Soil Remediation Goal (PSRG) of 880 ug/kg TCE. Only two soil samples from AOC 1, both located beneath the concrete floor, contain VOC concentrations above the industrial PSRGs. Past sampling results of indoor air indicated various volatile organic compounds (VOC) (including TCE) were detected between the collective cancer risk screening values of 1.0E-06 and 1.0E-04 and within a Hazard Index of 1. TCE was detected above the collective cancer risk screening value of 1.0E-04 or above the Hazard Index of 1 at select locations during the most recent (March 2013) sampling event. The facility is located within the Piedmont Physiographic Province of North Carolina. Bedrock is present at approximately 60 feet below land surface (ft bls). The bedrock is overlain by a layer of saprolite, a weathered and variably decomposed bedrock, which has the appearance of compact clayey to sandy soil that grades with depth to dense partially weathered rock (PWR). Groundwater at the site occurs within two separate, but interconnected, water-bearing zones. A shallow water-bearing zone occurs within the saprolite/PWR zone and a deeper aquifer zone occurs within the underlying competent bedrock.	

<p>Project Background and Scope of Work</p> <p>Include list of tasks to be completed by ERM personnel during this project, and a separate list of tasks to be completed by any subcontractors at the site.</p> <p>A site-specific Job Hazard Analysis (JHA) must be completed for each task to be performed. Subcontractors must provide their own HASP. Subcontractors must provide JHAs for each task they will perform for ERM review.</p> <p>JHA template and reference/example JHAs for more common tasks can be found at: Americas H&S Page - JHAs</p>	<p>ERM Scope of Work:</p> <ol style="list-style-type: none"> 1) Plan, coordinate, and manage/oversee subsurface clearance activities, including contracting with a private utility locating service (Taylor, Wiseman, & Taylor) and contacting NC One Call. 2) Manage/oversee installation of SVE/AS related wells: Install 2 observation wells, 1 SVE well and 1 AS well. Use rotary hollow stem auger drilling methods to install. 3) Conduct a SVE/AS pilot test, including field parameter monitoring of select wells and the collection of soil vapor samples for laboratory analysis. 4) Conduct pre- and post-SVE/AS pilot test groundwater sampling of select wells. 5) Submit groundwater and soil vapor samples to analytical laboratory for analysis. <p>Subcontractor(s) Scope of Work:</p> <p>Taylor, Wiseman, & Taylor: conduct private utility locate and mark out any subsurface utilities within the area of subsurface operations</p> <p>Geologic Exploration: Install 1 SVE well, 1 AS well, and 2 observation wells using rotary hollow stem auger drilling method.</p> <p>Shealy Environmental Services, Inc.: Provide laboratory analytical services.</p> <hr/> <p>Subcontractor(s) to be used:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 60%;">Taylor, Wiseman, & Taylor</td> <td style="width: 10%; text-align: center;"><input checked="" type="checkbox"/></td> <td style="width: 10%; text-align: center;">Y</td> <td style="width: 10%; text-align: center;"><input type="checkbox"/></td> <td style="width: 10%; text-align: center;">N</td> </tr> <tr> <td>Geologic Exploration</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;">Y</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;">N</td> </tr> <tr> <td>Shealy Environmental Services, Inc.</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;">Y</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;">N</td> </tr> <tr> <td></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;">Y</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;">N</td> </tr> <tr> <td></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;">Y</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;">N</td> </tr> </table>	Taylor, Wiseman, & Taylor	<input checked="" type="checkbox"/>	Y	<input type="checkbox"/>	N	Geologic Exploration	<input checked="" type="checkbox"/>	Y	<input type="checkbox"/>	N	Shealy Environmental Services, Inc.	<input checked="" type="checkbox"/>	Y	<input type="checkbox"/>	N		<input type="checkbox"/>	Y	<input type="checkbox"/>	N		<input type="checkbox"/>	Y	<input type="checkbox"/>	N
Taylor, Wiseman, & Taylor	<input checked="" type="checkbox"/>	Y	<input type="checkbox"/>	N																						
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	<input type="checkbox"/>	Y	<input type="checkbox"/>	N																						
	<input type="checkbox"/>	Y	<input type="checkbox"/>	N																						
<p>Site/Project General Information</p> <p>* Complete and attach the appropriate Risk Assessment checklist.</p>	<p>Site Type (check all applicable boxes)</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;"><input type="checkbox"/> Remote Site*</td> <td style="width: 33%;"><input type="checkbox"/> Inactive Facility*</td> <td style="width: 33%;"><input checked="" type="checkbox"/> Hazardous waste release site (HAZWOPER)</td> </tr> <tr> <td><input type="checkbox"/> Railroad</td> <td><input checked="" type="checkbox"/> Industrial</td> <td><input type="checkbox"/> Residential</td> </tr> <tr> <td><input type="checkbox"/> Unsecured</td> <td><input type="checkbox"/> Coastal / Offshore (on or near water)</td> <td><input type="checkbox"/> Other (specify)</td> </tr> </table>	<input type="checkbox"/> Remote Site*	<input type="checkbox"/> Inactive Facility*	<input checked="" type="checkbox"/> Hazardous waste release site (HAZWOPER)	<input type="checkbox"/> Railroad	<input checked="" type="checkbox"/> Industrial	<input type="checkbox"/> Residential	<input type="checkbox"/> Unsecured	<input type="checkbox"/> Coastal / Offshore (on or near water)	<input type="checkbox"/> Other (specify)																
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<input type="checkbox"/> Unsecured	<input type="checkbox"/> Coastal / Offshore (on or near water)	<input type="checkbox"/> Other (specify)																								

Safe Work Practices	Main Site Hazards (check all applicable boxes)			
<p>Place a checkmark by applicable site hazards.</p> <p>Adequate control measures for all checked hazards must be included in site-specific JHAs, which should be attached to the HASP</p> <p>** High hazard work requiring H&S team coordination (additional control measures required beyond JHA)</p> <p>*** Permit-required high hazard work, requiring safety team coordination and ERM or equivalent client-required permit to be completed</p> <p>More detailed guidance on specific safety topics can be found in the Health & Safety Guidance Documents Section on the Americas Safety Page on Minerva.</p>	<input checked="" type="checkbox"/> Natural Hazards (Plants, Insects Animals) <input type="checkbox"/> Journey Management <input checked="" type="checkbox"/> Compressed Gas <input type="checkbox"/> Work at Heights > feet (1.2 m)** <input type="checkbox"/> Use of Blasting Materials or Explosives** <input checked="" type="checkbox"/> Slip/Trip/Fall <input type="checkbox"/> Scaffold Use <input type="checkbox"/> Excavations and Trenching*** <input type="checkbox"/> Control of Hazardous Energy*** <input checked="" type="checkbox"/> Hazard Communication <input type="checkbox"/> Chemical mixing and injection <input type="checkbox"/> Travel to Medium/High Risk Locations** <input type="checkbox"/> Other (specify)	<input checked="" type="checkbox"/> Organic Chemicals <input type="checkbox"/> Overexertion / Fatigue <input type="checkbox"/> Asbestos <input type="checkbox"/> Extreme Weather <input type="checkbox"/> Confined Space Entry*** <input type="checkbox"/> Forklift and Industrial Truck Use** <input type="checkbox"/> Portable Ladders <input type="checkbox"/> All-Terrain Vehicle <input type="checkbox"/> Working on or over water <input checked="" type="checkbox"/> Medical Services and First Aid <input type="checkbox"/> Unexploded Ordnance / Munitions and Explosives of Concern (UXO/MEC)** <input checked="" type="checkbox"/> Drum Handling <input type="checkbox"/> Other(specify)	<input checked="" type="checkbox"/> Inorganic Chemicals <input type="checkbox"/> Line Breaking*** <input checked="" type="checkbox"/> High Noise (>85 dBA) <input checked="" type="checkbox"/> Hand/Portable Power Tools <input type="checkbox"/> ASTs/USTs <input type="checkbox"/> Scissor Lift / Cherry Picker Use* <input type="checkbox"/> Welding or Hot Work*** <input type="checkbox"/> Helicopter Transportation <input type="checkbox"/> Working in or near surface waters (lakes/rivers) <input type="checkbox"/> Airborne Contaminants <input checked="" type="checkbox"/> Personal Protective Equipment (PPE) <input type="checkbox"/> Protection by Armed Security Forces** <input type="checkbox"/> Other(specify)	<input checked="" type="checkbox"/> Material Handling Equipment in Use* <input type="checkbox"/> Extended Shifts (>14 hrs + driving) <input type="checkbox"/> Respirable Particles <input type="checkbox"/> Non-Ionizing Radiation <input checked="" type="checkbox"/> Buried/Overhead Utilities and Subsurface Clearance*** <input checked="" type="checkbox"/> Ergonomics / Manual Lifting <input type="checkbox"/> Construction** <input type="checkbox"/> Surface/Underground Mines <input type="checkbox"/> Underwater Diving** <input type="checkbox"/> Critical Lifting*** <input type="checkbox"/> Respiratory Protection <input type="checkbox"/> Non-Standard Shifts (e.g., night work) <input type="checkbox"/> Other(specify)

<p>Chemical Products Used or Stored Onsite</p> <p>For each chemical product identified, a Safety Data Sheet (SDS) or Chemical Safety Data Card (CSDC) must be attached to this HASP.</p> <p>SDS/CSDS for many common chemicals may be found on the Americas Safety Page on Minerva.</p>	<table border="0"> <tr> <td><input checked="" type="checkbox"/> Alconox or Liquinox*</td> <td><input type="checkbox"/> Calibration gas (Methane)</td> <td><input type="checkbox"/> Isopropyl Alcohol*</td> </tr> <tr> <td><input checked="" type="checkbox"/> Hydrochloric acid (HCl)*</td> <td><input checked="" type="checkbox"/> Calibration gas (Isobutylene)</td> <td><input type="checkbox"/> Household bleach (NaOCl)*</td> </tr> <tr> <td><input type="checkbox"/> Nitric acid (HNO₃)*</td> <td><input type="checkbox"/> Calibration gas (Pentane)</td> <td><input type="checkbox"/> Sulfuric acid (H₂SO₄)*</td> </tr> <tr> <td><input type="checkbox"/> Sodium hydroxide (NaOH)*</td> <td><input type="checkbox"/> Calibration gas (4-gas mixture)</td> <td><input type="checkbox"/> Hexane</td> </tr> <tr> <td><input checked="" type="checkbox"/> Other (specify) Compressed air</td> <td><input checked="" type="checkbox"/> Calibration gas (zero air)</td> <td><input type="checkbox"/> Other (specify)</td> </tr> <tr> <td></td> <td><input type="checkbox"/> Other (specify)</td> <td></td> </tr> </table> <p>*NOTE: Eyewash solution must be readily available on ALL project sites where materials are used or stored that pose a risk of getting into the eyes from splashes / airborne dust/debris, etc., including sample preservatives. The eyewash unit – stationary or portable – must be large enough to provide at least 15 minutes of eye flushing.</p>	<input checked="" type="checkbox"/> Alconox or Liquinox*	<input type="checkbox"/> Calibration gas (Methane)	<input type="checkbox"/> Isopropyl Alcohol*	<input checked="" type="checkbox"/> Hydrochloric acid (HCl)*	<input checked="" type="checkbox"/> Calibration gas (Isobutylene)	<input type="checkbox"/> Household bleach (NaOCl)*	<input type="checkbox"/> Nitric acid (HNO ₃)*	<input type="checkbox"/> Calibration gas (Pentane)	<input type="checkbox"/> Sulfuric acid (H ₂ SO ₄)*	<input type="checkbox"/> Sodium hydroxide (NaOH)*	<input type="checkbox"/> Calibration gas (4-gas mixture)	<input type="checkbox"/> Hexane	<input checked="" type="checkbox"/> Other (specify) Compressed air	<input checked="" type="checkbox"/> Calibration gas (zero air)	<input type="checkbox"/> Other (specify)		<input type="checkbox"/> Other (specify)																
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<input checked="" type="checkbox"/> Other (specify) Compressed air	<input checked="" type="checkbox"/> Calibration gas (zero air)	<input type="checkbox"/> Other (specify)																																
	<input type="checkbox"/> Other (specify)																																	
<p>Chemicals of Concern</p> <p>In the section to the right, check any chemicals present onsite in any media (air, soil, water), or check “No ERM exposure to these”.</p> <p>These chemicals include OSHA-regulated potential occupational carcinogens (29 CFR 1910.1003-1910.1016) as well as those chemicals for which OSHA has established specific respiratory protection requirements (29 CFR 1910.134)</p> <p>If any of these chemicals are present on site, contact your safety team member for guidance. Then, describe additional protective measures to be taken for boxes checked.</p>	<table border="0"> <tr> <td><input type="checkbox"/> Friable Asbestos</td> <td><input type="checkbox"/> alpha-Naphthylamine</td> <td><input type="checkbox"/> Methyl chromoethyl ether</td> </tr> <tr> <td><input type="checkbox"/> 3,3'-Dichlorobenzidine</td> <td><input type="checkbox"/> bis-Chloromethyl ether</td> <td><input type="checkbox"/> beta-Naphthylamine</td> </tr> <tr> <td><input type="checkbox"/> Benzidine</td> <td><input type="checkbox"/> 4-Aminodiphenyl</td> <td><input type="checkbox"/> Ethyleneimine</td> </tr> <tr> <td><input type="checkbox"/> beta-Propiolactone</td> <td><input type="checkbox"/> 2-Acetylamino-flourene</td> <td><input type="checkbox"/> 4-Dimethylaminoazobenzene</td> </tr> <tr> <td><input type="checkbox"/> N-Nitrosomethylamine</td> <td><input type="checkbox"/> Vinyl chloride</td> <td><input type="checkbox"/> Inorganic arsenic</td> </tr> <tr> <td><input type="checkbox"/> Lead</td> <td><input type="checkbox"/> Chromium (VI)</td> <td><input type="checkbox"/> Cadmium</td> </tr> <tr> <td><input type="checkbox"/> Benzene</td> <td><input type="checkbox"/> Coke oven emissions</td> <td><input type="checkbox"/> 1,2-Dibromo-3-chloropropane</td> </tr> <tr> <td><input type="checkbox"/> Acrylonitrile</td> <td><input type="checkbox"/> Ethylene oxide</td> <td><input type="checkbox"/> Formaldehyde</td> </tr> <tr> <td><input type="checkbox"/> Methylenedianiline</td> <td><input type="checkbox"/> 1,3-Butadiene</td> <td><input type="checkbox"/> Methylene chloride</td> </tr> <tr> <td><input type="checkbox"/> 4-Nitrobiphenyl</td> <td></td> <td></td> </tr> <tr> <td><input checked="" type="checkbox"/> No ERM exposure to these</td> <td></td> <td></td> </tr> </table> <p>Additional measures to be taken based on associated chemical hazard(s):</p>	<input type="checkbox"/> Friable Asbestos	<input type="checkbox"/> alpha-Naphthylamine	<input type="checkbox"/> Methyl chromoethyl ether	<input type="checkbox"/> 3,3'-Dichlorobenzidine	<input type="checkbox"/> bis-Chloromethyl ether	<input type="checkbox"/> beta-Naphthylamine	<input type="checkbox"/> Benzidine	<input type="checkbox"/> 4-Aminodiphenyl	<input type="checkbox"/> Ethyleneimine	<input type="checkbox"/> beta-Propiolactone	<input type="checkbox"/> 2-Acetylamino-flourene	<input type="checkbox"/> 4-Dimethylaminoazobenzene	<input type="checkbox"/> N-Nitrosomethylamine	<input type="checkbox"/> Vinyl chloride	<input type="checkbox"/> Inorganic arsenic	<input type="checkbox"/> Lead	<input type="checkbox"/> Chromium (VI)	<input type="checkbox"/> Cadmium	<input type="checkbox"/> Benzene	<input type="checkbox"/> Coke oven emissions	<input type="checkbox"/> 1,2-Dibromo-3-chloropropane	<input type="checkbox"/> Acrylonitrile	<input type="checkbox"/> Ethylene oxide	<input type="checkbox"/> Formaldehyde	<input type="checkbox"/> Methylenedianiline	<input type="checkbox"/> 1,3-Butadiene	<input type="checkbox"/> Methylene chloride	<input type="checkbox"/> 4-Nitrobiphenyl			<input checked="" type="checkbox"/> No ERM exposure to these		
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<input checked="" type="checkbox"/> No ERM exposure to these																																		

The following section must be filled out completely for all chemicals (suspected or confirmed) present in site media (soil, air, water). Attach an SDS for each chemical.

Materials Present or Suspected at Site	Highest Reported Concentration (Soil: PSRGs - Residential GW: NC 2L)	Exposure Limit (ppm)	IDLH Level (ppm)	Primary Hazards of the Material (explosive, flammable, toxic, volatile, radioactive, biohazard, oxidizer, or other)	Symptoms and Effects of Acute Exposure	Ionization Potential (eV)	Respirator Cartridge Type	Respirator Cartridge Replacement Schedule
TCE	Soil: 9,000 ug/kg GW: 3,030 ug/L	PEL = 100 REL = 25 (10hr TWA) TLV = N/A Other= Skin Hazard <input checked="" type="checkbox"/>	1,000	Flammable, toxic, volatile	Irritation of eyes and skin; visual disturbance; exhaustion/ weakness; dizziness; nausea; vomiting	9.32	Organic vapor	
PCE	Soil: 26.2 ug/kg GW: 99.7 ug/L	PEL = 100 REL = N/A TLV = 25 Other= Skin Hazard <input type="checkbox"/>	150	Flammable, toxic, volatile	Irritation of upper respiratory tract and eyes; kidney dysfunction; neurological effects, dizziness; headache; sleepiness	9.32	Organic vapor	
		PEL = REL = TLV = Other= Skin Hazard <input type="checkbox"/>						
		PEL = REL = TLV = Other= Skin Hazard <input type="checkbox"/>						
		PEL = REL = TLV = Other= Skin Hazard <input type="checkbox"/>						
		PEL = REL = TLV = Other= Skin Hazard <input type="checkbox"/>						

FOR ADDITIONAL CHEMICALS, USE THE LEVEL 2 HASP CHEMICALS TABLE ATTACHMENT.

PEL = OSHA Permissible Exposure Limit - http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992

REL = NIOSH Recommended Exposure Limit - <http://www.cdc.gov/niosh/npg/default.html>

TLV = ACGIH Threshold Limit Value (Contact your Division H&S Leader for additional information on these values).

IDLH = Immediately Dangerous to Life or Health - <http://www.cdc.gov/niosh/npg/default.html>

Levels of Personal Protective Equipment (PPE) Required for each Task	Task Description	Level of PPE			
		A	B	C	D
<p>Primary hazard control strategies, including elimination/avoidance, engineering controls, and/or administrative controls, must be documented for all tasks on task-specific JHAs, to be included as an attachment to this HASP. PPE is considered as the “last line of defense.”</p> <p>Signature of the H&S Team on Page 1 of this document signifies certification of PPE Hazard Assessment.</p>	1. Mobilize to Site/Re-Mobilize to Office	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2. Subsurface Utility Clearance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3. Well Installation. Drilling - High noise: Use hearing protection.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4. Conduct SVE/AS pilot test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5. Vapor/Groundwater Sampling.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<p>Personal Protective Equipment (PPE) based on identified tasks to be performed, as outlined in Scope of Work.</p> <p>Req = Required PPE for one or more tasks to be performed; required on site at all times. PPE specific to each task must be outlined in detail on task-specific JHAs.</p> <p>NA = Not applicable to this project</p>	PPE	Req	NA	PPE	Req	NA
	Steel Toe Boots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hard Hat	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Long Sleeve Shirt & Long Pants	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Safety Glasses w/ side shields	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Outer Disposable Boots	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Chemical/impact-resistant Goggles	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Tyvek Suit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Poly-Coated Tyvek	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Fully Encapsulated Chemical Suit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Full-Face Respirator	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Hearing Protection	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Half-Face Respirator	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Leather Gloves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Inner Chemical Gloves	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Outer Chemical Gloves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Other (specify) High visibility safety vest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<p>Training, Medical Surveillance, and Safety Supplies</p> <p>Req = Requirements are based on specific tasks performed in the field and the type of environments, chemicals or hazards encountered.</p> <p>NA = Not applicable to this project</p> <p>*Provides specialized training over-and-above the 40-hour HAZWOPER training necessary to serve as an on-site manager supervising employees engaged in work covered by the HAZWOPER standard at 29 CFR 1910.120</p> <p>**Physical examination requirements should be discussed with WorkCare well in advance of the start of work to allow adequate time to schedule examination requirements.</p>	Training	Req	NA	Medical Surveillance**	Req	NA
	40-hr HAZWOPER; current 8-hr refresher	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Medical Clearance	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	8 Hour HAZWOPER Supervisor*	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Respirator Clearance and Fit Test	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Current CPR and First Aid	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Blood Lead and ZPP	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	MSHA 40-hr New Miner and current 8-hr refresher	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Other (specify)	<input type="checkbox"/>	<input type="checkbox"/>
	ERM Field Safety Officer (FSO)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Other (specify)	<input type="checkbox"/>	<input type="checkbox"/>
	DDD Practice FSO/DM	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Supplies	Req	NA
	Subsurface Clearance (SSC)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	First Aid Kit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	EPA Hazardous Waste	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Eyewash Solution (capable of 15 minutes of eye flushing)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Hazmat/Dangerous Goods Shipping	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Air Horn	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	International Traveler	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Decontamination Supplies	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>	<input type="checkbox"/>	Fire Extinguisher	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>	<input type="checkbox"/>	Potable Water	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>	<input type="checkbox"/>	Toilets	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other (specify):	<input type="checkbox"/>	<input type="checkbox"/>	Other (specify):	<input type="checkbox"/>	<input type="checkbox"/>	

Monitoring Equipment: All monitoring equipment on site must be calibrated per manufacturer specifications (including daily bump tests) and results recorded. Under stable site conditions, measurements must be made in the breathing zone at least once every 30 minutes.

Instrument (Check all required)	Task	Instrument Reading	Action Guideline	Comments
<input type="checkbox"/> Combustible gas indicator model:	<input type="checkbox"/> 1	0 to 10% LEL	Monitor. Evacuate if confined space.	N/A
	<input type="checkbox"/> 2	10 to 25% LEL	Potential fire or explosion hazard.	
	<input type="checkbox"/> 3			
	<input type="checkbox"/> 4	>25% LEL	Fire/explosion hazard. Evacuate site.	
	<input type="checkbox"/> 5			
<input type="checkbox"/> Oxygen meter model:	<input type="checkbox"/> 1	>23.5% Oxygen	Fire hazard. Evacuate site.	N/A
	<input type="checkbox"/> 2	23.5 to 19.5% Oxygen	Normal oxygen levels.	
	<input type="checkbox"/> 3	<19.5% Oxygen	Oxygen deficient conditions. Evacuate site.	
	<input type="checkbox"/> 4			
	<input type="checkbox"/> 5			
<input type="checkbox"/> Radiation survey meter model:	<input type="checkbox"/> 1	Normal background	Proceed with normal operations.	Annual exposure not to exceed 1250 mrem per quarter. Background reading must be taken in area known to be free of radiation sources.
	<input type="checkbox"/> 2	Three times background	Notify Radiation Safety Officer.	
	<input type="checkbox"/> 3			
	<input type="checkbox"/> 4	>Three times background	Radiological hazard. Evacuate site.	
	<input type="checkbox"/> 5			
<input checked="" type="checkbox"/> Photoionization detector model: <input type="checkbox"/> 11.7 eV <input checked="" type="checkbox"/> 10.6 eV <input type="checkbox"/> 10.2 eV <input type="checkbox"/> 9.8 eV <input type="checkbox"/> _____ eV Level A-D PPE Requirements	<input type="checkbox"/> 1 <input type="checkbox"/> 2	Any response below 50 ppm, sustained for 1 minute	Level "D" is acceptable up to the action level. For response above established background level(s), appropriate level PPE requirements must be met.	The action level for upgrading the level of protection is typically one-half of the lowest published exposure limit identified for the potential COCs at the site. For COCs with extremely low exposure limits (e.g., < 5 ppm), contact your Division H&S Leader or for guidance on action levels. Respirator selection should be based on the Assigned Protection Factor (APF) and the Maximum Use Concentration (MUC). To determine the appropriate respirator selection, the following contaminant information must be known: <ul style="list-style-type: none"> • Permissible Exposure Limit (PEL) or other published Exposure Limit (note that the lowest published exposure guideline should be used to establish action levels) • Short-term Exposure Limit • Ceiling Limit • Peak Limit • Any other exposure limit for the hazardous substance Contact your Division H&S Leader or Project Health and Safety Consultant for assistance in defining the APF and MUC, as necessary, as well as any time upgrading of respiratory protection is required based on established action levels.
		50 ppm to 500 ppm, sustained for 1 minute	Level "C" is acceptable as appropriate.	
	<input checked="" type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	Greater than 500 ppm above background, sustained for 1 minute	Stop work. Tasks requiring Level B or Level A PPE are not anticipated during this project. If Level B or Level A PPE is needed, as determined by the FSO and/or the PM, the Division H&S Leader will be notified and the HASP will be revised.	

Instrument (Check all required)	Task	Instrument Reading	Action Guideline	Comments
<input type="checkbox"/> Flame ionization detector model:		Any response above background to _____ ppm above background, sustained for 1 minute	Level "D" is acceptable up to the action level. For response above established background level(s), appropriate level PPE requirements must be met.	<p>The action level for upgrading the level of protection is one-half of the lowest published exposure limit identified for the potential COCs at the site.</p> <p>Respirator selection should be based on the Assigned Protection Factor (APF) and the Maximum Use Concentration (MUC). To determine the appropriate respirator selection, the following contaminant information must be known:</p> <ul style="list-style-type: none"> • Permissible Exposure Limit (PEL) or other published Exposure Limit • Short-term Exposure Limit • Ceiling Limit • Peak Limit • Any other exposure limit for the hazardous substance <p>Contact your Division H&S Leader or Project Health and Safety Consultant for assistance in defining the APF and MUC, as necessary.</p>
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	_____ ppm above background to _____ ppm above background, sustained for 1 minute	Level "C" is acceptable as appropriate.	
	<input type="checkbox"/> 4 <input type="checkbox"/> 5	Greater than _____ ppm above background, sustained for 1 minute	Stop work. Tasks requiring Level B or Level A PPE are not anticipated during this project. If Level B or Level A PPE is needed, as determined by the FSO and/or the Project Health and Safety Consultant, the Division H&S Leader will be notified and the HASP will be revised.	
<input type="checkbox"/> Detector tube models:	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	Specify:	Specify:	
<input type="checkbox"/> Other (specify):	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	Specify:	Specify:	

<p>Work Zones</p> <p>If exclusion zones are necessary because of chemical and/or equipment hazards. Describe the set-up of these zones. Include landmarks, dimensions as necessary, equipment vs. personnel decontamination zones</p>	<p>Exclusion Zone: Cones and caution tape will be placed directly around the work areas, including 1) Drill rig and support area during well installation activities, 2) SVE/AS pilot test equipment and portable generator during conduct of SVE/AS pilot test, and 3) Groundwater wells during well sampling activities.</p>
	<p>Contamination Reduction Zone: Area immediately outside of the Exclusion Zone where personnel and equipment decontamination activities occur.</p>
	<p>Support Zone: ERM or Subcontractor field vehicle or onsite office area.</p>
<p>Site Access/Control</p> <p>Describe procedures for limiting unauthorized entry to the work zone(s). Are there any security requirements?</p>	<p>Access Control Procedures: Per property owner's protocols. Maintain awareness of surroundings at all times. All personnel and visitors on site for the SVE/AS pilot test must read the site HASP and sign the worker/visitor login sheet. Unauthorized personnel will be directed not to enter the support, contamination reduction or exclusion zones. Report suspicious persons to the facility contact and/or call 911. Exclusion zones will be setup around all work areas to consist of cones and caution tape. The ERM Field Safety Officer (FSO) will setup and/or approve of the exclusion zones around all work areas.</p>
<p>Decontamination Procedures</p> <p>Describe procedures for decontamination of personnel and equipment.</p>	<p>Personnel: Place gloves and Tyveks (if applicable) in a separate trash bag and dispose of in the appropriate trash receptacle. Decontaminate drilling tools/equipment on containment pad and drum impacted water. Place all used PPE in an appropriate bag for offsite disposal. Wash hands after sampling.</p>
	<p>Equipment: Sink, soap, water. Small tools - Clean withalconox solution then rinse twice with deionized water. Large drilling-related tools - Clean using a pressure washer inside a decontamination pad to contain any waste material.</p>

<p>Emergency Response Planning</p> <p>In the pre-work briefing and daily tailgate safety meetings, all onsite employees will be trained in the provisions of emergency response planning, site communication systems, and site evacuation routes. Note that clients may have their own procedures which may need to be followed.</p> <p>Signal a site emergency or medical emergency with three blasts of a loud horn (car horn, fog horn, or similar device).</p> <p>To complete this section, attach a hospital route map to the HASP.</p>	<p>ALL WORK-RELATED INCIDENTS MUST BE REPORTED. FOR ALL MEDICAL EMERGENCIES, CALL 911 OR THE LOCAL EMERGENCY NUMBER.</p> <p>For ALL non-emergency incidents resulting in injury or illness, you must:</p> <ul style="list-style-type: none"> • Give appropriate first aid care to the injured or ill individual and secure the scene. • Immediately notify the Project Manager and/or Partner-in-Charge. • Immediately call WorkCare Incident Intervention at (888) 449-7787 (available 24 hours/7 days per week) (US only). • Clients may have their own procedures which we may need to follow. • Enter the event into the ECS within 24 hours. <p>In the event of an emergency that necessitates evacuation of the work task area or the site as a whole, the following procedures shall occur:</p> <ul style="list-style-type: none"> • The ERM FSO will contact all nearby personnel using the onsite communications system to advise of the emergency. • Personnel will proceed along site roads to a safe distance upwind from the hazard source. • Personnel will remain in that area until the site safety contact or other authorized individual provides further instruction. <p>In the event of a severe spill or leak, site personnel will follow the procedures listed below:</p> <ul style="list-style-type: none"> • Evacuate the affected area and relocate personnel to an upwind location. • Inform the ERM FSO, an ERM office, and a site representative immediately. • Locate the source of the spill or leak, and stop the source if it is safe to do so and appropriately trained personnel are onsite to do so. • Begin containment and recovery of spilled or leaked materials. • Notify appropriate local, state, and federal agencies after obtaining client consent to do so. <p>In the event of severe weather, site personnel will follow the procedures listed below:</p> <ul style="list-style-type: none"> • Site work shall not be conducted during severe weather, including high winds and lightning. • In the event of severe weather, stop work, lower any equipment (drill rigs), and evacuate the affected area.
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<p>Client Specific Emergency Response</p> <p>In the event of an emergency, client specific emergency response procedures may take precedent over ERM established procedures.</p> <p>While engaging in field related activities on an active client site, measures they have in place to signal either emergency response or evacuation need to be reviewed and documented.</p> <p>Once completed, this summary, along with evacuation map(s), should be discussed with all visitors, subcontractors and others subject to HASP review upon site visit.</p>	<p>Contributing factors initiating emergency response (process, material, weather)</p> <p>Upon arriving at site, discuss the emergency evacuation procedure and designate a muster point. Meet with the site representative to identify any site-specific emergency response procedures and incorporate them into this plan.</p> <p>Lights and/or sounds associated with evacuation</p> <p>Meet with the site contact to identify alarms that are utilized at the facility.</p> <p>Drill requirements for contractors on-site</p> <p>NA</p> <p>Initial and alternative muster points</p> <p>Identify muster points and coordinate with facility procedures</p> <p>Map associated with evacuation</p> <p>Mark evacuation route(s) and muster point(s) on site map provided in this HASP and review with field crew</p> <p>Specific evacuation procedures</p> <p>Discuss evacuation procedures during initial tailgate meeting and incorporate facility procedures into plan.</p> <p>How does contractor account for all site visitors</p> <p>Brief any site visitors regarding evacuation procedures upon arrival to site.</p> <p>PPE and Spill Kit requirements (if emergency response is spill related)</p> <p>NA</p>
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Emergency Contacts	Name	Location	Phone	Cell Phone
Hospital (attach map)	Alamance Regional Medical Center	1240 Huffman Mill Rd, Burlington, NC	336-538-7000	
Police	Town of Elon Police Department	104 South Williamson Avenue	336-584-1301	
Fire	Elon Fire Department (Station No. 1)	219 South Williamson Avenue	336-584-9190	
Project Manager	Ed Hollifield	Charlotte, NC	704-409-3431	704-301-2262
Field Manager (if not PM)	Greg Kanellis	Raleigh, NC	919-233-4501	919-745-7197
Field Safety Officer (if not PM)	Greg Kanellis	Raleigh, NC	919-233-4501	919-745-7197
Division H&S Contact	Millard Griffin	Atlanta, GA	678-486-2700	678-294-8658
Alternate H&S Contact	Don Hall	Atlanta, GA	678-486-2700	704-472-3727
Americas Region H&S Contact	Mark Hickey	Denver, CO	720-200-7172	720-625-2869
Incident Intervention (US Only)	WorkCare	NA	888-449-7787	NA
SSC Experienced Person	Greg Kanellis	Raleigh, NC	919-233-4501	919-745-7197
Subcontractor Safety Contact(s)	N/A			
Client Site Contact	Jimmy McCandies	Elon	336-449-7707	336-380-5645

Acknowledgement	<p><i>I have read, understood, and agree with the information set forth in this Health & Safety Plan, and will follow guidance in the plan and in the ERM North America Health and Safety manual. I understand the training and medical monitoring requirements for conducting activities covered by this WARN HASP and have met these requirements.</i></p> <p><i>ERM has prepared this plan solely for the purpose of protecting the health and safety of ERM employees. Subcontractors, visitors, and others at the site are required to follow provisions in this document at a minimum, but must refer to their organization's health and safety program for their protection.</i></p>		
Printed Name	Signature	Organization	Date
Approval Signatures Signatures in this section indicate the signing employee will comply with and enforce this WARN HASP, as well as procedures and guidelines established in the ERM NA H&S. Signatures in this section also indicate that any subcontractors performing work under contract to ERM have met the minimum safety standards in the ERM Subcontractor Prequalification Process.	Project Manager		Date:
	Edward Hollifield		
Approval Signatures Signatures in this section indicate the signing employee will comply with and enforce this WARN HASP, as well as procedures and guidelines established in the ERM NA H&S. Signatures in this section also indicate that any subcontractors performing work under contract to ERM have met the minimum safety standards in the ERM Subcontractor Prequalification Process.	Partner in Charge		Date:
	Thomas Wilson		

Check all appropriate documents to be attached to this HASP.	<input checked="" type="checkbox"/> Site-specific JHAs for all tasks (including subcontractors)	<input checked="" type="checkbox"/> OFP Contractor Leaflet
	<input checked="" type="checkbox"/> SDS/CSDC for all chemicals brought to site and all chemicals suspected/confirmed in site media	<input type="checkbox"/> Risk Assessment Checklists
	<input checked="" type="checkbox"/> SSC Project Plan	<input type="checkbox"/> Health & Safety Guidance Documents: List:
	<input checked="" type="checkbox"/> Map of Route to Hospital/Emergency Services	<input type="checkbox"/> Client specific requirements
	<input type="checkbox"/> High-Hazard Work Procedures: Type:	<input type="checkbox"/> Travel Risk Assessment (TRA)
	<input type="checkbox"/> High-Hazard Work Permits: Type(s):	<input type="checkbox"/> PLAN Risk Assessment
	<input type="checkbox"/> Facility site map(s)	<input checked="" type="checkbox"/> Field Audit Forms
	<input checked="" type="checkbox"/> Tailgate Safety Meeting Forms	<input type="checkbox"/> PM H&S Checklist
	<input checked="" type="checkbox"/> Air Monitoring and Equipment Calibration Forms	<input checked="" type="checkbox"/> Vehicle Safety Checklist
	<input checked="" type="checkbox"/> SOS (See-Own-Share) Field Cards	<input type="checkbox"/> IH Sampling Data Sheet
	<input type="checkbox"/> Emergency Drill Forms	<input type="checkbox"/> Other (specify):
		<input type="checkbox"/> Other (specify):

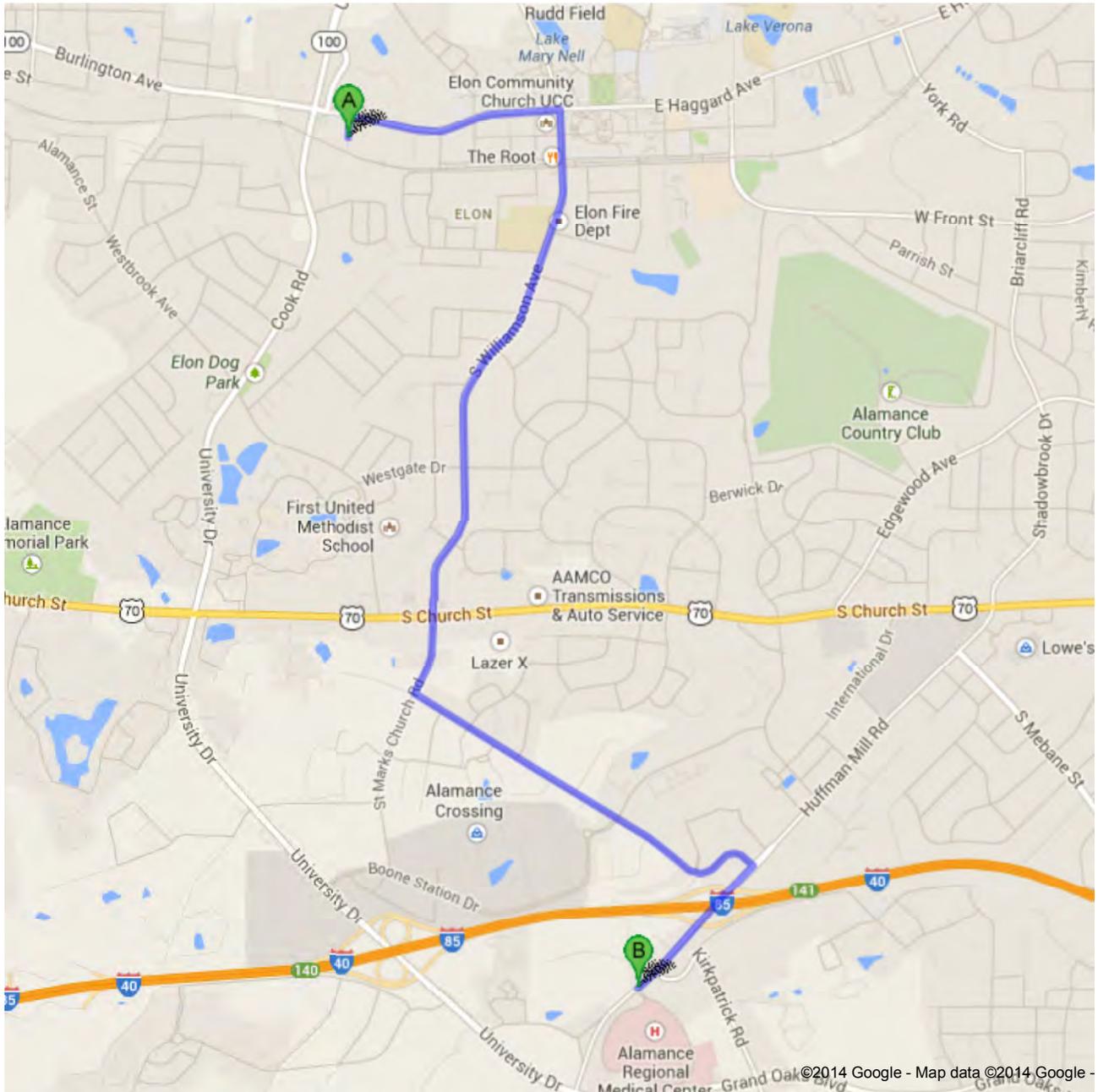
<h2>See It – Own It – Share It</h2>	<h2>Stop Work Authority</h2>
<p>It means that:</p> <ul style="list-style-type: none"> • We know that we have a responsibility to look out for each other, to intervene when necessary, to be proactive and to help keep safety issues from becoming problems. • We also look out for ourselves. If we recognize that a situation is unsafe, we are expected to stop what we're doing, reassess the situation and consult with others if necessary before proceeding safely. • We assign no blame to anyone who raises safety issues. • We strive to learn lessons from the large and small events that are part of our daily experience. 	<p>It is ERM policy that all ERM and ERM Subcontractor employees have the authority, without fear of reprimand or retaliation to:</p> <ul style="list-style-type: none"> • Immediately stop any work activity that presents a danger to the site team or the public. • Get involved, question and rectify any situation or work activity that is identified as not being in compliance with the HASP or with broader ERM health and safety policies. • Report any unsafe acts or conditions to supervision or, preferably, intervene to safely correct such acts or conditions themselves.

Revision Log	Date	By	Notes
	2/11/2013	S Perkins / M Griffin	Merged standard / intrusive L2 formats into single document. Revisions to include full HAZWOPER compliance, DDD practice applicability, and user feedback.
	5/2013	M. Griffin	Added additional user feedback.

ATTACHMENTS



Directions to 1240 Huffman Mill Rd, Burlington, NC 27215
4.4 mi – about 10 mins



 100 Rego Dr, Elon, NC 27244

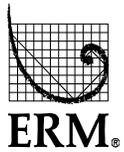
-
1. Head **north** on **Rego Dr** toward **W Haggard Ave** go 367 ft
total 367 ft
 -  2. Turn right onto **W Haggard Ave** go 0.7 mi
total 0.7 mi
About 2 mins
 -  3. Turn right onto **N Williamson Ave** go 1.7 mi
total 2.4 mi
About 3 mins
 4. Continue onto **State Rd 1301/St Marks Church Rd** go 0.3 mi
total 2.7 mi
 -  5. Turn left onto **State Rd 1308/Garden Rd** go 1.2 mi
total 3.9 mi
Continue to follow Garden Rd
About 3 mins
 -  6. Turn right onto **Huffman Mill Rd** go 0.5 mi
total 4.4 mi
Destination will be on the left
About 1 min

 1240 Huffman Mill Rd, Burlington, NC 27215

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 ©2014 Google

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



This Subsurface Clearance (SSC) Project Plan should be completed for each phase of ground disturbance activities at a project location, and included as an addendum to the Project-Specific Level 2 WARN Health & Safety Plan (HASP).

Ground disturbance activities that fall under this SSC Project Plan include ALL activities which require penetration of the ground surface deeper than 1 foot (0.3 meter), AND/OR the coring or removal of engineered surfaces (pavement, concrete, etc.). Examples of Ground Disturbance Activities include, but are not limited to:

- Hand digging
- Hand augering
- Drilling
- Direct-push or Geoprobe® borings
- Well installation
- Well decommissioning by over-drilling
- Excavation (by hand or with mechanical equipment)
- Trenching
- Grading
- Concrete coring
- Driving of posts, stakes, rods, poles, or sheet pile.

This SSC Project Plan summarizes the types and sources of SSC information obtained, describes the Site Services Model, and documents any waivers to ERM's Global SSC Process. The ERM Partner-in-Charge (PIC), Project Manager (PM), and SSC Experienced Person (EP)¹ must review and approve this SSC Project Plan, and maintain a copy (1) at the project location for the duration of ground disturbance activities and (2) in the project files.

All waivers must be approved by BOTH: (1) the ERM PIC and (2) the Business Unit Managing Partner (BU MP) or the BU MP's designee (cannot be the same person as the PIC).

Administrative Information	Project Name and Location: 00Q-011-010	
	Scope of Ground Disturbance Activities:	
	<i>Check all that apply:</i> <input checked="" type="checkbox"/> Point disturbances <input type="checkbox"/> Excavation / trenching <input type="checkbox"/> Removal of engineered surfaces <input type="checkbox"/> Other Describe:	
	<i>Use field documentation to document SSC:</i> <ul style="list-style-type: none"> • Process Checklist – broadly across the site • Remote/Greenfield Site Process Checklist – broadly across the site for those projects that meet these criteria and where ONLY hand digging will occur (refer to SSC Process Document Section 1.2) • Location Disturbance Permit – for each location inside a Critical Zone 	
	SSC Project Plan Date: FEB 11	Field Work Start Date: FEB 11
	Project Manager: Signature:	Partner In Charge: Signature:
SSC EP: Signature:	BU MP (req'd for waivers): Signature:	
List any SSC General Employees (GEs) working on this project: TBD		

¹ SSC EP not required for project sites determined to be Remote/Greenfield sites (as defined in the ERM Global SSC Process), where ONLY hand digging will occur.

Subsurface Clearance Information Sources Summary Document the information sources that ERM used or will use to locate Subsurface Structures on site.	Information Sources	Yes	No	N/A	Comments	
	Facility-provided as-built drawings, maps, site plans showing subsurface structures / utilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		Date(s):
	Other information obtained (e.g., easements, right-of-ways, historical plot plans, current/historical aerial photographs, fire insurance plans, tank (dip) charts, SSC information obtained as part of previous site investigations, soil surveys, boring logs)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		List (including dates):
	Knowledgeable Contact Person	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		Who: Time in Job: Time at Site:
	Utility Markouts	Yes	No	N/A	Comments	
	Site is Remote/Greenfield site <u>AND</u> only hand digging will occur	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<i>If "YES", utility markouts are not required by ERM process (Note that public markouts may be legally required based on jurisdiction of project site – it is the responsibility of the PIC and PM to determine these requirements and comply)</i>
	Public Utility Markouts (where they are available)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<i>Required where available – if not available check "N/A". If available and checked "NO", a Waiver is required (if legally able to do so).</i> Who:
Private Utility Markouts	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<i>If checked "NO" and site is not a Remote/Greenfield site, a Waiver is required</i> ERM employee <input type="checkbox"/> or Subcontractor <input type="checkbox"/> Who: List methods / equipment used:	

For Remote/Greenfield Sites where ONLY hand digging will occur – the remaining sections of this SSC Project Plan do not apply and can be left blank.

Site Services Model	Utility / Service	Present	Anticipated Depth (note units)	Located?		Absent	Unknown	Status (active/ inactive/ abandoned)	Comment (how located? Lines of evidence – types and quality. How will gaps be addressed?)
				Yes	No				
<p>List the utilities or other below ground services present on site.</p> <p>Do we know the locations of these services, their conveyance on site (to the site boundary, as appropriate) and the location of isolation switches or valves?</p> <p>If “Present” and not located or “Unknown”, comment on how those gaps will be addressed.</p> <p>Attach a site plan / drawing (to scale) showing planned ground disturbance location(s), the locations/routes of all identified or suspected subsurface structures and services, and associated critical zones.</p>	Electricity	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		Voltage:
	Gas	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Petroleum Pipeline	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Other Pressurized Lines	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		Type:
	Process Sewer	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Sanitary Sewer	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Storm Sewer	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Potable Water	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Telephone / Communication	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Fiber Optic	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Plant air / steam	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Fuel / oil	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Reclaimed / waste water	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Fire suppression	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Underground tank(s)	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Other:	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			

Subsurface Clearance Process Waivers Document any waivers to the process approved by BOTH the PIC and BU MP. Legally required steps cannot be waived.	Process Component Being Waived:	Waived By (PIC)	Waived by (BU MP)	Date	Reason
	Performance of Public Utility Markouts (where they are available)				
	Performance of Private Utility Markouts				
	No ground disturbance inside a Critical Zone				
	Physical Clearance to required depth(s) and diameters(s) at Point Disturbance Location(s). Indicate specific location(s):				

Subsurface and Overhead Utility Clearance Map	Attach a site plan / drawing (to scale) showing planned ground disturbance location(s), the locations/routes of all identified or suspected subsurface structures and services, associated critical zones, and location of all isolation devices and/or shutoff valves.
--	--



Subsurface Clearance Location Disturbance Permit

Disturbance
Location
Designation:

ERM Project No.:

SSC Exp. Person:

Contact Person Approval of Ground Disturbance Locations (indicate verbal approval by printing "Verbal" in the signature space)

Name (Print)	Company	Name (Sign)	Date / Time
--------------	---------	-------------	-------------

Critical Zone Determination and Clearance Depth (It is not preferred to initiate Ground Disturbance Activities within a Critical Zone)

If the Disturbance Location is known or suspected to fall within a Critical Zone, then a sketch (see reverse) or other map **must be** used to confirm proximal Critical Zones. Sketch / map must be to scale.

This Location Is:

Inside a Critical Zone. Partner-in-Charge (PIC) and Business Unit Managing Partner (BU MP) must BOTH grant waiver for disturbance at this location. Ensure documentation in the SSC Project Plan addendum to the HASP. Physical Clearance will proceed to the deeper of: **0.6 m / 2 feet below the frost line, 0.6 m / 2 feet deeper than the expected invert elevation of the service, OR 2.4 m / 8 feet below ground level.**

Outside a Critical Zone. Physical Clearance will proceed to the deeper of: **0.6 m / 2 feet below the frost line or 1.5 m / 5 feet below ground level.**

Physical Clearance Technique at This Location

Cleared using the following techniques / equipment:

Clearance depth and diameter (specify units):

None – or not completed to required depth or diameter. Waived by PIC and BU MP. (Ensure documentation in the SSC Project Plan addendum to HASP.)

Reason: _____ Date / Time: _____

Physical Clearance Executed & Observed By:

Company	Representative(s)	Date / Time Complete	Notes

Was any Subsurface Structure discovered (damaged or undamaged) during Clearance?

No (Proceed) Yes If Yes: Work stopped and discussed with PIC (Date / Time): _____

Agreed Action: _____

SSC Process Complete

Name of SSC Experienced Person (Print)	Name (Sign)	Date / Time
--	-------------	-------------



Subsurface Clearance Field Process Checklist

Site/Project Name: _____
 Client: _____
 ERM Project No.: _____
 SSC Exp. Person: _____

Project Information Utilized for Field SSC Activities	Yes	No	N/A	Comments
Contact Person requested and identified				
Subcontractors prequalified and approved				
ERM / client SSC requirements have been communicated to all field personnel (including subcontractors)				
As-built drawings, site plans, aerial photographs, and/or other information sources available and reviewed				
Site Plan(s) / Drawing(s) developed showing subsurface lines/structures, Critical Zones, and planned Ground Disturbance Locations				
SSC Experienced Person with current SSC training assigned				
Project staff with current SSC training assigned				
UXO / MEC risks assessed: UXO / MEC is present or potentially present				If Yes, stop work and contact PIC

General Field Activity & Site Walk	Yes	No	N/A	Comments																																																												
HASP available, reviewed, and signed by project team																																																																
Site walk Visual Clues / site features (below) integrated into Site Services Model																																																																
<table border="1"> <thead> <tr> <th>Identified Visual Clue</th> <th>Yes</th> <th>No</th> <th>Identified Visual Clue</th> <th>Yes</th> <th>No</th> </tr> </thead> <tbody> <tr> <td>Lights</td> <td></td> <td></td> <td>Pipeline markers</td> <td></td> <td></td> </tr> <tr> <td>Signage</td> <td></td> <td></td> <td>Fire hydrants</td> <td></td> <td></td> </tr> <tr> <td>Sewer drains / cleanouts</td> <td></td> <td></td> <td>Sprinkler systems</td> <td></td> <td></td> </tr> <tr> <td>Cable markers</td> <td></td> <td></td> <td>Water meters</td> <td></td> <td></td> </tr> <tr> <td>Utility poles with conduit leading to the ground</td> <td></td> <td></td> <td>Natural gas meters</td> <td></td> <td></td> </tr> <tr> <td>Utility boxes</td> <td></td> <td></td> <td>UST fill ports and vent pipes</td> <td></td> <td></td> </tr> <tr> <td>Manholes</td> <td></td> <td></td> <td>Equipment locations</td> <td></td> <td></td> </tr> <tr> <td>Pavement scarring</td> <td></td> <td></td> <td>Steam lines</td> <td></td> <td></td> </tr> <tr> <td>Distressed vegetation or vegetation in linear pattern</td> <td></td> <td></td> <td>Remote buildings with no visible utilities</td> <td></td> <td></td> </tr> </tbody> </table>	Identified Visual Clue	Yes	No	Identified Visual Clue	Yes	No	Lights			Pipeline markers			Signage			Fire hydrants			Sewer drains / cleanouts			Sprinkler systems			Cable markers			Water meters			Utility poles with conduit leading to the ground			Natural gas meters			Utility boxes			UST fill ports and vent pipes			Manholes			Equipment locations			Pavement scarring			Steam lines			Distressed vegetation or vegetation in linear pattern			Remote buildings with no visible utilities						
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Comments / Others:																																																																

Contact Person Approval of Ground Disturbance at All Locations (indicate verbal approval by printing "Verbal" in the signature space)								
<table border="1"> <thead> <tr> <th>Name (Print)</th> <th>Company</th> <th>Name (Sign)</th> <th>Date / Time</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Name (Print)	Company	Name (Sign)	Date / Time				
Name (Print)	Company	Name (Sign)	Date / Time					

Utility Markouts	Yes	No	N/A	Comments
Public Utility Markouts completed (where available; waiver required if "NO")				
List utilities notified:				
Responses received from ALL companies notified?				
Private Utility Markout completed (waiver required if "NO")				
Performed by:				
Type of equipment/methods used:				
Note any limitations (e.g., sources of interference, geology, etc.):				
Final Critical Zone determinations made by the SSC EP				



Subsurface Clearance Field Process Checklist

Site/Project Name: _____

Client: _____

ERM Project No.: _____

SSC Exp. Person: _____

Critical Zones

Are there any ground disturbance locations known or suspected to be inside Critical Zones? **Yes.** PIC and BU MP (or designee) must BOTH grant waiver for work within the Critical Zone. The SSC Location Disturbance Permit or equivalent is required for those locations.

No. Physical Clearance will proceed to the deeper of: 0.6 m / 2 feet below the frost line or 1.5 m / 5 feet below ground level, whichever is deeper.

Overhead Clearance	Yes	No	N/A	Comments
Overhead utility lines in the general vicinity of ERM work onsite?				
If overhead utilities are present, has nominal voltage been determined? If yes, list in comments section.				Voltage:
Overhead clearances confirmed with equipment operators for safely deploying equipment to the location? (The minimum horizontal distance from any point on the equipment to the nearest overhead electrical power line should adhere to the minimum clearance requirements stipulated by regulation, utility companies, client requirements, and/or industry best practice.)				Clearance distance(s):
Proximity alarms and /or spotters necessary to ensure safe clearances?				
If the equipment is closer than the minimum clearance distance to the overhead utility, can utility be de-energized via formal lockout/tagout (LOTO) program?				
If utility cannot be de-energized, alternate plan developed with approval from the PIC and client/site owner?				

Clearance for Point Disturbances	Yes	No	N/A	Comments
Physical Clearance technique used (waiver required if no Physical clearance performed)				Specify:
Diameter of physical clearance at least 125% larger than outside diameter of largest downhole tool (150% is best practice)				
Physical Clearance successfully completed at all locations				

Clearance for Excavations	Yes	No	N/A	Comments
Communicate excavation plan and Excavation Buffer location(s) to subcontractor. Delineate excavation buffers.				
There are disturbance locations known or suspected to be inside Critical Zones				
De-energize subsurface services via formal LOTO program prior to beginning excavation				

Additional Notes:

SSC Process Completed By (SSC Experienced Person)		
Name (Print)	Name (Sign)	Date / Time



Journey Management Plan

Ref No.: _____
 Who's Copy? Traveler
 Office Contact
 Retain in site or office project files Page: 1 of 3

This form is required for travel:

- > 4.5 hours of driving in a day,
- > 10 hours of driving.
- > 14 hours of combined working and driving.
- When you are traveling for field work to a location where you will be the only ERM / ERM Subcontractor present
- Anywhere you feel is "remote" or when requested by the Project PIC

Traveler Information	
Name(s):	
Primary Mobile Number:	
Destination(s):	
Dates of Departure & Return:	

Office Contact		
Primary	Name:	
	Contact Number:	
Alternate	Name:	
	Contact Number:	

Contact Plan & Log: Traveler and Office Contact develop in advance of departure				
General contact / communication plan:				
	Communication (check one)			
Tx/Rx Date & Time	Spoke to	Left VM	2 Text/ e-mail	Comment

Traveler and Office Contact Both Keep a Copy of This Page



Journey Management Plan

Ref No.:

Who's Copy?

Traveler

Office Contact

Retain in site or office project files Page: 2 of 3

Journey Map

(Include preferred and alternate routes)

(Note any restricted routes)

ERM's Behavioral Safety Program

"You See It – You Own It!"

March 2010



As a global leader in environmental, safety and health services, ERM places the highest priority on the health and safety of our employees, business associates, and the community.



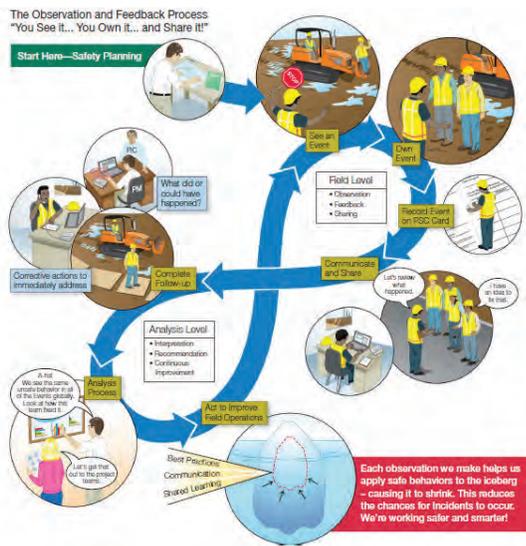
Major incidents, like the tip of an iceberg, are easy to recognize and hard to ignore. Other types of safety events are sometimes harder to recognize and easier to ignore; just like the part of the iceberg underneath the water line.

We need to pay attention to all of the ice in our iceberg – all types of safety events – so we can work safer and smarter.

ERM's Behavioral Safety Program "You See It – You Own It!" will help you do just that—work safer and smarter.. Under the framework of ERM's global health & safety policy and standards, this behavioral safety program emphasizes the role of recognizing, addressing and sharing Safety Events. These pages will familiarize you with our program.

“You See It – You Own It” – What does it mean for ERM contractors?

ERM’s Behavioral Safety Program incorporates three elements which are crucial for thinking and acting safely, be it in the field, in office environments, or in your free time. Whenever you are working on an ERM project, your active participation in all of these areas will be required to help make our joint projects even safer.



“Seeing”

In order to act on hazardous situations, one must first recognize them. Your experience is a large factor in this, and your experience, combined with a fresh pair of eyes and a short risk assessment immediately before starting a task, goes a long way in ensuring a safe work environment. When supported by good health & safety planning and other program elements, effective seeing is the basis for working safely.

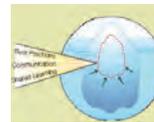
ERM employees receive specific training to recognize and understand the hazards of the work they are doing or supervising. As an ERM contractor, you may be invited to

participate in one of these training sessions held by ERM. In some cases participating in such a session may be mandatory for being awarded a contract.



“Owning”

Everyone working on an ERM project is empowered and required to intervene if they determine a situation to be unsafe, as well as to acknowledge and encourage safe behaviours. As an ERM contractor, you should not only expect that ERM staff will regularly talk to you about specific situations, but you will also be expected to intervene if you observe an unsafe act or condition – whether it involves a colleague, an ERMer, or another party on the worksite. Occasionally, you may be asked to moderate short safety discussions in the field.



“Sharing”

During a typical ERM project, we will observe many situations each day from which we can learn – remarkable safe behaviors as well as occasional unsafe acts and conditions. Some of these events will be shared with you during daily safety meetings, and those that are determined to be of special relevance are entered into a database and turned into Safety Alerts that are shared across the ERM global footprint and with other contractors and clients.

On some ERM projects, you may be handed field cards called Personal Safety Contracts (PSC). The PSC cards are an easy way to quickly plan your workday safely, as well as record observations during your workday. Your active participation using PSC cards is critical, as it is your Seeing, Owning and Sharing that will make it possible for us to leave the jobsite every single day free from injury.

SHARING

SEEN:
Safety Observations +
Safe/Unsafe Behaviors

OWNED:
Action(s) Taken



SOS CARD

ERM See It. Own It. Share It.

ONE CARD PER PERSON PER DAY.

TURN IN CARDS TO FIELD SAFETY OFFICER
(FSO) AT END OF EACH DAY.

Project: _____

Date: _____

Your Name: _____

Who is FSO? _____

CALL 911 (or facility first responders)
if injury or illness is severe or life threatening

CONTACTS:

Project Manager / Partner-in-Charge
Safety Team Members:

Steven Perkins – Western US – 714-928-3608
Brad Bishop – Western US – 916-752-7989
Matt Boardman – Northern US – 616-283-5863
Millard Griffin – Southern US – 678-294-8658
Philip Platcow – US Lead – 617-899-5403
Mark Hickey – Americas Region – 720-625-2869
WorkCare Incident Intervention – 888-449-7787

SHARING

SEEN:
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SEEN:
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WorkCare Incident Intervention – 888-449-7787

SEEING

Do you fully understand the task?

What could go wrong?

Aggressive / violent acts		Overexertion / strain	
Electrocution		Security / theft	
Equipment hazards		Slips / trips	
Exposure to chemicals / noise/vibration		Struck by / crushed by / caught between	
Fall from height		Subsurface strike	
Fire / explosion		Travel risks	
Heat or cold stress		Vehicle Incident	
Natural / biological hazards		Other?	

What is the worst that could happen to you or others if something goes wrong?

OWNING

HASP and JHAs reviewed and understood?

Tailgate safety meeting conducted and scope of work clear?

Do you have all necessary training, qualifications, and experience for assigned tasks?

Do you need additional persons and/or time to complete task safely?

All required PPE available? In good condition?

Right tools/equipment available? In good condition?

Any work permits required? (hot work, work at heights above 6 feet, hazardous energy control, excavation, etc.)

Can you control hazards by:

REMOVING THEM?

AVOIDING OR ISOLATING (GUARDING) THEM?

MODIFYING PROCEDURES OR EQUIPMENT?

ADDITIONAL SAFETY EQUIPMENT / WARNINGS / ALERTS?

TALKING TO OTHERS IF THEY ARE DOING SOMETHING UNSAFE?

Location of nearest fire extinguisher/eyewash/first aid kit?

Emergency evacuation route and assembly area location?

If something changes - pause work and re-assess the risks. Discuss with others on site.

EVERYONE ON THIS JOB SITE IS EMPOWERED TO STOP WORK IF SOMETHING IS UNSAFE OR IF THERE ARE ANY QUESTIONS OR CONCERNS REGARDING SAFETY

SEEING

Do you fully understand the task?

What could go wrong?

Aggressive / violent acts		Overexertion / strain	
Electrocution		Security / theft	
Equipment hazards		Slips / trips	
Exposure to chemicals / noise/vibration		Struck by / crushed by / caught between	
Fall from height		Subsurface strike	
Fire / explosion		Travel risks	
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Natural / biological hazards		Other?	

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ERM SEE-OWN-SHARE (SOS) Card Template

Revision: March 2013

Instructions:

- Print the first two sides front and back on the same sheet of paper.
- Print in color on heavy stock paper
- Cut along the bold dashed lines
- Fold along the normal dashed lines with the ERM logo on the outside
- One printing makes four SOS Cards

Material Safety Data Sheet

Trichloroethylene, stabilized

ACC# 23850

Section 1 - Chemical Product and Company Identification

MSDS Name: Trichloroethylene, stabilized

Product Grade : SQ, ExcelaR, EL

Catalog Numbers: 28455, 28456, 28457, 14715, 41957

Synonyms: Trichloroethylene

Company Identification:

Fisher Scientific

Part of Thermo Fisher Scientific

THERMO ELECTRON LLS INDIA PVT.LTD.

Godrej Coliseum, 101A-101B, Somaiya Hospital Road,

Off Eastern Express Highway, Sion (East), Mumbai-400 022, India

For information, call: 022 – 6680 3001/2, **Call India Toll Free** – 1800 209 7001

Emergency Number: 022-66803004/14

For CHEMTREC assistance, call: 800-424-9300 [International]

For International CHEMTREC assistance, call: 703-527-3887 [International]

Section 2 - Composition, Information on Ingredients

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

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid.

Warning! Breathing vapors may cause drowsiness and dizziness. Causes eye and skin irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. May cause cancer based on animal studies. May cause liver damage.

Target Organs: Central nervous system, liver, eyes, skin.

Potential Health Effects

Eye: Causes moderate eye irritation. May result in corneal injury. Contact produces irritation, tearing, and burning pain. Contact with trichloroethylene causes pain but no permanent injury to the eyes. (Doc of TLV)

Skin: Causes mild skin irritation. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. May cause peripheral nervous system function impairment including persistent neuritis, and temporary loss of touch. Damage to the liver and other organs has been observed in workers who have been overexposed.

Ingestion: May cause irritation of the digestive tract. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.

Inhalation: May cause respiratory tract irritation. May cause liver abnormalities. May cause cardiac abnormalities. May cause peripheral nervous system effects. Inhalation overexposure may lead to central nervous system depression, producing effects such as dizziness, headache, confusion, incoordination, nausea, weakness, and loss of consciousness. Extreme exposures may cause other CNS effects including death. The chief symptoms of TCE exposure were found to be abnormal fatigue, irritability, headache, gastric disturbances, and intolerance to alcohol. (Doc to TLV)

Chronic: Possible cancer hazard based on tests with laboratory animals. Chronic inhalation may cause effects similar to those of acute inhalation. Prolonged or repeated skin contact may cause defatting and dermatitis. May cause peripheral nervous system function impairment including persistent neuritis, and temporary loss of touch. Damage to the liver and other organs has been observed in workers who have been overexposed.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin: Get medical aid if irritation develops or persists. Flush skin with plenty of soap and water.

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Possible aspiration hazard. Get medical aid immediately.

Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool.



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Extinguishing Media: Use extinguishing media most appropriate for the surrounding fire.

Flash Point: None

Autoignition Temperature: 420 deg C (788.00 deg F)

Explosion Limits, Lower:8

Upper: 10.5

NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

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

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

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing. Avoid breathing vapor.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

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

Exposure Limits

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

OSHA Vacated PELs: Trichloroethylene: 50 ppm TWA; 270 mg/m³ TWA



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Personal Protective Equipment

Eyes: Wear chemical splash goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: clear, colorless

Odor: chloroform-like

pH: Not available.

Vapor Pressure: 58 mm Hg @ 20 deg C

Vapor Density: 4.5 (air=1)

Evaporation Rate:0.69 (CCl₄=1)

Viscosity: 0.0055 poise

Boiling Point: 87 deg C

Freezing/Melting Point:-86 deg C

Decomposition Temperature:Not available.

Solubility: Slightly soluble.

Specific Gravity/Density:1.46

Molecular Formula:C₂HCl₃

Molecular Weight:131.39

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Light, confined spaces.

Incompatibilities with Other Materials: Active metals.

Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.

Hazardous Polymerization: May occur.

Section 11 - Toxicological Information



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RTECS#:

CAS# 79-01-6: KX4550000

LD50/LC50:

CAS# 79-01-6:

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

Carcinogenicity:

CAS# 79-01-6:

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

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

Teratogenicity: No information available.

Reproductive Effects: Experimental reproductive effects have been observed.

Mutagenicity: Human mutation data has been reported. IARC and the National Toxicology Program (NTP) stated that variability in the mutagenicity test results with trichloroethylene may be due to the presence of various stabilizers used in TCE which are mutagens (e.g. epoxybutane, epichlorohydrin). See actual entry in RTECS for complete information. R68 Mutagen Category 3 (CHIP 2002, UK).

Neurotoxicity: No information available.

Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: 41-67 mg/L; 96 hrs.; LC50 Daphnia: Daphnia: 2.2-100 mg/L; 48 hrs.; LC50 Mollusk Shrimp: 2 mg/L; 96 hrs.; LC50 Bluegill sunfish, LD50=44,700 ug/L/96Hr. Fathead minnow, LC50=40.7 mg/L/96Hr.

Environmental: In air, substance is photooxidized and is reported to form phosgene, dichloroacetyl chloride, and formyl chloride. In water, it evaporates rapidly. Potential for



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mobility in soil is high.

Physical: No information available.

Other: Bioconcentration potential is low (BCF less than 100).

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 79-01-6: waste number U228.

Section 14 - Transport Information

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

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 79-01-6 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs



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CAS# 79-01-6: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 79-01-6: immediate, delayed, reactive.

Section 313

This material contains Trichloroethylene (CAS# 79-01-6, >99%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

CAS# 79-01-6 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 79-01-6 is listed as a Hazardous Substance under the CWA. CAS# 79-01-6 is listed as a Priority Pollutant under the Clean Water Act. CAS# 79-01-6 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

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

STATE

CAS# 79-01-6 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

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

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

California No Significant Risk Level: CAS# 79-01-6: 50 æg/day NSRL (oral); 80 æg/day NSRL (inhalation)

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 36/38 Irritating to eyes and skin.

R 45 May cause cancer.

R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R 67 Vapours may cause drowsiness and dizziness.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

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

WGK (Water Danger/Protection)

CAS# 79-01-6: 3



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Canada - DSL/NDSL

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

Canada - WHMIS

This product has a WHMIS classification of D1B, D2B.

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

Canadian Ingredient Disclosure List

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

Section 16 - Additional Information

MSDS Creation Date: 2/01/1999

Revision #7 Date: 12/27/2006

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



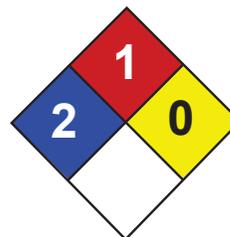
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Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

1,1,1-Trichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,1,1-Trichloroethane

Catalog Codes:

CAS#: 71-55-6

RTECS: KJ2975000

TSCA: TSCA 8(b) inventory: 1,1,1-Trichloroethane

CI#: Not available.

Synonym:

Chemical Formula: CH₃CCl₃

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
{1,1,1-}Trichloroethane	71-55-6	100

Toxicological Data on Ingredients: 1,1,1-Trichloroethane: ORAL (LD50): Acute: 9600 mg/kg [Rat]. 6000 mg/kg [Mouse]. DERMAL (LD50): Acute: 15800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 18000 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of eye contact (irritant), of ingestion. Hazardous in case of skin contact (irritant, permeator), of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, the nervous system, liver, mucous membranes. 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: 537°C (998.6°F)

Flash Points: Not available.

Flammable Limits: LOWER: 7.5% UPPER: 12.5%

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

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of oxidizing materials, of acids, of alkalis.

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. Slightly explosive to explosive in presence of oxidizing materials, of acids, of alkalis.

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 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. 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. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

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: 350 STEL: 440 CEIL: 440 (ppm) from ACGIH (TLV) [1995] TWA: 1900 STEL: 2460 CEIL: 2380 (mg/m3) from ACGIH [1995] 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: 133.41 g/mole

Color: Not available.

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

Boiling Point: 74.1°C (165.4°F)

Melting Point: -32.5°C (-26.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.3376 (Water = 1)

Vapor Pressure: 100 mm of Hg (@ 20°C)

Vapor Density: 4.6 (Air = 1)

Volatility: Not available.

Odor Threshold: 400 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: Not available.

Solubility: 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: 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:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 6000 mg/kg [Mouse]. Acute dermal toxicity (LD50): 15800 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 18000 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:

Very hazardous in case of ingestion. Hazardous in case of skin contact (irritant, permeator), of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: 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: : 1,1,1-Trichloroethane : UN2831 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: 1,1,1-Trichloroethane Massachusetts RTK: 1,1,1-Trichloroethane TSCA 8(b) inventory: 1,1,1-Trichloroethane SARA 313 toxic chemical notification and release reporting: 1,1,1-Trichloroethane CERCLA: Hazardous substances.: 1,1,1-Trichloroethane

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).

DSCL (EEC):

R38- Irritating to skin. R41- Risk of serious damage to eyes.

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.

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Last Updated: 05/21/2013 12:00 PM

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Material Safety Data Sheet

1,4-Dioxane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,4 -Dioxane
Catalog Codes: 21122, 22123, 25124
CAS#: 123-91-1
TSCA: TSCA 8(b) inventory: 1,4-Dioxane
CI#: Not applicable.
Synonym: p-Dioxane; Diethylene dioxide; 1,4-Dioxane
Chemical Name: 1,4-Dioxacyclohexane
Chemical Formula: C₄H₈O₂
Contact Information: Runa Chemicals Pvt. Ltd.
W-11 & W-23, M.I.D.C., Phase 2
Dombivli – 421204. Maharashtra. (India)
International Sales: +91 (0) 251 2871 106 / 2870473
Fax: +91 (0) 251 2871 757
Order Online: www.runachemicals.com
Emergency Telephone: +91 (0) 251 2871 106

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,4-}Dioxane	123-91-1	100

Toxicological Data on Ingredients: 1,4-Dioxane: ORAL (LD50): Acute: 4200 mg/kg [Rat.]. 5300 mg/kg [Mouse]. 2000 mg/kg [Rabbit]. VAPOR (LC50): Acute: 37000 mg/m³ 2 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Potential Chronic Health Effects:

Hazardous in case of inhalation.

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC.

Classified 2 (Some evidence.) by NTP.

MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance may be toxic to blood, kidneys, liver, skin, central nervous system (CNS).

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. Get medical attention.

Skin Contact:

Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Cold water may be used.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

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 unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 180°C (356°F)

Flash Points: CLOSED CUP: 12°C (53.6°F). OPEN CUP: 18.3°C (64.9°F) (Cleveland).

Flammable Limits: LOWER: 2% UPPER: 22%

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

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat.

Non-flammable in presence of shocks.

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:

Flammable liquid, soluble or dispersed in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:

Vapor is heavier than air and may travel considerable distance to source of ignition and flash back. When heated to decomposition, it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards:

Vapor forms explosive mixtures with air over a wide range. Dioxane is capable of forming explosive peroxides under certain conditions, and unless proper precautions are taken, it can explode when redistilled.

In the reaction with triethynylaluminum, the residue from the sublimation of the complex with Dioxane is explosive. The complex should not be dried by heating.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:

Flammable liquid.

Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. 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. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. 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. Keep away from incompatibles such as oxidizing agents.

Storage:

Store in a segregated and approved area. 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).

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 (impervious).

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: 72 (mg/m³) from ACGIH (TLV) [United States]

TWA: 20 (ppm) from ACGIH (TLV) [United States]

CEIL: 3.6 (mg/m³) from NIOSH

CEIL: 1 (ppm) from NIOSH

TWA: 25 (ppm) from OSHA (PEL) [United States]

TWA: 90 (mg/m³) from OSHA (PEL) [United States]

TWA: 25 STEL: 100 (ppm) [United Kingdom (UK)]

TWA: 91 STEL: 366 (mg/m³) [United Kingdom (UK)]

CEIL: 100 (ppm) from OSHA (PEL) [United States]

CEIL: 360 (mg/m³) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Ethereal. Pleasant. (Slight.)

Taste: Not available.

Molecular Weight: 88.11 g/mole

Color: Colorless.

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

Boiling Point: 101.1°C (214°F)

Melting Point: 11.8°C (53.2°F)

Critical Temperature: 312°C (593.6°F)

Specific Gravity: 1.0337 (Water = 1)

Vapor Pressure: 3.9 kPa (@ 20°C)

Vapor Density: 3.03 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: The product is more soluble in water; $\log(\text{oil/water}) = -0.3$

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatible materials, air, sunlight.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Hydroperoxide-free Dioxane rapidly forms hydroperoxide on contact with air. Exposure to sunlight accelerates this formation. Decomposes to carbon monoxide.

Incompatible with silver perchlorate, oxidizing agents, sulfur trioxide, decaborane, triethynyl aluminum, boron trifluoride.

Dioxane may react with hydrogen in the presence of Rainey nickel above 210C (410F).

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.

Acute oral toxicity (LD50): 2000 mg/kg [Rabbit].

Acute toxicity of the vapor (LC50): 37000 mg/m³ 2 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC.

Classified 2 (Some evidence.) by NTP.

MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells.

May cause damage to the following organs: blood, kidneys, liver, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation.

Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals:

LD50 [Rabbit] - Route: Skin; Dose: 7600 ul/kg

LCL [Human] - Route: Inhalation; Dose: 470 ppm/72 hrs.

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (fetotoxicity) based on animal data.

May affect genetic material (mutagenic) based on animal data.

May cause cancer (tumorigenic).

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: Causes skin irritation. May be absorbed through skin with possible system effects.

Eyes: Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

Inhalation: Highly toxic by inhalation. Easily absorbed through lungs. Causes irritation of the respiratory tract.

May affect respiration (coughing), behavior and brain (headache, dizziness, narcosis, irritability, drowsiness, altered sleep time, psychophysical changes), cardiovascular system (increased blood pressure), sense organs, gastrointestinal tract (nausea, vomiting), liver, and kidneys. metabolism

Ingestion: Causes gastrointestinal (digestive) tract irritation with nausea, vomiting, sore throat, abdominal pain.

May also affect behavior, sense organs, urinary system.

Chronic Potential Health Effects:

Prolonged exposure may cause central nervous system depression, loss of appetite, nausea, abdominal tenderness, and liver or kidney damage. Prolonged skin contact may cause dermatitis. Suspected human carcinogen based on animal data.

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 product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Dioxane UNNA: 1165 PG: II

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:

1,4-Dioxane

California prop. 65 (no significant risk level): 1,4-Dioxane

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: 1,4-Dioxane

Connecticut hazardous material survey.: 1,4-Dioxane

Illinois toxic substances disclosure to employee act: 1,4-Dioxane

Illinois chemical safety act: 1,4-Dioxane

New York release reporting list: 1,4-Dioxane

Rhode Island RTK hazardous substances: 1,4-Dioxane

Pennsylvania RTK: 1,4-Dioxane

Minnesota: 1,4-Dioxane

Massachusetts RTK: 1,4-Dioxane

Massachusetts spill list: 1,4-Dioxane

New Jersey: 1,4-Dioxane

New Jersey spill list: 1,4-Dioxane

Louisiana spill reporting: 1,4-Dioxane

California Director's list of Hazardous Substances: 1,4-Dioxane

TSCA 8(b) inventory: 1,4-Dioxane

SARA 313 toxic chemical notification and release reporting: 1,4-Dioxane

CERCLA: Hazardous substances.: 1,4-Dioxane: 100 lbs. (45.36 kg)

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).

CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R11- Highly flammable.

R36- Irritating to eyes.

R45- May cause cancer.

S2- Keep out of the reach of children.

S46- If swallowed, seek medical advice immediately and show this container or label.

S53- Avoid exposure - obtain special instructions

before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 1

Personal Protection: j

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

Health: 2

Flammability: 3

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves (impervious).

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:

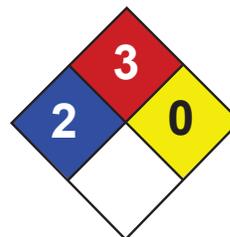
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- The Sigma-Aldrich Library of Chemical Safety Data, Edition II. RTECS, and HSDB databases

Other Special Considerations: Not available.

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet 1,2-Dichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,2-Dichloroethane

Catalog Codes: SLD2521, SLD3721

CAS#: 107-06-2

RTECS: KH9800000

TSCA: TSCA 8(b) inventory: 1,2-Dichloroethane

CI#: Not available.

Synonym: Ethylene dichloride

Chemical Formula: C₂H₄CL₂

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
{1,2-}Dichloroethane	107-06-2	100

Toxicological Data on Ingredients: 1,2-Dichloroethane: ORAL (LD50): Acute: 670 mg/kg [Rat]. 413 mg/kg [Mouse]. DERMAL (LD50): Acute: 2800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 1414.2 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Extremely hazardous in case of ingestion. Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant). Corrosive to skin and eyes on contact. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:

Very hazardous in case of ingestion, of inhalation. **CARCINOGENIC EFFECTS:** Classified + (PROVEN) by OSHA. Classified 2B (Possible for human.) by IARC. Classified 2 (Reasonably anticipated.) by NTP. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance is toxic to lungs, the nervous system, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

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:

If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. 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 immediate 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. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. 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: Flammable.

Auto-Ignition Temperature: 413°C (775.4°F)

Flash Points: CLOSED CUP: 13°C (55.4°F). OPEN CUP: 18°C (64.4°F).

Flammable Limits: LOWER: 6.2% UPPER: 15.6%

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

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks. Slightly flammable to flammable in presence of oxidizing materials.

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. Slightly explosive to explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. **SMALL FIRE:** Use DRY chemical powder. **LARGE FIRE:** Use alcohol foam, water spray or fog.

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:

Flammable liquid. Corrosive liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on 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 container dry. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Never add water to this product 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:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

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: 10 CEIL: 75 (ppm) from ACGIH (TLV) TWA: 40 CEIL: 300 (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: 98.96 g/mole

Color: Not available.

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

Boiling Point: 83.5°C (182.3°F)

Melting Point: -35.3°C (-31.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.2351 (Water = 1)

Vapor Pressure: 61 mm of Hg (@ 20°C)

Vapor Density: 3.42 (Air = 1)

Volatility: Not available.

Odor Threshold: 26 ppm

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

Ionicity (in Water): Not available.

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

Solubility:

Easily soluble in methanol, diethyl ether, n-octanol, 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: 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: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 413 mg/kg [Mouse]. Acute dermal toxicity (LD50): 2800 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1414.2 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified 2B (Possible for human.) by IARC. Classified 2 (Reasonably anticipated.) by NTP. The substance is toxic to lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:

Extremely hazardous in case of ingestion. Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in animal. Excreted 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 3: Flammable liquid.

Identification: : Ethylene dichloride : UN1184 PG: II

Special Provisions for Transport: Marine Pollutant

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: 1,2-Dichloroethane 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: 1,2-Dichloroethane Pennsylvania RTK: 1,2-Dichloroethane Massachusetts RTK: 1,2-Dichloroethane TSCA 8(b) inventory: 1,2-Dichloroethane CERCLA: Hazardous substances.: 1,2-Dichloroethane

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

Other Classifications:**WHMIS (Canada):**

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):

R11- Highly flammable. R20/22- Harmful by inhalation and if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

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 08:17 PM

Last Updated: 05/21/2013 12:00 PM

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Ottawa	Nepean	Tel : 613-226-4228	Fax : 613-226-4229
Quebec	Quebec	Tel : 418-834-7447	Fax : 418-834-3774

1,1,-DICHLORETHYLENE- MATERIAL SAFETY DATA SHEET

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6. [Accidental Release Measures](#)
7. [Handling and Storage](#)
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9. [Physical and Chemical Properties](#)
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11. [Toxicological Information](#)
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13. [Disposal Considerations](#)
14. [Transport Information](#)
15. [Regulatory Information](#)
16. [Other Information](#)

24 Hour EMERGENCY CONTACT

U.S- CHEMTREC 1-800-424-9300

CANADA- CANUTEC 613-996-6666

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

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Matheson Tri-Gas, Inc.

The telephone numbers listed below are emergency numbers, please contact your local branch for routine inquiries.

USA

959 Route 46 East
Parsippany, New Jersey
07054-0624 USA
Phone: 973-257-1100

CANADA

530 Watson Street
Whitby, Ontario
L1N 5R9 Canada
Phone: 905-668-3570

SUBSTANCE: 1,1-DICHLOROETHYLENE

SYMBOL: C₂H₂Cl₂

TRADE NAMES/SYNONYMS:

1,1-DICHLOROETHENE; 1,1-DICHLOROETHYLENE; VDC; VINYLIDENE CHLORIDE MONOMER; VINYLIDENE DICHLORIDE; VINYLIDENE CHLORIDE, INHIBITED; RCRA U078; UN 1303; C₂H₂CL₂; MAT25070; RTECS KV9275000

CHEMICAL FAMILY: halogens

CREATION DATE: Jan 24 1989

REVISION DATE: Mar 16 1999

2. COMPOSITION, INFORMATION ON INGREDIENTS

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[Contents](#)

COMPONENT: 1,1-DICHLOROETHYLENE

CAS NUMBER: 75-35-4

EC NUMBER (EINECS): 200-864-0

PERCENTAGE: >99.9

COMPONENT: 4-METHOXYPHENOL

CAS NUMBER: 150-76-5

EC NUMBER (EINECS): 205-769-8

PERCENTAGE: 0.02000

3. HAZARDS IDENTIFICATION

[Up to Table of Contents](#)

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

WHMIS CLASSIFICATION: BD2

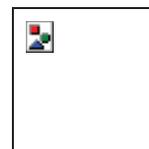
EC CLASSIFICATION (ASSIGNED):

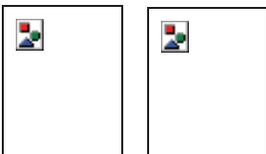
F+ Extremely Flammable

Xn Harmful

R 12-20-40

EC Classification may be inconsistent with independently-researched data.



**EMERGENCY OVERVIEW:**

Color: colorless

Physical Form: volatile liquid

Odor: faint odor, sweet odor

Major Health Hazards: harmful if swallowed, respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

Physical Hazards: Flammable liquid and vapor. Vapor may cause flash fire. May polymerize. Containers may rupture or explode. May form peroxides during prolonged storage.

POTENTIAL HEALTH EFFECTS:**INHALATION:**

Short Term Exposure: irritation, symptoms of drunkenness, lung congestion, liver damage, convulsions

Long Term Exposure: kidney damage, tumors

SKIN CONTACT:

Short Term Exposure: irritation (possibly severe)

Long Term Exposure: same as effects reported in short term exposure

EYE CONTACT:

Short Term Exposure: irritation (possibly severe), eye damage

Long Term Exposure: same as effects reported in short term exposure

INGESTION:

Short Term Exposure: same as effects reported in short term exposure

Long Term Exposure: same as effects reported in short term exposure

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

4. FIRST AID MEASURES

[Up to Table of Contents](#)

INHALATION:

Remove from exposure immediately. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Get medical attention.

SKIN CONTACT:

Remove contaminated clothing, jewelry, and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention, if needed.

EYE CONTACT:

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

INGESTION:

If vomiting occurs, keep head lower than hips to help prevent aspiration. Get medical attention, if needed.

5. FIRE FIGHTING MEASURES

[Up to Table of Contents](#)

FIRE AND EXPLOSION HAZARDS:

Severe fire hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive above flash point. Containers may rupture or explode if exposed to heat.

EXTINGUISHING MEDIA:

alcohol resistant foam, carbon dioxide, regular dry chemical, water

Large fires: Use alcohol-resistant 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:

14 F (-10 C)

LOWER FLAMMABLE LIMIT:

5.6%

UPPER FLAMMABLE LIMIT:

11.4%

AUTOIGNITION:

855 F (457 C)

FLAMMABILITY CLASS (OSHA):

IA

6. ACCIDENTAL RELEASE MEASURES

[Up to Table of Contents](#)

AIR RELEASE:

Reduce vapors with water spray. Stay upwind and keep out of low areas.

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:

Collect with absorbent into suitable container. Collect spilled material using mechanical equipment.

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Remove 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. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas. Reportable Quantity (RQ): 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

[Up to Table of Contents](#)

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. Store in a cool, dry place. Store in a well-ventilated area. Keep in the dark. Keep separated from incompatible substances. Store outside or in a detached building. Store with flammable liquids. Store in a tightly closed container. Containers must have overpressure release device. Avoid heat, flames, sparks and other sources of ignition. Keep separated from incompatible substances. Monitor inhibitor content. Avoid exposure to low temperatures or freezing. May form explosive peroxides. Store in a tightly closed container. Avoid contact with light. Store in a cool, dry place. Monitor inhibitor content. Do not evaporate or distill to dryness. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

[Up to Table of Contents](#)

[Contents](#)

EXPOSURE LIMITS:**1,1-DICHLOROETHYLENE:**

1 ppm (4 mg/m³) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)

5 ppm (20 mg/m³) ACGIH TWA

20 ppm (80 mg/m³) ACGIH STEL

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. 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 full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Escape -

Any air-purifying respirator with a full facepiece and an 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 full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES

[Up to Table of Contents](#)

PHYSICAL STATE: liquid

COLOR: colorless

PHYSICAL FORM: volatile liquid

ODOR: faint odor, sweet odor

MOLECULAR WEIGHT: 96.64

MOLECULAR FORMULA: C₂H₂CL₂

BOILING POINT: 86-90 F (30-32 C)

FREEZING POINT: -188 F (-122 C)

VAPOR PRESSURE: 400 mmHg @ 14.8 C

VAPOR DENSITY (air=1): 3.4

SPECIFIC GRAVITY (water=1): 1.213

WATER SOLUBILITY: 0.04% @ 20 C

PH: Not available

VOLATILITY: Not available

ODOR THRESHOLD: 500 ppm

EVAPORATION RATE: Not available

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:

Soluble: organic solvents

10. STABILITY AND REACTIVITY

[Up to Table of Contents](#)

REACTIVITY:

May form explosive peroxides. Avoid contact with temperatures above -40 C. Avoid contact with heat, air, light or moisture and monitor inhibitor content. May polymerize. Closed containers may rupture violently.

CONDITIONS TO AVOID:

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

INCOMPATIBILITIES:

metals, acids, oxidizing materials

HAZARDOUS DECOMPOSITION:

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

POLYMERIZATION:

May polymerize. Avoid contact with heat or light and monitor inhibitor content.

11. TOXICOLOGICAL INFORMATION

[Up to Table of Contents](#)

VINYLDENE CHLORIDE:

TOXICITY DATA:

6350 ppm/4 hour(s) inhalation-rat LC50; 200 mg/kg oral-rat LD50

CARCINOGEN STATUS:

IARC: Human Inadequate Evidence, Animal Limited Evidence, Group 3; ACGIH: A3 -Animal Carcinogen

LOCAL EFFECTS:

Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL:

Toxic: ingestion

Slightly Toxic: inhalation

TARGET ORGANS:

central nervous system, liver

TUMORIGENIC DATA:

Available.

MUTAGENIC DATA:

Available.

REPRODUCTIVE EFFECTS DATA:

Available.

12. ECOLOGICAL INFORMATION

[Up to Table of Contents](#)

ECOTOXICITY DATA:

FISH TOXICITY:

74000 ug/L 96 hour(s) LC50 (Mortality) Bluegill (*Lepomis macrochirus*)

INVERTEBRATE TOXICITY:

224000 ug/L 96 hour(s) LC50 (Mortality) Opossum shrimp (*Mysidopsis bahia*)

ALGAL TOXICITY:

>712000 ug/L 96 hour(s) EC50 (Photosynthesis) Diatom (*Skeletonema costatum*)

ENVIRONMENTAL SUMMARY:

Moderately toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

[Up to Table of Contents](#)

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U078. Hazardous Waste Number(s): D029. 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

[Up to Table of Contents](#)

U.S. DOT 49 CFR 172.101. SHIPPING NAME-UN NUMBER; HAZARD CLASS; PACKING GROUP; LABEL:

Vinylidene chloride, inhibited-UN1303; 3; I; Flammable liquid



15. REGULATORY INFORMATION

[Up to Table of Contents](#)

U.S. REGULATIONS:

TSCA INVENTORY STATUS: Y

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CERCLA SECTION 103 (40CFR302.4): Y

1,1-Dichloroethylene: 100 LBS RQ

SARA SECTION 302 (40CFR355.30): N

SARA SECTION 304 (40CFR355.40): N

SARA SECTION 313 (40CFR372.65): Y

1,1-Dichloroethylene

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):

ACUTE: Y

CHRONIC: Y

FIRE: Y

REACTIVE: Y

SUDDEN RELEASE: Y

OSHA PROCESS SAFETY (29CFR1910.119): N

STATE REGULATIONS:

California Proposition 65: N

EUROPEAN REGULATIONS:

EC NUMBER (EINECS): 200-864-0

EC RISK AND SAFETY PHRASES:

R 12	Extremely flammable.
R 20	Harmful by inhalation.
R 40	Possible risks of irreversible effects.
S 2	Keep out of reach of children.
S 7	Keep container tightly closed.
S 16	Keep away from sources of ignition - No smoking.
S 29	Do not empty into drains.

CONCENTRATION LIMITS:

C_{>=}12.5% Xn R 20-40

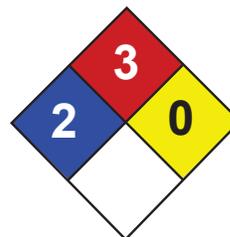
1%_{<=}C_<12.5% Xn R 40

16. OTHER INFORMATION

[Up to Table of Contents](#)

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet 1,1-Dichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,1-Dichloroethane

Catalog Codes: SLD3280

CAS#: 75-34-3

RTECS: KI0175000

TSCA: TSCA 8(b) inventory: 1,1-Dichloroethane

CI#: Not available.

Synonym:

Chemical Name: 1,1-Dichloroethane

Chemical Formula: C₂H₄Cl₂

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
{1,1-}Dichloroethane	75-34-3	100

Toxicological Data on Ingredients: 1,1-Dichloroethane: ORAL (LD50): Acute: 725 mg/kg [Rat].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified 2 (Reasonably anticipated.) by NTP. A4 (Not classifiable for human or animal.) by ACGIH. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Classified Development toxin [POSSIBLE]. The substance is toxic to kidneys, lungs, liver, central nervous system (CNS). 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. 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 immediate 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. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. 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: Flammable.

Auto-ignition Temperature: 458°C (856.4°F)

Flash Points: CLOSED CUP: -17°C (1.4°F). OPEN CUP: -6°C (21.2°F).

Flammable Limits: LOWER: 5.6% UPPER: 11.4%

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:

Flammable liquid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

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:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. 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. 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 Keep away from incompatibles such as oxidizing agents, alkalis.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

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: 100 STEL: 250 (ppm) from ACGIH (TLV) [1999] TWA: 100 (ppm) from OSHA (PEL) Australia: TWA: 200 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Oily liquid.)

Odor: Chloroform like odor (Slight.)

Taste: Not available.

Molecular Weight: 98.96 g/mole

Color: Colorless.

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

Boiling Point: 57.3°C (135.1°F)

Melting Point: -96.9°C (-142.4°F)

Critical Temperature: 261.5°C (502.7°F)

Specific Gravity: 1.175 (Water = 1)

Vapor Pressure: 180 mm of Hg (@ 20°C)

Vapor Density: 3.44 (Air = 1)

Volatility: Not available.

Odor Threshold: 120 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:

Partially dispersed in diethyl ether. See solubility in water, diethyl ether.

Solubility: Partially soluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, alkalis.

Corrosivity: Corrosive in presence of aluminum.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Will attack some forms of plastic and rubber

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 725 mg/kg [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 2 (Reasonably anticipated.) by NTP. A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to kidneys, lungs, liver, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

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 as toxic as the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

CLASS 3: Combustible liquid with a flash point greater than 37.8C (100F). Marine pollutant

Identification: : 1,1-Dichloroethane : UN2362 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65 (no significant risk level): 1,1-Dichloroethane 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: 1,1-Dichloroethane Rhode Island RTK hazardous substances: 1,1-Dichloroethane Pennsylvania RTK: 1,1-Dichloroethane Florida: 1,1-Dichloroethane Minnesota: 1,1-Dichloroethane Massachusetts RTK: 1,1-Dichloroethane New Jersey: 1,1-Dichloroethane New Jersey spill list: 1,1-Dichloroethane TSCA 8(b) inventory: 1,1-Dichloroethane TSCA 8(a) PAIR: 1,1-Dichloroethane TSCA 8(d) H and S data reporting: 1,1-Dichloroethane: June 1999 TSCA 12(b) one time export: 1,1-Dichloroethane SARA 313 toxic chemical notification and release reporting: 1,1-Dichloroethane: 1% CERCLA: Hazardous substances.: 1,1-Dichloroethane: 1000 lbs. (453.6 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R11- Highly flammable. R22- Harmful if swallowed. R37/38- Irritating to respiratory system and skin. R41- Risk of serious damage to eyes. R52- Harmful to aquatic organisms.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

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: 10/09/2005 05:07 PM

Last Updated: 05/21/2013 12:00 PM

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Material Safety Data Sheets

MSDS No: 156-59-2**Date: 03/09/2001**

SUPPLIER ADDRESS: 6141 Easton Road, Bldg. 1
PO Box 310
Plumsteadville, PA 18949-0310

EMERGENCY PHONE NUMBER: (215) 766-8861 

1. CHEMICAL PRODUCT

PRODUCT NAME: 1,2-DICHLOROETHYLENE (CIS) **SYNONYMS:** cis-Dichloroethylene

2. COMPOSITION, INFORMATION ON INGREDIENTS

Ingredient Name	Formula	CAS #	Concentration	Exposure Limits (PPM)			
				ACGIH TLV	OSHA PEL	MAC	Other STEL
1,2-DICHLOROETHYLENE (CIS)	C2H2CL2	156-59-2	99+%	200	NE	NE	NE

Note: NE = NONE ESTABLISHED

S/A = SIMPLE ASPHYXIANT

3. HAZARD IDENTIFICATION

* * * EMERGENCY OVERVIEW * * *

Flammable liquid and vapor.

Can form explosive mixtures with air.

Can cause irritation to eyes, skin and respiratory tract.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation , Ingestion

ACUTE EFFECTS: Vapor or mist is irritating to the eyes, skin, mucous membrane, and upper respiratory tract. Skin and eye irritation may occur. High concentrations may have a narcotic effect.

CHRONIC EFFECTS: Kidney and liver damage.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known

OTHER EFFECTS OF OVEREXPOSURE: None

CARCINOGENICITY (US ONLY):

NTP - No

IARC MONOGRAPHS - No

OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If

breathing is difficult, give oxygen.

EYE CONTACT: Immediately flush with copious amounts of water for at least 15 minutes.

SKIN CONTACT: Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing.

INGESTION: Never give anything by mouth to an unconscious person. Have conscious and alert person drink 1 to 2 glasses of water. Induce vomiting after victim drinks water.

IN EVENT OF EXPOSURE, CONSULT A PHYSICIAN

NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: 2 deg.C

AUTOIGNITION TEMPERATURE: 460 deg. C

FLAMMABLE LIMITS: Vol.%

LOWER: 5.6
UPPER: 12.80

EXTINGUISHING MEDIA: Carbon dioxide, foam, or dry chemical.

SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray.

HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide, hydrogen chloride and phosgene.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Cylinder rupture may occur under fire conditions. Emits toxic fumes under fire conditions. Vapors may travel a considerable distance to the source of ignition and flash back.

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Remove leaking cylinder to exhaust hood or safe outdoor area. Shut off source if possible and remove source of heat. Absorb with sand or vermiculite and place in closed containers for disposal.

SPECIALIZED EQUIPMENT: None

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders. Use only in a well-ventilated area.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store in well ventilated areas. Keep valve protection cap on cylinders when not in use. Store away from oxidizers, combustible materials, and source of ignition or heat.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation to maintain concentrations below exposure and flammable limits.

EYE / FACE PROTECTION: Goggles. A safety shower and eyewash station should be readily available.

SKIN PROTECTION: Wear suitable protective clothing.

RESPIRATORY PROTECTION: Use a self-contained breathing apparatus in case of emergency or non-routine use.

OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless

ODOR: Pleasant aromatic odor

PHYSICAL PRESSURE: Liquid

VAPOR PRESSURE: @41 deg.C: 400 mm Hg

VAPOR DENSITY (AIR=1): 3.34

BOILING POINT (C): 59

SOLUBILITY IN WATER: Insoluble

SPECIFIC GRAVITY (H2O=1): @20 deg.C: 1.284

EVAPORATION RATE: N/Av

ODOR THRESHOLD: N/Av

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.

CONDITIONS TO AVOID: Storage in poorly ventilated areas. Storage near a heat source.

MATERIALS TO AVOID: Oxidizing agents, air and moisture. Nitrogen dioxide, sodium, potassium hydroxide.

HAZARDOUS POLYMERIZATION: Will not occur.

HAZARDOUS DECOMPOSITION: HCl gas, phosgene gas, CO and oxides of chlorine.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): None established

LETHAL DOSE 50 (LD50): N/Av

TERATOGENICITY: N/Av

REPRODUCTIVE EFFECTS: N/Ap

MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Dispose of non-refillable cylinders in accordance with federal, state and local regulations. Allow gas to vent slowly to atmosphere in an unconfined area or exhaust hood. If the cylinders are the refillable type, return cylinders to supplier with any valve outlet plugs or caps secured and valve protection caps in place. Waste can be burned in an approved incinerator equipped with an afterburner and scrubber.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%

DOT DESCRIPTION (US ONLY):

PROPER SHIPPING NAME: Flammable liquids, n.o.s.
HAZARD CLASS: 3 (flammable), Packing Group I
IDENTIFICATION NUMBER: UN1993
REPORTABLE QUANTITIES: 1000 lb.
LABELING: FLAMMABLE LIQUID

ADR / RID (EU Only): Class 3, 3(b)

SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.

TSCA: Material is listed in TSCA inventory.

SARA: The threshold planning quantity for material is 10,000 lbs.

EU NUMBER: N/Av

NUMBER IN ANNEX 1 OF DIR 67/548: Material is listed in annex 1.

EU CLASSIFICATION: N/Av

R: 22-33-35-64

S: 15-22-23-27-36-65-71-76-104

16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS: N/Ap - Not Applicable N/Av - Not Available SA - Simple Asphyxiant NE - None Established

DISCLAIMER: Information included in this document is given to the best of our knowledge, however, no warranty is made that the information is accurate or complete. We do not accept any responsibility for damages by the use of the document.

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; C ₂ H ₃ Cl; 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

<u>Name</u>	<u>CAS number</u>	<u>% Volume</u>	<u>Exposure limits</u>
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 (ft ³ /lb)	: 6.25
Gas Density (lb/ft ³)	: 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.



Material Safety Data Sheet

Toluene

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Toluene

OTHER/GENERIC NAMES: Toloul, Methylbenzene

PRODUCT USE: Solvent

MANUFACTURER: Honeywell
1953 South Harvey Street
Muskegon, MI 49442

DISTRIBUTOR: VWR International
1310 Goshen Parkway
West Chester, PA 19380

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-5:00pm)
1-800-932-5000

IN CASE OF EMERGENCY CALL:
(24 Hours/Day, 7 Days/Week)
1-800-424-9300 (USA Only)
For Transportation Emergencies:
1-800-424-9300 (CHEMTREC - Domestic)
1-613-996-6666(CANUTEC- Canada)

NOTE: Emergency telephone numbers are to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to customer service.

2. COMPOSITION/INFORMATION ON INGREDIENTS

<u>INGREDIENT NAME</u>	<u>CAS NUMBER</u>	<u>WEIGHT %</u>
Toluene	108-88-3	100

Component Information/Information on Non-Hazardous Components

This product is considered to be hazardous according to the criteria specified in 29 CFR 1910.1200 (Hazard Communication Standard) and the Canadian Controlled Product Regulations.

Trace impurities and additional material names not listed above may also appear in Section 15 toward the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: This product is a clear, volatile, flammable liquid. Has a sweet, pungent odor. Highly flammable. Vapours may form explosive mixtures with air. The product causes irritation of eyes, skin and mucous membranes. Causes headache, drowsiness or other effects to the central nervous system. Harmful: may cause lung damage if swallowed. Severe exposure may cause respiratory depression, unconsciousness, convulsions and death. Do not allow product to contact skin, eyes and clothing. Do not breathe vapours.



MATERIAL SAFETY DATA SHEET

Toluene

POTENTIAL HEALTH HAZARDS

SKIN: Irritating to skin. May be harmful if absorbed through skin. Skin absorption may cause toxic effects similar to those described for inhalation. Repeated or extended contact may cause erythema (reddening of the skin) or dermatitis, resulting from a defatting action on tissue.

EYES: Vapours irritate the eyes. Contact with liquid or mist will irritate the eyes. May cause damage to the cornea.

INHALATION: Harmful: danger of serious damage to health by prolonged exposure through inhalation. Vapours may cause drowsiness and dizziness. Inhalation of high vapour concentrations can cause CNS-depression and narcosis. Symptoms include headache, nausea, dizziness, lack of coordination and anesthesia.

INGESTION: Harmful: may cause lung damage if swallowed. Ingestion causes gastrointestinal disturbances. Ingestion of this product may result in central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision.

DELAYED EFFECTS: Repeated and prolonged exposure to solvents may cause brain and nervous system damage. Repeated or prolonged exposure may cause damage to the liver and kidney. Possible risk of harm to the unborn child.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory diseases, liver or kidney dysfunctions, or blood, cardiovascular or central nervous system disorders may be aggravated by exposure.

HMIS Ratings: Health: 2* Fire: 3 Physical Hazard: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

<u>INGREDIENT NAME</u>	<u>NTP STATUS</u>	<u>IARC STATUS</u>	<u>OSHA LIST</u>
No component of this product at levels greater than or equal to 0.1% is identified as a carcinogen by ACGIH, IARC, NTP or OSHA.			

4. FIRST AID MEASURES

SKIN: Wash off immediately with soap and plenty of water. Take off contaminated clothing and shoes immediately. Wash contaminated clothing before re-use. Obtain medical attention.

EYES: Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

INHALATION: Move to fresh air in case of accidental inhalation of vapours. If not breathing, give artificial respiration. If breathing is difficult, give oxygen, provided a qualified operator is available. Call a physician immediately.



MATERIAL SAFETY DATA SHEET

Toluene

INGESTION: DO NOT induce vomiting. Immediate medical attention is required. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration.

ADVICE TO PHYSICIAN: Treat symptomatically.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT: 39.2°F (4°C)
FLASH POINT METHOD: Closed Cup
AUTOIGNITION TEMPERATURE: 896°F (480°C)
UPPER FLAME LIMIT (volume % in air): 7.1
LOWER FLAME LIMIT (volume % in air): 1.1
FLAME PROPAGATION RATE (solids): Not applicable
OSHA FLAMMABILITY CLASS: Class 1B Flammable Liquid

EXTINGUISHING MEDIA:

Use alcohol-resistant foam, carbon dioxide (CO₂) or dry chemical.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

Highly flammable. Vapours may form explosive mixtures with air. Vapours are heavier than air and may travel along the ground to some distant source of ignition and flash back.

Hazardous combustion products may include carbon monoxide, carbon dioxide (CO₂).

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

Water may be ineffective. Fire-fighters should wear self-contained, NIOSH-approved breathing apparatus and full protective clothing. Fire or intense heat may cause violent rupture of packages. In the event of fire, cool tanks with water spray. Do not use a solid water stream as it may scatter and spread fire. After fire, flush area with water to prevent re-ignition.

NFPA Ratings: Health: 2 Fire: 3 Reactivity: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE:

Containment Procedures: Use personal protective equipment. Ensure adequate ventilation. Remove all sources of ignition. Stop flow of material, if this is without risk.

Cleanup Procedures: Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Shovel into suitable container for disposal. Do not use sparking tools. Do not allow product to enter sewer or waterways.

Evacuation Procedures: Keep unnecessary people away. Isolate area.

Special Procedures: Use personal protective equipment. Remove all sources of ignition. Ensure adequate ventilation.



MATERIAL SAFETY DATA SHEET

Toluene

Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

7. HANDLING AND STORAGE

NORMAL HANDLING: (Always wear recommended personal protective equipment.)

Ensure all equipment is electrically grounded before beginning transfer operations. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing. Do not breathe vapours. Keep away from fire, sparks and heated surfaces. Keep container tightly closed in a dry and well-ventilated place.

STORAGE RECOMMENDATIONS:

Keep in a well-ventilated place. Empty containers may retain product residue including Flammable or Explosive vapours. Do not cut, drill, grind, or weld near full, partially full, or empty product containers. Keep away from heat and sources of ignition. Store away from incompatible substances. Re-open used containers with caution. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Store in area designed for storage of flammable liquids. Outside or detached storage is preferable. Protect containers against physical damage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:

Provide local and general exhaust ventilation to effectively remove and prevent buildup of any vapours or mists generated from the handling of this product. Use product only in closed system. Prevent electrostatic charge build-up by using common bonding and grounding techniques.

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION:

Wear impervious gloves and flame retardant antistatic protective clothing. For leak, spills, or other emergency, use full protective equipment.

EYE PROTECTION:

For handling in closed ventilation system, wear safety glasses with side-shields. For leak, spill or other emergency, use chemical goggles and face-shield.

RESPIRATORY PROTECTION:

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. For routine operations, wear self-contained breathing apparatus.

ADDITIONAL RECOMMENDATIONS:

Provide eyewash stations and quick-drench shower facilities.



MATERIAL SAFETY DATA SHEET

Toluene

EXPOSURE GUIDELINES

Component Exposure Limits

Toluene (108-88-3)

ACGIH:	50 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA (Final):	200 ppm TWA 300 ppm Ceiling
OSHA (Vacated):	100 ppm TWA; 375 mg/m ³ TWA 150 ppm STEL; 560 mg/m ³ STEL
NIOSH:	100 ppm TWA; 375 mg/m ³ TWA 150 ppm STEL; 560 mg/m ³ STEL
Alberta:	50 ppm TWA; 188 mg/m ³ TWA Substance may be readily absorbed through intact skin
British Columbia:	50 ppm TWA Skin notation
Manitoba:	100 ppm TWA; 375 mg/m ³ TWA 150 ppm STEL; 560 mg/m ³ STEL
New Brunswick:	50 ppm TWA; 188 mg/m ³ TWA Skin - potential for cutaneous absorption
North West Territories:	100 ppm TWA; 375 mg/m ³ TWA 150 ppm STEL; 560 mg/m ³ STEL Skin notation
Nova Scotia:	50 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route
Nunavut:	100 ppm TWA; 375 mg/m ³ TWA 150 ppm STEL; 560 mg/m ³ STEL Skin notation
Ontario:	50 ppm TWAEV
Quebec:	100 ppm TWAEV; 377 mg/m ³ TWAEV 150 ppm STEV; 565 mg/m ³ STEV
Saskatchewan:	188 mg/m ³ TWA; 50 ppm TWA 235 mg/m ³ STEL; 60 ppm STEL
Yukon:	100 ppm TWA; 375 mg/m ³ TWA 150 ppm STEL; 560 mg/m ³ STEL Skin notation

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Clear, colorless liquid
PHYSICAL STATE:	Liquid
MOLECULAR WEIGHT:	92.14
CHEMICAL FORMULA:	C ₇ H ₈
ODOR:	Sweet, pungent
SPECIFIC GRAVITY (water = 1.0):	0.867@ 68°F (20°C)



MATERIAL SAFETY DATA SHEET

Toluene

SOLUBILITY IN WATER (weight %): 0.074% @ 68°F (20°C)
pH: Not applicable
BOILING POINT: 231.08°F (110.6°C) @ 760 mm Hg
MELTING POINT: -125°F (-95°C)
VAPOUR PRESSURE: 28.5 @ 68°F (20°C)
VAPOUR DENSITY (air = 1.0): 3.1
EVAPORATION RATE: 4.5 **COMPARED TO:** Ether
% VOLATILES: ~100
FLASH POINT: 39.2°F (4°C)
(Flash point method and additional flammability data are found in Section 5.)

10. STABILITY AND REACTIVITY

NORMALLY STABLE? (CONDITIONS TO AVOID):

Stable under recommended storage conditions.
Avoid: Heat, flames and sparks. Incompatible products

INCOMPATIBILITIES:

Keep away from oxidising agents, strongly alkaline and strongly acid materials in order to avoid exothermic reactions.

HAZARDOUS DECOMPOSITION PRODUCTS:

Hazardous decomposition products include carbon monoxide and carbon dioxide (CO₂).

HAZARDOUS POLYMERISATION:

Hazardous polymerisation does not occur.

11. TOXICOLOGICAL INFORMATION

Component Analysis - LD50/LC50

Toluene (108-88-3)

Rat: LD50 - Route: Inhalation; Dose: 12.5 mg/L/4H
LD50 - Route: Inhalation; Dose: >26700 ppm/1H
LD50 - Route: Oral; Dose: 636 mg/kg
Rabbit: LD50 - Route: Dermal; Dose: 8390 mg/kg

IMMEDIATE (ACUTE) EFFECTS:

The product causes irritation of eyes, skin and mucous membranes. Causes headache, drowsiness or other effects to the central nervous system. Harmful: may cause lung damage if swallowed. Severe exposure may cause respiratory depression, unconsciousness, convulsions and death.

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

Possible risk of harm to the unborn child. Repeated and prolonged exposure to solvents may cause brain and nervous system damage. Repeated or prolonged exposure may cause damage to the liver and kidney. Inhalation (rats) of 2500 ppm/6.5h/day for 15 weeks, produced changes in heart, liver, kidney, urethra and bladder.

Mutagenicity:



MATERIAL SAFETY DATA SHEET

Toluene

- Non mutagenic in Ames salmonella/microsome assay
- Non mutagenic in CHO chromosome aberration assay

OTHER DATA:

This material is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP, or EPA.

Component Carcinogenicity

Toluene (108-88-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

IARC: Monograph 71, 1999; Monograph 47, 1989 (Group 3 (not classifiable))

12. ECOLOGICAL INFORMATION

Harmful to aquatic organisms. Prevent from entering sewer or waterway.

Component Analysis - Ecotoxicity - Aquatic Toxicity

Toluene (108-88-3)

Test & Species

		Conditions
96 Hr LC50 fathead minnow (1 day old)	25 mg/L	flow-through
96 Hr LC50 rainbow trout	24.0 mg/L	static
96 Hr LC50 bluegill	24.0 mg/L	static
96 Hr LC50 fathead minnow	31.7 mg/L	flow-through
30 min EC50 Photobacterium phosphoreum	19.7 mg/L	
48 Hr EC50 water flea	11.3 mg/L	
48 Hr EC50 water flea	310 mg/L	

Accumulation in terrestrial organisms is unlikely. Bioaccumulation is unlikely.

13. DISPOSAL CONSIDERATIONS

WASTE INFORMATION: This product is a D001 ignitable waste in supplied form. Dispose of as special waste in compliance with local and national regulations. Waste codes should be assigned by the user based on the application for which the product was used. Incineration of waste material in an EPA-approved facility is recommended, allowing a solid, inert residue to form.

OTHER DISPOSAL CONSIDERATIONS: Observe all Federal, State, and Local Environmental regulations.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT PROPER SHIPPING NAME: Toluene

US DOT HAZARD CLASS: 3

US DOT ID NUMBER: UN1294

PACKING GROUP: II



MATERIAL SAFETY DATA SHEET

Toluene

TDG PROPER SHIPPING NAME: Toluene

TDG HAZARD CLASS: 3

PACKING GROUP: II

TDG ID NUMBER: UN1294

North American Emergency Response Guide (ERG) Number: 130

For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: All components are on the U.S. EPA TSCA Inventory List.

OTHER TSCA ISSUES: Additional TSCA information may exist. Contact VWR if you have questions regarding your application or use of this product.

SARA TITLE III/CERCLA

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

<u>INGREDIENT NAME</u>	<u>SARA/CERCLA RQ (lb)</u>	<u>SARA EHS TPQ (lb)</u>
Toluene	1000	None.

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: Immediate. Delayed. Fire.

SARA 313 TOXIC CHEMICALS:

The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section 2.

<u>INGREDIENT NAME</u>	<u>COMMENT</u>
Toluene (108-88-3)	1.0 % de minimis concentration

STATE RIGHT-TO-KNOW

In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.

<u>INGREDIENT NAME</u>	<u>WEIGHT %</u>	<u>COMMENT</u>
Toluene (108-88-3)	100	CA, MA, MN, NJ, PA, RI

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):



MATERIAL SAFETY DATA SHEET

Toluene

WARNING! This product contains a chemical known to the state of California to cause reproductive/developmental effects.

ADDITIONAL REGULATORY INFORMATION:

Toluene is regulated by the Drug Enforcement Administration and appears on List II (21 CFR Section 1310.02(b) and 1310.04(f)(2)). Importation, exportation and domestic sales in excess of the applicable thresholds must comply with the regulations.

WHMIS CLASSIFICATION (CANADA):

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

WHMIS Classification:

B2- Flammable Liquid
D2A- Very Toxic Material
D2B- Toxic Material

FOREIGN INVENTORY STATUS:

Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC	AUST	PHIL	MITI	KOREA	CHINA
Toluene	108-88-3	Yes	DSL	EINECS	Yes	Yes	Yes	Yes	Yes

16. OTHER INFORMATION

CURRENT ISSUE DATE: December 21, 2005

PREVIOUS ISSUE DATE: New MSDS.

CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING:

New MSDS.

OTHER INFORMATION: As per the OSHA Hazard Communication Standard, 1910.1200, the information contained within this MSDS must be given to those persons using this material. For laboratory use only. Not for food or drug use. Do not store with foodstuffs.

KEY/LEGEND: ACGIH = American Conference of Governmental Industrial Hygienists; CAS = Chemical Abstracts Service; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CFR = Code of Federal Regulations; CPR = Controlled Products Regulations; DOT = Department of Transportation; DSL = Domestic Substances List; EINECS = European Inventory of Existing Commercial Chemical Substances; EPA = Environmental Protection Agency; IARC = International Agency for Research on Cancer; IATA = International Air Transport Association; mg/Kg = milligrams per Kilogram; mg/L = milligrams per Liter; mg/m³ = milligrams per Cubic Meter; MSHA = Mine Safety and Health Administration; NA = Not Applicable or Not Available; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; SARA = Superfund Amendments and Reauthorization Act; TDG = Transport Dangerous Goods; TSCA = Toxic Substances Control Act; WHMIS = Workplace Hazardous Materials Information System.

End of Sheet #BDH-180

METHYLENE CHLORIDE
M47008_NA_US

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MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY INFORMATION

Occidental Chemical Corporation

5005 LBJ Freeway, Suite 2200

P.O. Box 809050

Dallas, Texas 75380-9050

24 HOUR EMERGENCY TELEPHONE:

1-800-733-3665 or 1-972-404-3228 (U.S.);

32.3.575.55.55 (Europe);

1800-033-111 (Australia)

TO REQUEST AN MSDS:

MSDS@oxy.com or 1-972-404-3245

CUSTOMER SERVICE:

1-800-752-5151 or 1-972-404-3700

MSDS NUMBER: M47008

SUBSTANCE: METHYLENE CHLORIDE

TRADE NAMES:

METHYLENE CHLORIDE, TECHNICAL GRADE; METHYLENE CHLORIDE, DECAFFEINATION GRADE; METHYLENE CHLORIDE, AEROSOL GRADE; METHYLENE CHLORIDE, DEGREASING GRADE; METHYLENE CHLORIDE, SPECIAL GRADE

SYNONYMS:

Dichloromethane

PRODUCT USE: paint remover formulations, vapor depressant in aerosol applications, general cleaning solvent, foam blowing agent

PRODUCT DESCRIPTION: Note - The Special, Aerosol, and Degreasing Grades contain small amounts of a propylene oxide stabilizer. The Technical and Decaffeination Grades do not.

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2. HAZARDS IDENTIFICATION

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

GHS CLASSIFICATION:
Acute toxicity, Category 4

GHS SYMBOL:



GHS SIGNAL WORD: WARNING

GHS HAZARD STATEMENT:
Harmful if swallowed
May be harmful if inhaled

EMERGENCY OVERVIEW:

COLOR: colorless

PHYSICAL FORM: liquid

ODOR: mildly sweet, chloroform-like odor

SIGNAL WORD: WARNING

MAJOR HEALTH HAZARDS: HARMFUL IF SWALLOWED. MAY BE IRRITATING TO RESPIRATORY TRACT, SKIN AND EYES. MAY CAUSE CARDIAC AND CENTRAL NERVOUS SYSTEM EFFECTS. CHEMICAL ASPHYXIANT. MAY CAUSE LIVER DAMAGE. MAY CAUSE CANCER BASED ON ANIMAL DATA.

PRECAUTIONARY STATEMENTS: Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation.

POTENTIAL HEALTH EFFECTS:

INHALATION:

May cause upper respiratory tract irritation and central nervous system depression with symptoms such as confusion, lightheadedness, nausea, vomiting, headache, and fatigue. Causes formation of carbon monoxide in blood which may affect the cardiovascular system and central nervous system. Continued exposure may cause unconsciousness and even death.

SKIN CONTACT:

May cause effects ranging from mild irritation to severe pain, and possibly burns, depending on the intensity of contact. Skin absorption may occur.

EYE CONTACT:

Vapors may cause eye irritation. Contact may cause tearing, redness, a stinging or burning feeling, swelling,

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and blurred vision.

INGESTION:

May cause nausea or vomiting. If vomiting results in aspiration, chemical pneumonia could occur. Absorption through the gastrointestinal tract may produce central nervous system depression.

TARGET ORGANS: blood, central nervous system, liver, skin, cardiovascular system, eyes

CHRONIC EFFECTS:

May cause liver damage. May cause cancer based on animal data.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: heart or cardiovascular disorders, kidney disorders, liver disorders, nervous system disorders, respiratory system (including asthma and other breathing disorders), skin disorders and allergies

ADDITIONAL DATA: Alcohol may enhance the toxic effects. May cross the placenta. May be excreted in breast milk. Concurrent exposure to carbon monoxide, smoking, or physical activity may increase the level of carboxyhemoglobin in the blood resulting in additive effects.

CARCINOGEN STATUS:

OSHA: Yes

NTP: Yes

IARC: Yes

See Section 11: TOXICOLOGICAL INFORMATION

3. COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT: DICHLOROMETHANE

CAS NUMBER: 75-09-2

PERCENTAGE: 99.97-100

COMPONENT: PROPYLENE OXIDE (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY)

CAS NUMBER: 75-56-9

PERCENTAGE: Proprietary

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. If respiration or pulse has stopped, have a trained person administer Basic Life Support (Cardio-Pulmonary Resuscitation/Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: Immediately flush contaminated areas with water. Remove contaminated clothing, jewelry, and shoes immediately. Wash contaminated areas with soap and water. Thoroughly clean and dry contaminated clothing before reuse. Discard contaminated leather goods. GET MEDICAL ATTENTION IMMEDIATELY.

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EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Never give anything by mouth to an unconscious or convulsive person. If swallowed, do not induce vomiting. If vomiting occurs spontaneously, keep airway clear. Do not give fluids. GET MEDICAL ATTENTION IMMEDIATELY.

NOTE TO PHYSICIAN: This material is an aspiration hazard. Risk of aspiration must be weighed against possible toxicity of the material (see ingestion) when determining whether to induce emesis or to perform gastric lavage. This material sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. This material is metabolized to carbon monoxide. Consequently, elevations in carboxyhemoglobin as high as 50% have been reported, and levels may continue to rise for several hours after exposure has ceased. Data in experimental animals suggest there is a narrow margin between concentrations causing anesthesia and death.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Slight fire hazard.

EXTINGUISHING MEDIA: Use foam, dry chemical, CO₂, or water spray.

FIRE FIGHTING: Wear NIOSH approved positive-pressure self-contained breathing apparatus. Concentrated vapors may be ignited by high intensity energy source. Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Keep water runoff out of water supplies and sewers (see Section 6 of the MSDS).

SENSITIVITY TO MECHANICAL IMPACT: Not sensitive

SENSITIVITY TO STATIC DISCHARGE: Not sensitive

FLASH POINT: none, TCC

LOWER FLAMMABLE LIMIT: 12% @ 100 C

UPPER FLAMMABLE LIMIT: 19% @ 100 C

AUTOIGNITION: 1033 F (556.1 C)

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition or combustion products: hydrogen chloride, chlorine, phosgene, oxides of carbon

6. ACCIDENTAL RELEASE MEASURES

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OCCUPATIONAL RELEASE:

Evacuation of surrounding area may be necessary for large spills. Shut off ventilation system if needed. Wear appropriate personal protective equipment recommended in Section 8 of the MSDS. Completely contain spilled material with dikes, sandbags, etc. Most vapors are heavier than air and will spread along ground and collect in low or confined areas (drains, basements, tanks). Ventilate closed spaces before entering. Stop leak if possible without personal risk. Remove contaminated soil or collect with appropriate absorbent and place into suitable container. Keep container tightly closed. Dispose properly. Liquid material may be removed with a properly rated vacuum truck. Keep out of water supplies, sewers and soil. Avoid discharge into drains, surface water or groundwater. Releases should be reported, if required, to appropriate agencies. 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. Keep container tightly closed and properly labeled. Store in a cool, dry place. Store in a well-ventilated area. Prevent water or moist air from entering storage tanks or containers. Do not enter confined spaces without following proper confined space entry procedures. Do not store in aluminum container or use aluminum fittings or transfer lines. Protect from sunlight. Do not reuse drum without recycling or reconditioning in accordance with any applicable federal, state or local laws. Do not use cutting or welding torches, open flames or electric arcs on empty or full containers. Keep separated from incompatible substances (see Section 10 of the MSDS).

HANDLING: Most vapors are heavier than air and will spread along ground and collect in low or confined areas (drains, basements, tanks). Avoid breathing vapor or mist. Avoid contact with eyes, skin and clothing. Do not taste or swallow. Wash thoroughly after handling. When using, do not eat, drink or smoke.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

DICHLOROMETHANE:

DICHLOROMETHANE (METHYLENE CHLORIDE):

25 ppm OSHA TWA PEL

125 ppm OSHA STEL 15 minute(s)

12.5 ppm OSHA action level

50 ppm ACGIH TWA

PROPYLENE OXIDE (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY):

PROPYLENE OXIDE:

100 ppm (240 mg/m³) OSHA TWA

20 ppm (50 mg/m³) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)

2 ppm ACGIH TWA (sensitizer)

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BIOLOGICAL LIMIT VALUES:
DICHLOROMETHANE (METHYLENE CHLORIDE):

BEI®: 0.3 mg/L

DETERMINANT: Dichloromethane in urine

SAMPLING TIME: End of shift

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits. Monitoring must be performed regularly in accordance with 29 CFR 1910.1052(d) to determine exposure level(s).

EYE PROTECTION: Wear safety glasses with side shields. Wear chemical safety goggles with a faceshield to protect against skin and eye contact when appropriate. 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.

PROTECTIVE MATERIAL TYPES: Trelchem®, Tychem®, Viton®, polyvinyl alcohol (PVA)

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 2300 ppm (methylene chloride)

RESPIRATOR: The minimum requirements for respiratory protection for methylene chloride appear in 29 CFR 1910.1052 (f).

Where concentrations are above the IDLH, or are unknown, or during spills and/or emergencies, use any supplied-air respirator that has a full facepiece and 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.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid

APPEARANCE: clear

COLOR: colorless

ODOR: mildly sweet, chloroform-like odor

MOLECULAR WEIGHT: 84.94

MOLECULAR FORMULA: CH₂Cl₂

BOILING POINT: 104 F (40 C)

FREEZING POINT: -139 F (-95 C)

FLASH POINT: none, TCC

LOWER FLAMMABLE LIMIT: 12% @ 100 C

UPPER FLAMMABLE LIMIT: 19% @ 100 C

AUTOIGNITION: 1033 F (556.1 C)

VAPOR PRESSURE: 350 mmHg @ 20 C

VAPOR DENSITY (air=1): 2.9

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SPECIFIC GRAVITY (water=1): 1.31-1.32 @ 25 C
WATER SOLUBILITY: 1.32% @ 25 C
PH: Not applicable
VOLATILITY: 100%
ODOR THRESHOLD: 200-300 ppm (causes olfactory fatigue)
EVAPORATION RATE: 0.7 (ether=1)
COEFFICIENT OF WATER/OIL DISTRIBUTION: log Kow = 1.25

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. Avoid contact with incompatible substances and conditions due to generation of phosgene and other toxic and irritating substances.

INCOMPATIBILITIES: bases, oxygen, sodium, potassium, strong oxidizing materials, reactive metals

HAZARDOUS DECOMPOSITION:

Thermal decomposition or combustion products: hydrogen chloride, chlorine, phosgene, oxides of carbon

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

METHYLENE CHLORIDE:

IRRITATION DATA: 810 mg/24 hour(s) skin-rabbit severe; 100 mg/24 hour(s) skin-rabbit moderate; 162 mg eyes-rabbit moderate; 10 mg eyes-rabbit mild; 500 mg/24 hour(s) eyes-rabbit mild

TOXICITY DATA: 52 mg/L/4 hour(s) inhalation-rat LC50; 985-1600 mg/kg oral-rat LD50

MUTAGENIC DATA: Positive results have been observed in the Ames test. In mammalian systems, responses have generally been negative. **IMMUNOTOXICITY:** A study found there was no evidence of harm to the immune system of laboratory animals or reduced ability to combat disease. **NEUROTOXICITY:** Tests in rats indicate no significant neurotoxic effects after exposure to concentrations up to 2,000 ppm for 90 days. No neurotoxic effects have been observed in humans at typical occupational exposure levels. **DEVELOPMENTAL/REPRODUCTIVE:** No significant developmental effects were observed in female rats and mice exposed to 1,250 ppm during gestation. A similar result was observed in rats exposed to 4,500 ppm before and during gestation. A two-generation inhalation study showed no adverse reproductive effects in rats exposed to as much as 1,500 ppm for 14 weeks.

CARCINOGEN STATUS: Methylene chloride is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are not considered relevant to worker exposure. Available epidemiological studies do not confirm an increased risk of cancer in humans. Available evidence suggests that this material is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

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12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

FISH TOXICITY: 310 mg/L 96 hour(s) LC50 (Static) Fathead minnow; 220 mg/L 96 hour(s) LC50 (Static) Bluegill sunfish

INVERTEBRATE TOXICITY: 256 mg/L 96 hour(s) LC50 Mysid Shrimp

FATE AND TRANSPORT:

BIODEGRADATION: Biodegradation may occur in groundwater, but will be very slow compared with evaporation.

PERSISTENCE: AIR: This material released to the atmosphere will degrade by reaction with hydroxyl radicals with a half-life of several months. It is not subject to direct photooxidation. SOIL: On land is expected to evaporate rapidly into the atmosphere due to its high vapor pressure. It is poorly adsorbed to soil and can leach into the groundwater. Calculated Adsorption Coefficient (log KOC) is 1. WATER: This material is subject to rapid evaporation, with estimated evaporative half-lives ranging from 3 to 5.6 hours under moderate mixing condition. This material has a negligible rate of hydrolysis.

BIOCONCENTRATION: Bioconcentration potential in aquatic organisms is low with BCF of 2.

13. DISPOSAL CONSIDERATIONS

Reuse or reprocess if possible. Keep out of water supplies, sewers and soil. Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U080. May be subject to disposal regulations: D002. D029. F002.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Dichloromethane

ID NUMBER: UN1593

HAZARD CLASS OR DIVISION: 6.1

PACKING GROUP: III

LABELING REQUIREMENTS: 6.1

DOT HAZARDOUS SUBSTANCE(S):

Dichloromethane 1000 lb(s) (454 kg(s))

Propylene oxide 100 lb(s) (45.4 kg(s))

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Dichloromethane

UN NUMBER: UN1593

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Revision Date: May 09 2008

CLASS: 6.1

PACKING GROUP/RISK GROUP: III

15. REGULATORY INFORMATION

U.S. REGULATIONS:

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):**Dichloromethane (Methylene chloride):** 1000 LBS RQ**1,1,2-Trichloroethane:** 100 LBS RQ**VINYLDINE CHLORIDE:** 100 LBS RQ**Propylene Oxide (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY):** 100 lbs RQ**SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):****Propylene Oxide (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY):** 10000/lbs lbs TPQ**SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):**

ACUTE: Yes

CHRONIC: Yes

FIRE: No

REACTIVE: No

SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):**Dichloromethane (Methylene chloride)****Propylene Oxide (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY)**

This product contains a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372. Refer to Section 3.

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.**OTHER U.S. REGULATIONS:** OSHA Specifically Regulated Substances (29 CFR 1910.1052).

STATE REGULATIONS:

California Proposition 65:

Known to the state of California to cause the following:

Dichloromethane (Methylene chloride)

Cancer (Apr 01, 1988)

1,1,2-Trichloroethane

Cancer (Oct 01, 1990)

This product may contain contaminants known to the State of California to cause cancer or reproductive toxicity as listed under Proposition 65 State Drinking Water and Toxic Enforcement Act. For additional information, contact Customer Service.

METHYLENE CHLORIDE
M47008_NA_US

Revision Date: May 09 2008

NEW JERSEY WORKER AND COMMUNITY RIGHT TO KNOW:**REPORTING REQUIREMENT:**

DICHLOROMETHANE 75-09-2 99.97-100%

RIGHT TO KNOW HAZARDOUS SUBSTANCE LIST:

DICHLOROMETHANE 75-09-2 99.97-100%

1,1,2-TRICHLOROETHANE 79-00-5 <10 ppm

VINYLIDENE CHLORIDE 75-35-4 0-12.2 ppm

PROPYLENE OXIDE (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY) 75-56-9

Proprietary

SPECIAL HEALTH HAZARD SUBSTANCE LIST:

1,1,2-TRICHLOROETHANE 79-00-5 <10 ppm

VINYLIDENE CHLORIDE 75-35-4 0-12.2 ppm

PROPYLENE OXIDE (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY) 75-56-9

Proprietary

PENNSYLVANIA RIGHT TO KNOW:**REPORTING REQUIREMENT:**

DICHLOROMETHANE 75-09-2 99.97-100%

HAZARDOUS SUBSTANCE LIST:

DICHLOROMETHANE 75-09-2 99.97-100%

PROPYLENE OXIDE (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY) 75-56-9

Proprietary

ENVIRONMENTAL HAZARDOUS SUBSTANCE LIST:

DICHLOROMETHANE 75-09-2 99.97-100%

PROPYLENE OXIDE (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY) 75-56-9

Proprietary

SPECIAL HAZARDOUS SUBSTANCE LIST:

DICHLOROMETHANE 75-09-2 99.97-100%

PROPYLENE OXIDE (SPECIAL, AEROSOL, AND DEGREASING GRADES ONLY) 75-56-9

Proprietary

CANADIAN REGULATIONS:

CONTROLLED PRODUCTS REGULATIONS (CPR): This product has been classified in accordance with the criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

WHMIS CLASSIFICATION: D1B, D2A, D2B.

NATIONAL INVENTORY STATUS:

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

METHYLENE CHLORIDE
M47008_NA_US

Revision Date: May 09 2008

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Listed on inventory.

16. OTHER INFORMATION

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

HMIS RATINGS (SCALE 0-4): HEALTH=2* FLAMMABILITY=1 REACTIVITY=0

This information is intended solely for the use of individuals trained in the NFPA and/or HMIS systems. Rated using 2nd Edition HMIS Instructions.

MSDS SUMMARY OF CHANGES

2. HAZARDS IDENTIFICATION

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

11. TOXICOLOGICAL INFORMATION

15. REGULATORY INFORMATION

Standard 29 CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, material safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Material Safety Data Sheet available to your employees.

IMPORTANT: The information presented herein, while not guaranteed, was prepared by competent technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, IS MADE REGARDING PERFORMANCE, SUITABILITY, STABILITY OR OTHERWISE. The information included herein is not intended to be all-inclusive as to the appropriate manner and/or conditions of use, handling and/or storage. Factors pertaining to certain conditions of storage, handling, or use of this product may involve other or additional safety or performance considerations. While our technical personnel will be happy to respond to questions regarding safe handling and use procedures, safe handling and use remains the responsibility of the customer. No suggestions for use are intended to, and nothing herein shall be construed as a recommendation to, infringe any existing patents or violate any laws, rules, regulations or ordinances of any governmental entity.



Health	3
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Cadmium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cadmium

Catalog Codes: SLC3484, SLC5272, SLC2482

CAS#: 7440-43-9

RTECS: EU9800000

TSCA: TSCA 8(b) inventory: Cadmium

CI#: Not applicable.

Synonym:

Chemical Name: Cadmium

Chemical Formula: Cd

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
Cadmium	7440-43-9	100

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.
MUTAGENIC EFFECTS: Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance is toxic to kidneys, lungs, liver. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

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: Not available.

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. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. 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: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:

Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

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:

Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. 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 dust. 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. Keep away from incompatibles such as oxidizing agents.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust 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: 0.01 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 112.4 g/mole

Color: Silvery.

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

Boiling Point: 765°C (1409°F)

Melting Point: 320.9°C (609.6°F)

Critical Temperature: Not available.

Specific Gravity: 8.64 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity: Reacts violently with potassium.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 890 mg/kg [Mouse]. Acute toxicity of the dust (LC50): 229.9 mg/m³ 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. The substance is toxic to kidneys, lungs, liver.

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

Special Remarks on other Toxic Effects on Humans: May cause allergic reactions, exzema and/or dehydration of the skin.

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 as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport:

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: Cadmium 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: Cadmium Pennsylvania RTK: Cadmium Massachusetts RTK: Cadmium TSCA 8(b) inventory: Cadmium SARA 313 toxic chemical notification and release reporting: Cadmium CERCLA: Hazardous substances.: Cadmium

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

R26- Very toxic by inhalation. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

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

Health: 3

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References:

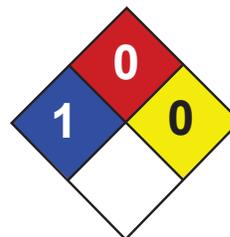
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:29 PM

Last Updated: 05/21/2013 12:00 PM

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Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

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
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

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

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). 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. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

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

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

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: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. 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 dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust 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: 0.05 (mg/m³) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m³) from OSHA (PEL) [United States] TWA: 0.03 (mg/m³) from NIOSH [United States] TWA: 0.05 (mg/m³) [Canada] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

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

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungs by mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually absorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, delirium, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead colic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

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 less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

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: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead 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: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

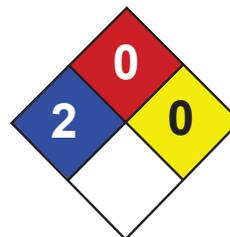
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 05/21/2013 12:00 PM

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Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

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
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer). **CARCINOGENIC EFFECTS:** Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance is toxic to skin. The substance may be toxic to kidneys, lungs, liver, 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. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

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:

Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:

Material in powder form, capable of creating a dust explosion. Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode. Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion. Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. 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.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust 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: 1 (mg/m³) from ACGIH (TLV) [United States] Inhalation Respirable. TWA: 0.5 (mg/m³) [United Kingdom (UK)] TWA: 1 (mg/m³) from OSHA (PEL) [United States] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

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

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water. Insoluble in Ammonia. Soluble in dilute Nitric Acid. Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + industrial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. Causes damage to the following organs: skin. May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc: LDL [Rat] - Route: Oral; Dose: 5000 mg/kg LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Nickel dust and fume can irritate skin. Eyes: Nickel dust and fume can irritate eyes. Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis. Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal, and diarrhea. Nickel may damage the kidneys (proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased coronary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venous dilation). Chronic Potential Health Effects: Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis. Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count). Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy.

Chronic ingestion of Nickel may also affect respiration and cause pneumoconiosis or fibrosis. Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

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 as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

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: Nickel metal 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: Nickel metal Connecticut hazardous material survey.: Nickel metal Illinois toxic substances disclosure to employee act: Nickel metal Illinois chemical safety act: Nickel metal New York release reporting list: Nickel metal Rhode Island RTK hazardous substances: Nickel metal Pennsylvania RTK: Nickel metal Michigan critical material: Nickel metal Massachusetts RTK: Nickel metal Massachusetts spill list: Nickel metal New Jersey: Nickel metal New Jersey spill list: Nickel metal Louisiana spill reporting: Nickel metal California Director's List of Hazardous Substances: Nickel metal TSCA 8(b) inventory: Nickel metal

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R40- Possible risks of irreversible effects. R43- May cause sensitization by skin contact. S22- Do not breathe dust. S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Manganese MSDS

Section 1: Chemical Product and Company Identification

Product Name: Manganese

Catalog Codes: SLM2245

CAS#: 7439-96-5

RTECS: OO9275000

TSCA: TSCA 8(b) inventory: Manganese

CI#: Not available.

Synonym:

Chemical Name: Manganese

Chemical Formula: Mn

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
Manganese	7439-96-5	100

Toxicological Data on Ingredients: Manganese: ORAL (LD50): Acute: 9000 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, lungs, brain, central nervous system (CNS). 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. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

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: Not applicable.

Special Remarks on Fire Hazards:

Moderate fire potential, in the form of dust or powder, when exposed to flame. When manganese is heated in the vapor of phosphorus at a very dull red heat, union occurs with incandescence. Concentrated nitric acid reacts with powdered manganese with incandescence and explosion. Powdered manganese ignites in chlorine.

Special Remarks on Explosion Hazards: Moderate explosion potential, in the form of dust or powder, when exposed to flame.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. 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:

Do not ingest. Do not breathe dust. 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. Keep away from incompatibles such as oxidizing agents, reducing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust 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: 0.1 (mg/m³) from ACGIH (TLV) [United States] TWA: 5 (mg/m³) [Canada] TWA: 1 STEL: 3 (mg/m³) from NIOSH [United States] TWA: 5 (mg/m³) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Not available.

Molecular Weight: 54.94 g/mole

Color: Grayish white.

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

Boiling Point: 2095°C (3803°F)

Melting Point: 1244°C (2271.2°F)

Critical Temperature: Not available.

Specific Gravity: 7.44 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Superficially oxidized on exposure to air. Reacts with aqueous solutions of sodium or potassium bicarbonate. Reacts with dilute mineral acids with evolution of hydrogen and formation of divalent manganous salts. Reacts with fluorine and chlorine to produce di or tri fluoride, and di and tri chloride, respectively. In the form of powder, it reduces most metallic oxides on heating. On heating, it reacts directly with carbon, phosphorus, antimony, or arsenic. Also incompatible with hydroxides, cyanides, carbonates.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 9000 mg/kg [Rat].

Chronic Effects on Humans: May cause damage to the following organs: blood, lungs, brain, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

Manganese can cross the placenta. May cause cancer (tumorigenic) based on animal data.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause skin irritation Eyes: Dust may cause mechanical irritation. Inhalation: Dust may cause respiratory tract irritation. May cause "Metal Fume Fever" which may include flu-like symptoms (fever, chills, upset stomach, vomiting, weakness, headache, body aches, muscle pains, dry mouth and throat, coughing, tightness of the chest). May affect behavior/Central Nervous system (change in motor activity, torpor, nervousness, tremor, yawning, mood swings, irritability, restlessness, fatigue, headache, apathy, languor, insomnia than somnolence, hallucinations, delusions, uncontrollable laughter followed by crying, compulsions, aggressiveness, weakness in legs, memory loss, decreased libido, impotence, salivation, hearing loss, slow gait,), and respiration (dyspnea, shallow respiration, cyanosis, alveolar inflammation). Ingestion: Repeated or prolonged exposure from ingestion may affect brain (degenerative changes), blood and metabolism. Ingestion: May cause digestive tract irritation. There is a low gastrointestinal absorption of manganese. Chronic Potential Health Effects: Inhalation: Repeated or prolonged exposure from inhalation may affect brain (degenerative changes), behavior/Central Nervous system with symptoms to acute exposure. May also affect liver (chronic liver disease, jaundice) Ingestion: Repeated or prolonged exposure from ingestion may affect brain, blood and metabolism

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 product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

Illinois toxic substances disclosure to employee act: Manganese Rhode Island RTK hazardous substances: Manganese Pennsylvania RTK: Manganese Minnesota: Manganese Massachusetts RTK: Manganese New Jersey: Manganese New Jersey spill list: Manganese Louisiana spill reporting: Manganese California Director's List of Hazardous Substances: Manganese TSCA 8(b) inventory: Manganese SARA 313 toxic chemical notification and release reporting: Manganese

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC): Not applicable.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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ALCONOX MSDS

Section 1 : MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency 800-255-3924.

phone number: 813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2009/04/20

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A : ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).
 CAS# 497-19-8: LD50 4020 mg/kg - rat oral.
 CAS# 7758-29-4: LD50 3100 mg/kg - rat oral.

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS
--

Physical state: Solid
Appearance & odor: Almost odourless.
 White granular powder.
Odor threshold (ppm): Not available.
Vapour pressure (mmHg): Not applicable.
Vapour density (air=1): Not applicable.
By weight: Not available.
Evaporation rate (butyl acetate = 1): Not applicable.
Boiling point (°C): Not applicable.
Freezing point (°C): Not applicable.
pH: (1% aqueous solution).
 9.5
Specific gravity @ 20 °C: (water = 1).
 0.85 - 1.10
Solubility in water (%): 100 - > 10% w/w
Coefficient of water\oil dist.: Not available.
VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability: Not flammable.
Conditions of flammability: Surrounding fire.
Extinguishing media: Carbon dioxide, dry chemical, foam.
 Water
 Water fog.
Special procedures: Self-contained breathing apparatus required.
 Firefighters should wear the usual protective gear.
Auto-ignition temperature: Not available.
Flash point (°C), method: None
Lower flammability limit (% vol): Not applicable.
Upper flammability limit (% vol): Not applicable.
 Not available.
Sensitivity to mechanical impact: Not applicable.
Hazardous combustion products: Oxides of carbon (COx).
 Hydrocarbons.
Rate of burning: Not available.
Explosive power: None

Section 5 : REACTIVITY DATA

- Chemical stability:** Stable under normal conditions.
- Conditions of instability:** None known.
- Hazardous polymerization:** Will not occur.
- Incompatible substances:** Strong acids.
Strong oxidizers.
- Hazardous decomposition products:** See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

- Route of entry:** Skin contact, eye contact, inhalation and ingestion.
- Effects of Acute Exposure**
- Eye contact:** May cause irritation.
- Skin contact:** Prolonged contact may cause irritation.
- Inhalation:** Airborne particles may cause irritation.
- Ingestion:** May cause vomiting and diarrhea.
May cause abdominal pain.
May cause gastric distress.
- Effects of chronic exposure:** Contains an ingredient which may be corrosive.
- LD50 of product, species & route:** > 5000 mg/kg rat oral.
- LC50 of product, species & route:** Not available for mixture, see the ingredients section.
- Exposure limit of material:** Not available for mixture, see the ingredients section.
- Sensitization to product:** Not available.
- Carcinogenic effects:** Not listed as a carcinogen.
- Reproductive effects:** Not available.
- Teratogenicity:** Not available.
- Mutagenicity:** Not available.
- Synergistic materials:** Not available.
- Medical conditions aggravated by exposure:** Not available.
- First Aid**
- Skin contact:** Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.
- Eye contact:** Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
- Inhalation:** Remove victim to fresh air.
Seek medical attention if symptoms persist.
- Ingestion:** Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.
Do not induce vomiting, seek immediate medical attention.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak/Spill: Contain the spill.
Recover uncontaminated material for re-use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves/Type:



Neoprene or rubber gloves.

Respiratory/Type:



If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye/Type:



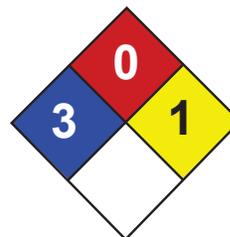
Safety glasses with side-shields.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash capability should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.



Health	3
Fire	0
Reactivity	1
Personal Protection	

Material Safety Data Sheet

Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

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
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). **CARCINOGENIC EFFECTS:** Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. 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. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

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

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

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. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammable gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrogen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:

Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. 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 container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. 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. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

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:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

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:

CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:

108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:

-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:

1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:

Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:

Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalis (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothermic reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the following can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinum, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (fetotoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjunctivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and laryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well as headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomiting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophageal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

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 less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):

R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

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

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:

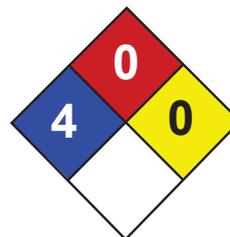
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

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Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet

Nitric acid, 65% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nitric acid, 65%

Catalog Codes: SLN2161

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Water; Nitric acid, fuming

CI#: Not applicable.

Synonym: Nitric Acid, 65%

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

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
Water	7732-18-5	35
Nitric acid, fuming	7697-37-2	65

Toxicological Data on Ingredients: Nitric acid, fuming: VAPOR (LC50): Acute: 244 ppm 0.5 hours [Rat]. 344 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to lungs, mucous membranes, upper respiratory

tract, skin, eyes, teeth. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. 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. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

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

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

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. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of combustible materials

Explosion Hazards in Presence of Various Substances:

Explosive in presence of reducing materials, of organic materials, of metals, of alkalis. Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Flammable in presence of cellulose or other combustible materials. Phosphine, hydrogen sulfide, selenide all ignite when fuming nitric acid is dripped into gas. (Nitric Acid, fuming)

Special Remarks on Explosion Hazards:

Reacts explosively with metallic powders, carbides, cyanides, sulfides, alkalies and turpentine. Can react explosively with many reducing agents. Arsine, phosphine, tetraborane all oxidized explosively in presence of nitric acid. Cesium and rubidium

acetylides explode in contact with nitric acid. Explosive reaction with Nitric Acid + Nitrobenzene + water. Detonation with Nitric Acid + 4-Methylcyclohexane. (Nitric acid, fuming)

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:

Corrosive liquid. Oxidizing material. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. 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 container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. 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. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 23°C (73.4°F).

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:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

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: 2 STEL: 4 (ppm) from ACGIH (TLV) [United States] TWA: 2 STEL: 4 from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Acrid. Disagreeable and choking. (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point: 121°C (249.8°F)

Melting Point: -41.6°C (-42.9°F)

Critical Temperature: Not available.

Specific Gravity: 1.408 (Water = 1)

Vapor Pressure: 6 kPa (@ 20°C)

Vapor Density: 2.5 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.29 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:

Easily soluble in cold water, hot water. Soluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances:

Highly reactive with alkalis. Reactive with reducing agents, combustible materials, organic materials, metals, acids.

Corrosivity:

Extremely corrosive in presence of aluminum, of copper. Non-corrosive in presence of glass, of stainless steel(304), of stainless steel(316), of brass.

Special Remarks on Reactivity:

A strong oxidizer. Reacts violently with alcohol, organic material, turpene, charcoal. Violent reaction with Nitric acid + Acetone and Sulfuric acid. Nitric Acid will react with water or steam to produce heat and toxic, corrosive and flammable vapors. (Nitric acid, fuming)

Special Remarks on Corrosivity:

In presence of traces of oxides, it attacks all base metals except aluminum and special chromium steels. It will attack some forms of plastics, rubber, and coatings. No corrosive effect on bronze. No corrosivity data for zinc, and steel

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

Contains material which may cause damage to the following organs: lungs, mucous membranes, upper respiratory tract, skin, eyes, teeth.

Other Toxic Effects on Humans:

Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals: LDL - Lowest Published Lethal Dose [Human] - Route: Oral; Dose: 430 mg/kg (Nitric acid, fuming)

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (effects on newborn and fetotoxicity) based on animal data. (Nitric acid, fuming)

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Severely irritates skin. Causes skin burns and may cause deep and penetrating ulcers of the skin with a characteristic yellow to brownish discoloration. May be fatal if absorbed through skin. Eyes: Severely irritates eyes. Causes eye burns. May cause irreversible eye injury. Ingestion: May be fatal if swallowed. Causes serious gastrointestinal tract irritation or burns with nausea, vomiting, severe abdominal pain, and possible "coffee grounds" appearance of the vomitus . May cause perforation of the digestive tract. Inhalation: May be fatal if inhaled. Vapor is extremely hazardous. Vapor may cause nitrous gas poisoning. Effects may be delayed. May cause irritation of the mucous membranes and respiratory tract with burning pain in the nose and throat, coughing, sneezing, wheezing, shortness of breath and pulmonary edema. Other symptoms may include nausea, and vomiting. Chronic Potential Health Effects: Repeated inhalation may produce changes in pulmonary function and/or chronic bronchitis. It may also affect behavior (headache, dizziness, drowsiness, muscle contraction or spasticity, weakness, loss of coordinaton, mental confusion), and urinary system (kidney faillure, decreased urinary output after several hours of

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 less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Nitric acid UNNA: 2031 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

New York release reporting list: Nitric acid, fuming Rhode Island RTK hazardous substances: Nitric acid, fuming Pennsylvania RTK: Nitric acid, fuming Florida: Nitric acid, fuming Minnesota: Nitric acid, fuming Massachusetts RTK: Nitric acid, fuming

New Jersey: Nitric acid, fuming TSCA 8(b) inventory: Water; Nitric acid, fuming SARA 302/304/311/312 extremely hazardous substances: Nitric acid, fuming SARA 313 toxic chemical notification and release reporting: Nitric acid, fuming 65% CERCLA: Hazardous substances.: Nitric acid, fuming: 1000 lbs. (453.6 kg);

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

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):

R8- Contact with combustible material may cause fire. R35- Causes severe burns. S23- Do not breathe gas/fumes/vapour/spray [***] S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S36- Wear suitable protective clothing. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

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

Health: 4

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 10:59 AM

Last Updated: 05/21/2013 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.



MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS

PRODUCT NAME: ISOBUTYLENE (1 PPM – 0.9%) IN AIR

MSDS NO: 248

Version: 3

Date: March, 2013

1. Chemical Product and Company Identification

Gasco Affiliates, LLC
320 Scarlett Blvd.
Oldsmar, FL 34677

TELEPHONE NUMBER: (800) 910-0051 24-HOUR EMERGENCY NUMBER: 1-800-424-9300
FAX NUMBER: (866) 755-8920
E-MAIL: info@gascogas.com

PRODUCT NAME: ISOBUTYLENE (1 PPM – 0.9%) IN AIR
CHEMICAL NAME: Isobutylene in air
COMMON NAMES/ SYNONYMS: None
TDG (Canada) CLASSIFICATION: 2.2
WHIMIS CLASSIFICATION: A

2. COMPOSITION/ INFORMATION ON INGREDIENTS

Table with 5 columns: INGREDIENT, %VOLUME, PEL-OSHA, TLV-ACGIH, LD50 or LC50 Route/Species. Rows include Isobutylene and Air.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Release of this product may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly ventilated environments); individuals in such atmospheres may be asphyxiated. Isobutylene may cause drowsiness and other central nervous system effects in high concentrations; however, due to the low concentration of this gas mixture, this is unlikely to occur.

ROUTE OF ENTRY:

Table with 5 columns: Skin Contact, Skin Absorption, Eye Contact, Inhalation, Ingestion. Values: No, No, No, Yes, No.

HEALTH EFFECTS:

Table with 5 columns: Exposure Limits, Irritant, Sensitization, Reproductive Hazard, Mutagen. Values: Yes, No, No, No, No.

Carcinogenicity: --NTP: No IARC: No OSHA: No

EYE EFFECTS:

N/A.

SKIN EFFECTS:

N/A.



MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS

PRODUCT NAME: ISOBUTYLENE (1 PPM – 0.9%) IN AIR

INGESTION EFFECTS:

Ingestion unlikely. Gas at room temperature.

INHALATION EFFECTS:

Due to the small size of this cylinder, no unusual health effects from over-exposure are anticipated under normal routine use.

NFPA HAZARD CODES

Health: 1
Flammability: 0
Reactivity: 0

HMIS HAZARD CODES

Health: 1
Flammability: 0
Reactivity: 0

RATING SYSTEM

0= No Hazard
1= Slight Hazard
2= Moderate Hazard
3= Serious Hazard
4= Severe Hazard

4. FIRST AID MEASURES

EYES:

N/A

SKIN:

N/A

INGESTION:

Not required

INHALATION:

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH THE SELF-CONTAINED BREATHING APPARATUS. Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. If breathing has stopped administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

5. FIRE-FIGHTING MEASURES

These containers hold gas under pressure, with no liquid phase. If involved in a major fire, they should be sprayed with water to avoid pressure increases, otherwise pressures will rise and ultimately they may distort or burst to release the contents. The gases will not add significantly to the fire, but containers or fragments may be projected considerable distances - thereby hampering fire fighting efforts.

6. ACCIDENTAL RELEASE MEASURES

In terms of weight, these containers hold very little contents, such that any accidental release by puncturing etc. will be of no practical concern.

7. HANDLING AND STORAGE

Suck back of water into the container must be prevented. Do not allow backfeed into the container. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Use only in well-ventilated areas. Do not heat cylinder by any means to increase rate of product from the cylinder. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Use adequate ventilation for extended use of gas.



MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS

PRODUCT NAME: ISOBUTYLENE (1 PPM – 0.9%) IN AIR

9. PHYSICAL AND CHEMICAL PROPERTIES

PARAMETER:	VALUE:
Physical state	: Gas
Evaporation point	: N/A
pH	: N/A
Odor and appearance	: Colorless, odorless gas

10. STABILITY AND REACTIVITY

Stable under normal conditions. Expected shelf life 48 months.

11. TOXICOLOGICAL INFORMATION

No toxicological damage caused by this product.

12. ECOLOGICAL INFORMATION

No ecological damage caused by this product.

13. DISPOSAL INFORMATION

Do not discharge into any place where its accumulation could be dangerous. Used containers are acceptable for disposal in the normal waste stream as long as the cylinder is empty and valve removed or cylinder wall is punctured; but GASCO encourages the consumer to return cylinders.

14. TRANSPORT INFORMATION

	<u>United States DOT</u>	<u>Canada TDG</u>
PROPER SHIPPING NAME:	Compressed Gas N.O.S. (Isobutylene in Air)	Compressed Gas N.O.S. (Isobutylene in Air)
HAZARD CLASS:	2.2	2.2
IDENTIFICATION NUMBER:	UN1956	UN1956
SHIPPING LABEL:	NONFLAMMABLE GAS	NONFLAMMABLE GAS

15. REGULATORY INFORMATION

Isobutylene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

16. OTHER INFORMATION

This MSDS has been prepared in accordance with the Chemicals (Hazard Information and Packaging for Supply (Amendment) Regulation 1996. The information is based on the best knowledge of GASCO, and its advisors and is given in good faith, but we cannot guarantee its accuracy, reliability or completeness and therefore disclaim any liability for loss or damage arising out of use of this data. Since conditions of use are outside the control of the Company and its advisors we disclaim any liability for loss or damage when the product is used for other purposes than it is intended.

MSDS/S010/248/ March, 2013

APPENDIX B

Pilot Test Design Calculations

Air Sparge System Design

Flowrate of Vertical Air Sparge Wells

Number of wells = 1
 AS flow rate (cfm per well) = 10
 System Flow Rate = 10 cfm

cfm = cubic feet per minute

Sizing of Air Sparge Piping

$Q_{\text{individual well}} = 10 \text{ cfm} = 0.2 \text{ cfs}$

*Q = flowrate (units as shown)
cfm = cubic feet per minute
cfs = cubic feet per second*

(Pipe size is based on an industry recommended air velocity of 75 ft/s)

$D_{\text{main}} = (4 \times ((Q \text{ (cfs)} / 75 \text{ (ft/s)}) / \pi))^{1/2} = 0.05 \text{ ft} = 0.6 \text{ in (round up)}$

Therefore, at least a 1 in dia pipe will be used
(A 2-inch pipe will be used to minimize friction losses)

Water Column Losses

Depth of Well = 65 ft bgs
 Depth of Water Table = 32 ft bgs

*ft bgs = feet below ground surface
psi = pounds per square inch
P = pressure*

Ht. of Water Column = 38.00 ft. (assumes water level may rise up to 5')

$P_{\text{breakthrough}} = 16.47 \text{ psi}$

200% $P_{\text{breakthrough}} = 32.95 \text{ psi}$

Pressure Losses for 1 Inch Well Line

Well = AS-1
 Q (scfm) = 10
 L (ft) = 20
 K_{90} (#) = 3
 L_{eq} (ft) = 2.62
 K_{tee} (#) = 0
 L_{eq} (ft) = 5.2
 $K_{\text{ball valve}}$ (#) = 0
 L_{eq} (ft) = 30
 f (psi / 100' pipe)* = 0.2
 FOS = 2
 Assumed f (psi / 100' pipe) = 0.4
 F₁ (psi) = 0.1
 F₁ (" H₂O) = 3.08

*Q = flowrate (units as shown)
scfm = standard cubic feet per minute
L = length (units as shown)
 K_{90} = 90-degree pipe fitting
 K_{tee} = Tee pipe fitting
 $K_{\text{ball valve}}$ = Ball valve pipe fitting
 L_{eq} = equivalent length of straight pipe
F = friction factor (units as shown)
F₁ = total friction (units as shown)
" H₂O = inches of water
" Hg = inches of mercury (Note: 1" H₂O = 0.0735" Hg)*

F_{1 Total} (psi) = 0.11
 F_{1 Total} (" H₂O) = 3.08

*friction factor for 1" schedule 40 steel pipe at 10 cfm

AS System Losses

$$F_{1 \text{ Total}} = 0.11 \text{ psi}$$

$$200\% P_{\text{breakthrough}} = 32.95 \text{ psi}$$

$$\text{Compressor/Manifold Losses} = 1 \text{ psi}$$

$$\text{Miscellaneous Losses} = 2 \text{ psi}$$

(Misc. Losses include guages, valves, mineral deposits, and filters)

$$F_{\text{system}} = (F_{1 \text{ Total}} + P_{\text{breakthrough}} + \text{Misc. Losses} + \text{Compressor/Manifold Losses})$$

$$F_{\text{system}} = 36.06 \text{ psi}$$

$$= 73.42 \text{ " Hg}$$

Alternate Calculation Method

$$P_{\text{required}} = P_{\text{hydrostatic}} + P_{\text{friction}} + P_{\text{formation}}$$

$$P_{\text{hydrostatic}} = \rho gh$$

$$\rho = 62.4 \text{ lb/ft}^3$$

$$g = 32.2 \text{ ft/sec}^2$$

$$h = 38.00 \text{ ft}$$

$$\text{conversion} = 1 \text{ lb} / 32.2 \text{ lb-ft} / \text{sec}^2$$

$$P_{\text{hydrostatic}} = 2371.2 \text{ lb/ft}^2 = 16.47 \text{ psi}$$

$$P_{\text{formation}} = 2\sigma/r$$

$$\sigma = 73.49 \text{ dynes/cm}$$

$$r = 0.001 \text{ cm for silt}$$

$$P_{\text{formation}} = 146980 \text{ dynes/cm} = 2.1 \text{ psi}$$

$$P_{\text{friction}} = \text{Estimate at } 3.11 \text{ psi}$$

$$P_{\text{required}} = 21.68 \text{ psi}$$

$$\text{FOS (2x } P_{\text{hydrostatic}}) = 38.16 \text{ psi}$$

Notes:

A pressure of **24 psi** will be assumed. The above model uses a factor of safety of 2 for pipe losses. In addition, the breakthrough pressure was scaled to allow the water table to rise up to 5 feet from the most recent measurements. 200% of the breakthrough pressure will be supplied to ensure proper flow and influence radius.

Soil Vapor Extraction System Design

Flowrate of Vertical SVE Wells

Number of wells	1		cfm (cubic feet per minute)
AS flow rate (cfm per well)	10		
SVE flow rate	=	40	cfm / well (target 4x SVE:AS ratio for effective capture)
System Flow Rate	=	40	cfm

Sizing of Vapor Extraction Piping

Q = flowrate (units as shown)
cfm (cubic feet per minute)
cfs (cubic feet per second)

$Q_{\text{individual well}} = 40 \text{ cfm} = 0.7 \text{ cfs}$

(Pipe size is based on an industry recommended air velocity of 75 ft/s)

$D_{\text{main}} = (4 \times ((Q \text{ (scfs)} / 75 \text{ (ft/s)}) / \text{Pi}))^{1/2} = 0.11 \text{ ft} = 1.3 \text{ in (round up)}$

Therefore, at least a 1.5 in dia pipe to be used
(A 4-inch pipe will be used for safety and to minimize losses. Selecting a larger pipe size allows for an increase in system flow if desired)

Pressure Losses for 1.5 Inch Main Lines

Q = flowrate (units as shown)
scfm = standard cubic feet per minute
L = length (units as shown)
 K_{90} = 90-degree pipe fitting
 L_{eq} = equivalent length of straight pipe
F = friction factor (units as shown)
 F_1 = total friction (units as shown)
" H₂O = inches of water
" Hg = inches of mercury (Note: 1" H₂O = 0.0735" Hg)

Well		SVE-1	
Q (scfm)	=	40	
L (ft)	=	25	
K_{90} (#)	=	3	
L_{eq} (ft)	=	4.02	
f (psi / 100' pipe)*	=	0.38	
FOS	=	2	
Assumed f (psi / 100' pipe)	=	0.76	
F_1 (psi)	=	0.28	
F_1 (" Hg)	=	0.57	
$F_{1 \text{ Total}}$ (psi)	=	0.28	
$F_{1 \text{ Total}}$ (" Hg)	=	0.57	

*friction factor for 1.5" schedule 40 steel pipe at 40 cfm

SVE System Losses

$F_{1 \text{ Total}}$	=	0.28	psi
System Vacuum	=	1.45	psi (40" of H ₂ O)
Misc. System Losses	=	1.25	psi

(Misc. System Losses includes losses due to filters, blowers, moisture separator, vavles, guages, and flow meters)

$F_{\text{system}} = (F_{\text{total}} + \text{System Vacuum} + \text{Filter/Blower Losses})$

F_{system}	=	2.98	psi
	=	82.39	" H ₂ O
	=	6.06	" Hg

A minimum vacuum of 85" H₂O will be assumed. The above model uses a factor of safety of 2 for pipe friction losses

System Design Notes

cfm (cubic feet per minute)

cfs (cubic feet per second)

Q = flowrate (units as shown)

D = pipe diameter (units as shown)

F = friction factor (units as shown)

F₁ = total friction (units as shown)

L = length (units as shown)

L₁ = for wells, length of piping from subheader to well location; for headers, entire length of common flow piping

L₂ = vertical extent of well

L_{eq} = equivalent length of straight pipe

P=Pressure

psi = pounds per square inch

" H₂ O = inches of water

" Hg = inches of mercury (Note: 1" H₂ O = 0.0735" Hg)

K₉₀ = 90-degree pipe fitting

K_{tee} = Tee pipe fitting

K_{ball valve} = Ball valve pipe fitting

Misc Sys Losses include filters, mineral deposits, etc.

As a factor of safety, the calculations assume the full combined flow rate along the entire length of the header. Actual will be less flow = less header friction.

Friction values are based on steel pipe, which has a stated higher friction than PVC, based on product literature

APPENDIX C

Notification of Intent to Construct or Operate Injection Wells

NOTIFICATION OF INTENT TO CONSTRUCT OR OPERATE INJECTION WELLS

*The following are “permitted by rule” and do not require an individual permit when constructed in accordance with the rules of 15A NCAC 02C .0200. **This form shall be submitted at least 2 weeks prior to injection.***

AQUIFER TEST WELLS (15A NCAC 02C .0220)

These wells are used to inject uncontaminated fluid into an aquifer to determine aquifer hydraulic characteristics.

IN SITU REMEDIATION (15A NCAC 02C .0225) or TRACER WELLS (15A NCAC 02C .0229):

- 1) Passive Injection Systems - In-well delivery systems to diffuse injectants into the subsurface. Examples include ORC socks, iSOC systems, and other gas infusion methods.
- 2) Small-Scale Injection Operations – Injection wells located within a land surface area not to exceed 10,000 square feet for the purpose of soil or groundwater remediation or tracer tests. **An individual permit shall be required for test or treatment areas exceeding 10,000 square feet.**
- 3) Pilot Tests - Preliminary studies conducted for the purpose of evaluating the technical feasibility of a remediation strategy in order to develop a full scale remediation plan for future implementation, and where the surface area of the injection zone wells are located within an area that does not exceed five percent of the land surface above the known extent of groundwater contamination. **An individual permit shall be required to conduct more than one pilot test on any separate groundwater contaminant plume.**
- 4) Air Injection Wells - Used to inject ambient air to enhance in-situ treatment of soil or groundwater.

Print Clearly or Type Information. Illegible Submittals Will Be Returned As Incomplete.

DATE: October 20 , 2014 PERMIT NO. _____ (to be filled in by DWR)

A. WELL TYPE TO BE CONSTRUCTED OR OPERATED

- (1) _____ Air Injection Well.....Complete sections B-F, K, N
- (2) _____ Aquifer Test Well.....Complete sections B-F, K, N
- (3) _____ Passive Injection System.....Complete sections B-F, H-N
- (4) _____ Small-Scale Injection Operation.....Complete sections B-N
- (5) X Pilot Test.....Complete sections B-N
- (6) _____ Tracer Injection Well.....Complete sections B-N

B. STATUS OF WELL OWNER: Choose an item.

C. WELL OWNER – State name of entity and name of person delegated authority to sign on behalf of the business or agency:

Name: Jimmy McCandies, Engineered Controls International, LLC

Mailing Address: PO Box 247

City: Felon State: NC Zip Code: 27244 County: Alamance

Day Tele No.: 336.380.5645 Cell No.: _____

EMAIL Address: JMcCandi@regoproducts.com Fax No.: _____

D. PROPERTY OWNER (if different than well owner)

Name: Same as above

Mailing Address: _____

City: _____ State: _____ Zip Code: _____ County: _____

Day Tele No.: _____ Cell No.: _____

EMAIL Address: _____ Fax No.: _____

E. PROJECT CONTACT - Person who can answer technical questions about the proposed injection project.

Name: Ed Hollifield, ERM NC, Inc.

Mailing Address: 15720 Brixham Hill Ave. Suite 120

City: Charlotte State: NC Zip Code: 28277 County: Mecklenburg

Day Tele No.: 704.541.8345 Cell No.: 704.301.2262

EMAIL Address: ed.hollifield@erm.com Fax No.: 704.624.7928

F. PHYSICAL LOCATION OF WELL SITE

(1) Physical Address: 100 Rego Drive

_____ County: Alamance

City: Elon State: NC Zip Code: 27244

(2) Geographic Coordinates: Latitude**: 36 ° 6 ' 5.48" or _____ °

Longitude**: 79 ° 31 ' 1.66" or _____ °

Reference Datum: _____ Accuracy: _____

Method of Collection: Google Earth

**FOR AIR INJECTION AND AQUIFER TEST WELLS ONLY: A FACILITY SITE MAP WITH PROPERTY BOUNDARIES MAY BE SUBMITTED IN LIEU OF GEOGRAPHIC COORDINATES.

G. TREATMENT AREA

Land surface area of contaminant plume: 94,000 square feet

Land surface area of inj. well network: 400 square feet ($\leq 10,000 \text{ ft}^2$ for small-scale injections)

Percent of contaminant plume area to be treated: <1% (must be $\leq 5\%$ of plume for pilot test injections)

H. INJECTION ZONE MAPS – Attach the following to the notification.

(1) Contaminant plume map(s) with isoconcentration lines that show the horizontal extent of the contaminant plume in soil and groundwater, existing and proposed monitoring wells, and existing and proposed injection wells; and

(2) Cross-section(s) to the known or projected depth of contamination that show the horizontal and vertical extent of the contaminant plume in soil and groundwater, changes in lithology, existing and proposed monitoring wells, and existing and proposed injection wells.

I. DESCRIPTION OF PROPOSED INJECTION ACTIVITIES – Provide a brief narrative regarding the purpose, scope, and goals of the proposed injection activity.

A pilot test will be completed to evaluate the viability and effectiveness of AS/SVE technology for source area soil and groundwater remediation and estimate design parameters for a full-scale remediation system. One AS well and one SVE well will be installed adjacent to each other within the source area. Two AS/SVE observation points will also be installed in the pilot test areas to evaluate the AS and SVE radius of influence (ROI) and the effects of subsurface lithologic anisotropy and heterogeneity.

J. INJECTANTS – Provide a MSDS and the following for each injectant. Attach additional sheets if necessary.

NOTE: Approved injectants (tracers and remediation additives) can be found online at <http://portal.ncdenr.org/web/wg/aps/gwpro>. All other substances must be reviewed by the Division of Public Health, Department of Health and Human Services. Contact the UIC Program for more info (919-807-6496).

Injectant: Air (air sparge pilot testing)

Volume of injectant: Approximately 10 cfm at a pressure of 25 psi

Concentration at point of injection: 100%

Percent if in a mixture with other injectants: _____

Injectant: _____

Volume of injectant: _____

Concentration at point of injection: _____

Percent if in a mixture with other injectants: _____

Injectant: _____

Volume of injectant: _____

Concentration at point of injection: _____

Percent if in a mixture with other injectants: _____

K. WELL CONSTRUCTION DATA

(1) Number of injection wells: 1 Proposed _____ Existing _____

(2) Provide well construction details for each injection well in a diagram or table format. A single diagram or line in a table can be used for multiple wells with the same construction details. Well construction details shall include the following:

(a) well type as permanent, direct-push, or subsurface distribution system (infiltration gallery)

(b) depth below land surface of grout, screen, and casing intervals

(c) well contractor name and certification number

Well Installation summary

Well Type	Well Diameter	Well Material	Well Depth Ft bls	Anticipated Screen Interval	Number of Wells
Air Sparge Well	2-inch	PVC	60	60 to 55 ft bgs / KVA required	1
SVE Well	4-inch	PVC	30	10 to 30 ft bgs standard 0.010 slot	1
Nested Observation wells	1-inch	PVC	60	55 -60 standard	2
	1-inch	PVC	30	10 -30 standard	

L. **SCHEDULES** – Briefly describe the schedule for well construction and injection activities.

Well construction will likely commence the week of November 24, 2014.
Pilot testing will be conducted prior to December 31, 2014.

M. **MONITORING PLAN** – Describe below or in separate attachment a monitoring plan to be used to determine if violations of groundwater quality standards specified in [Subchapter 02L](#) result from the injection activity.

Baseline groundwater samples will be collected from 3 monitor wells prior to pilot testing and analyzed for VOCs by EPA 8260B. Additional groundwater samples will be collected from the same three locations following the pilot test.

N. **SIGNATURE OF APPLICANT AND PROPERTY OWNER**

APPLICANT: “I hereby certify, under penalty of law, that I am familiar with the information submitted in this document and all attachments thereto and that, based on my inquiry of those individuals immediately responsible for obtaining said information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties, including the possibility of fines and imprisonment, for submitting false information. I agree to construct, operate, maintain, repair, and if applicable, abandon the injection well and all related appurtenances in accordance with the [15A NCAC 02C 0200](#) Rules.”

Signature of Applicant

Print or Type Full Name

PROPERTY OWNER (if the property is not owned by the permit applicant):

“As owner of the property on which the injection well(s) are to be constructed and operated, I hereby consent to allow the applicant to construct each injection well as outlined in this application and agree that it shall be the responsibility of the applicant to ensure that the injection well(s) conform to the Well Construction Standards ([15A NCAC 02C .0200](#)).”

“Owner” means any person who holds the fee or other property rights in the well being constructed. A well is real property and its construction on land shall be deemed to vest ownership in the land owner, in the absence of contrary agreement in writing.

Signature* of Property Owner (if different from applicant)

Print or Type Full Name

* An access agreement between the applicant and property owner may be submitted in lieu of a signature on this form.

Submit one copy of the completed notification package to:

DWR – UIC Program
1636 Mail Service Center
Raleigh, NC 27699-1636
Telephone: (919) 807-6464

APPENDIX D

Example Field Activities Forms

SVE/AS PILOT TEST PROCEDURE

PILOT TEST PROCEDURES

Prior to test: Gauge all test and observation wells
Measure D.O. in all test/observation wells
Measure vacuum/pressure in all test/observation wells
Measure well vapor and O2 in all test/observation wells

DAY 1

SVE test: Approx. 4 hour test
Start at 3 inches Hg (40" H2O)
Collect data at: 5, 10, 15, 30, 60, 90 minutes
Re-set vacuum to 5 inches Hg after data equilibrates (68" H2O)
Collect data at: 5, 10, 15, 30, 60, 90 minutes
Collect tedlar bag air sample for lab analysis
Re-set vacuum to maximum vacuum (e.g. 7-10 inches Hg [95-135" H2O) after data equilibrates
Collect data at: 5, 10, 15, 30, 60, 90 minutes

AS test: Approx. 3 hour test
Start at 25 psi. Goal is to achieve approx flow of at least 4cfm (determined in field)
If no air flow, increase pressure in 5 psi increments until air flow is achieved
Once air flow is achieved, maintain pressure
Collect data at: 5, 10, 15, 30, 60, 90 minutes
Visually check for air bubbling in observation wells
Increase pressure to achieve flow of 7-10cfm, depending on pressure encountered
Collect data at: 5, 10, 15, 30, 60, 90 minutes
Visually check for air bubbling in observation wells
Toward end of test lower pressure until no air flow occurs and record pressure

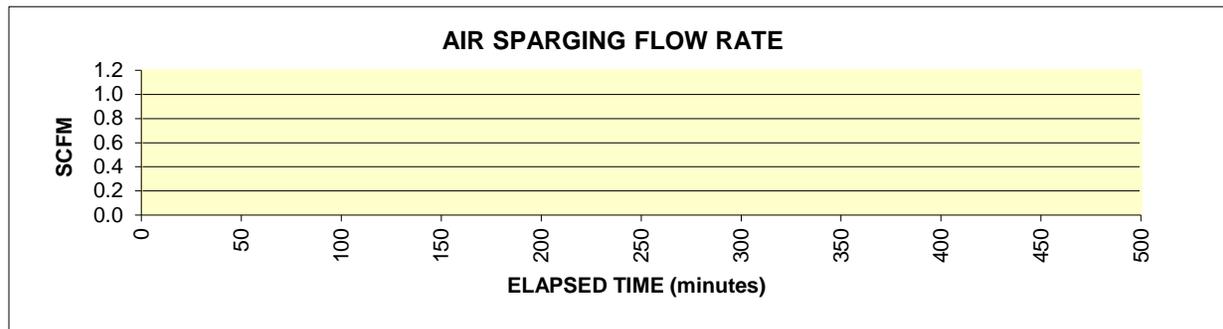
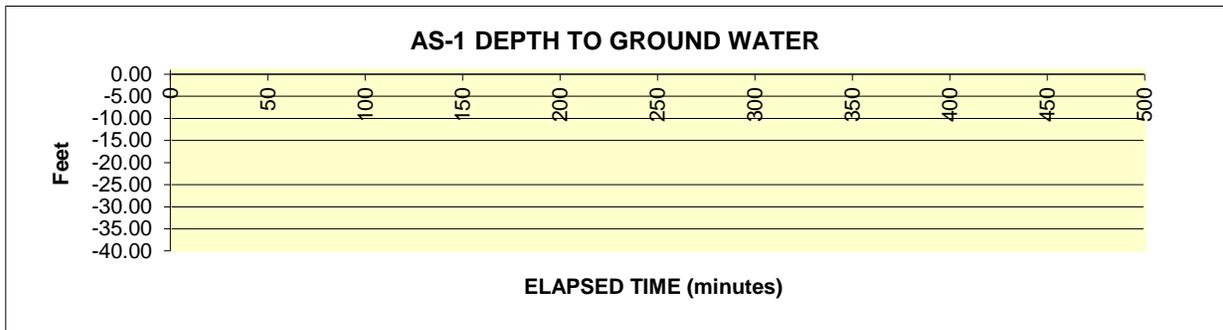
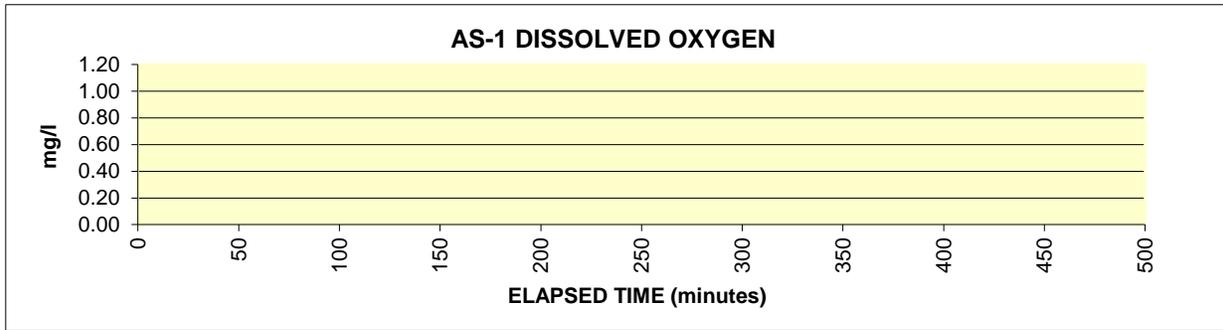
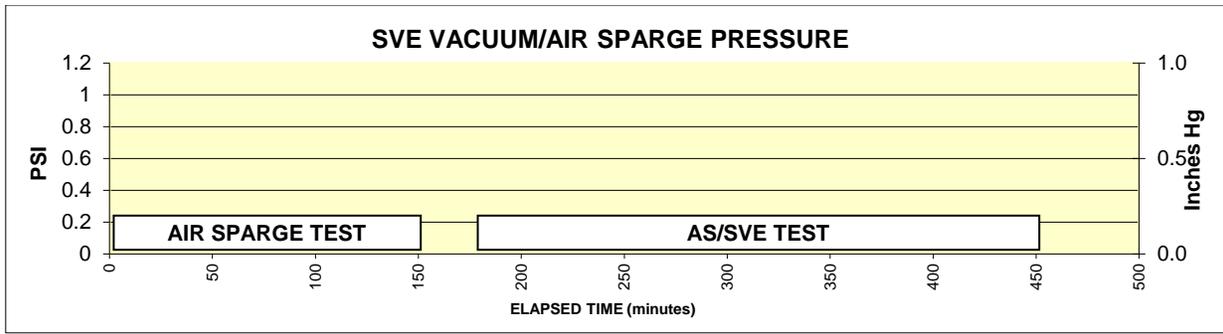
DAY 2

SVE/AS test: Approx. 4 hour test
Activate SVE system - set for lower vacuum utilized on Day 1 (e.g. 3-4" Hg;
activate AS system - set for lower pressure from Day 1 (e.g. 25 psi)
Collect data at: 5, 10, 15, 30, 60, 90 minutes
Collect tedlar bag air sample for lab analysis
Turn SVE up to 7-10 inches Hg (higher vacuum from Day 1)
Collect data at: 5, 10, 15, 30, 60, 90 minutes
Collect tedlar bag air sample for lab analysis
Increase AS to higher flow achieved during Day 1.
Collect data at: 5, 10, 15,30, 60, 90 minutes
Collect tedlar bag air sample for lab analysis

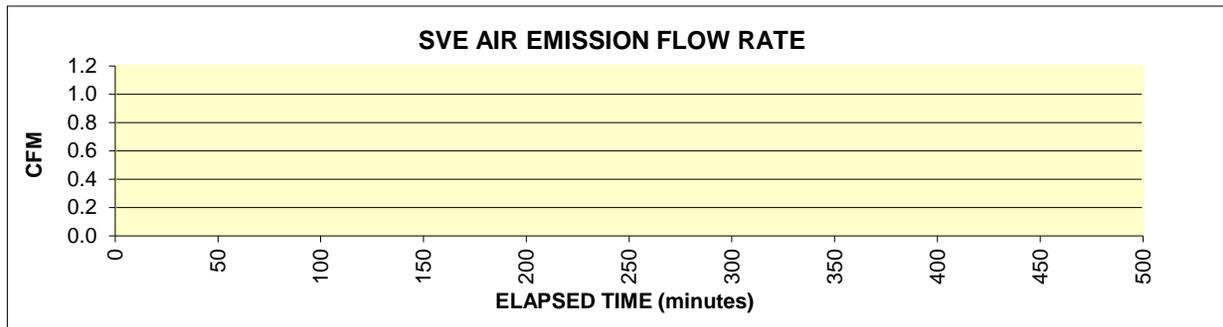
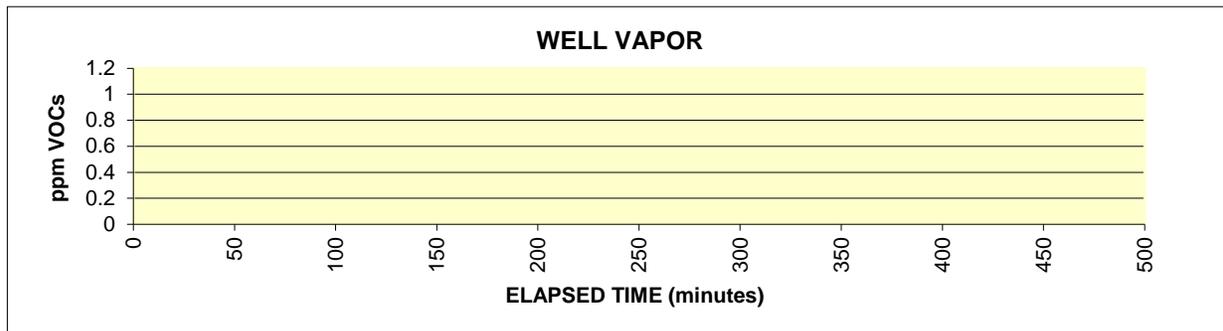
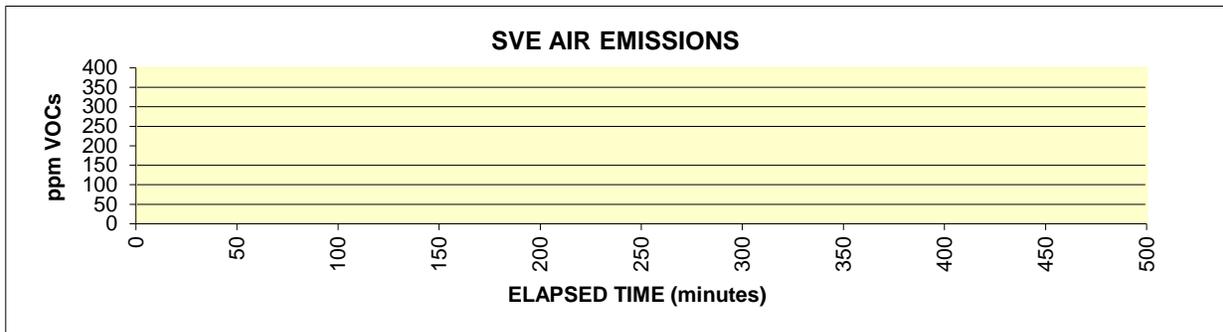
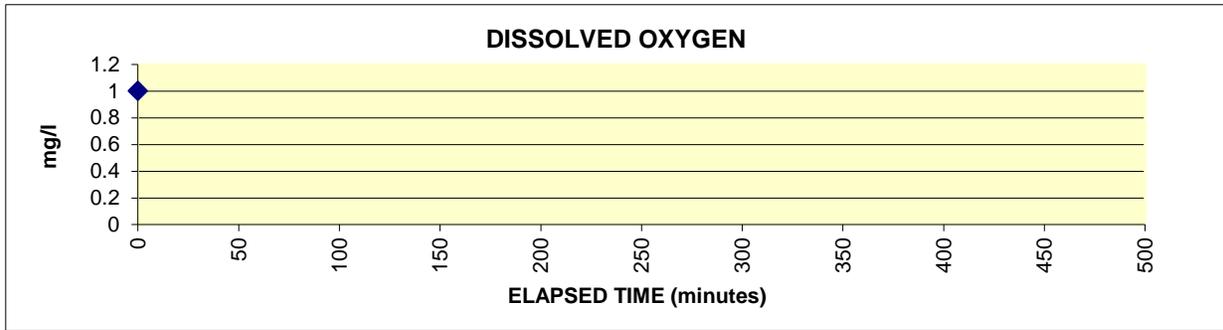
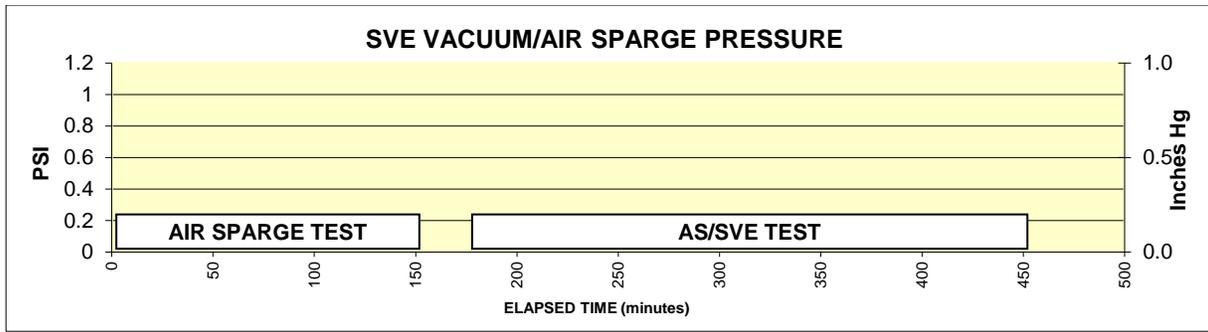
Post-test: Shutdown SVE and AS
Collect final round of data - Get WL data from SVE & AS wells first

To do during test: Measure distances between each test/monitor well and record
Make a scaled map of the pilot test well layout

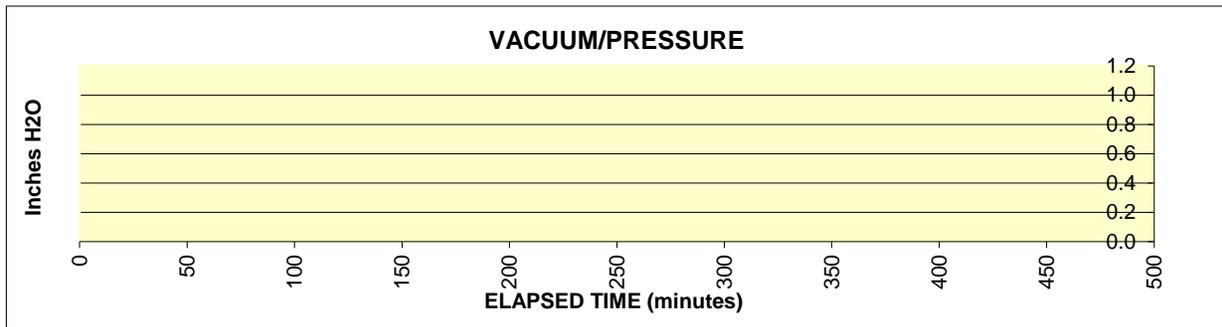
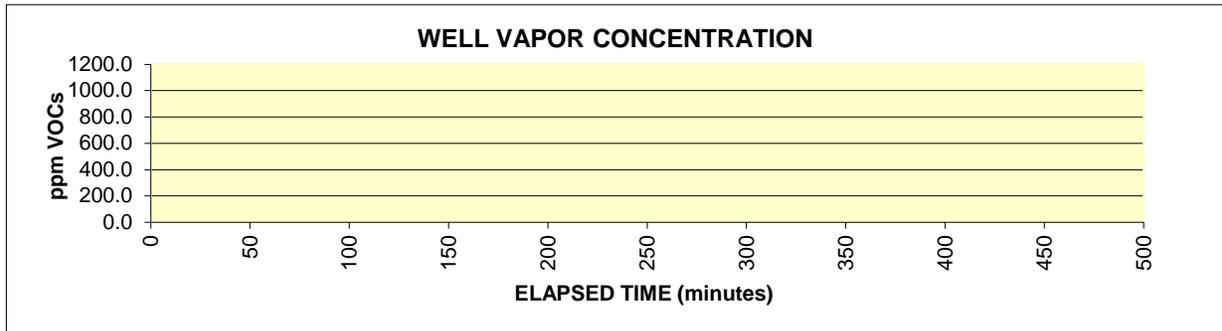
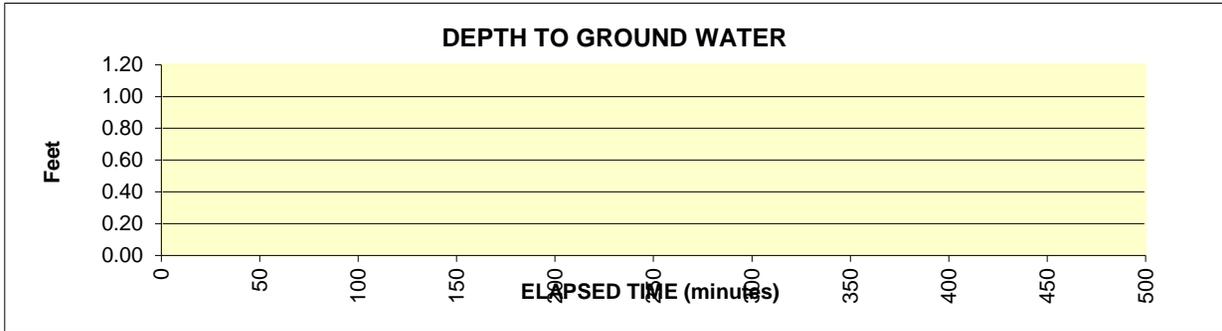
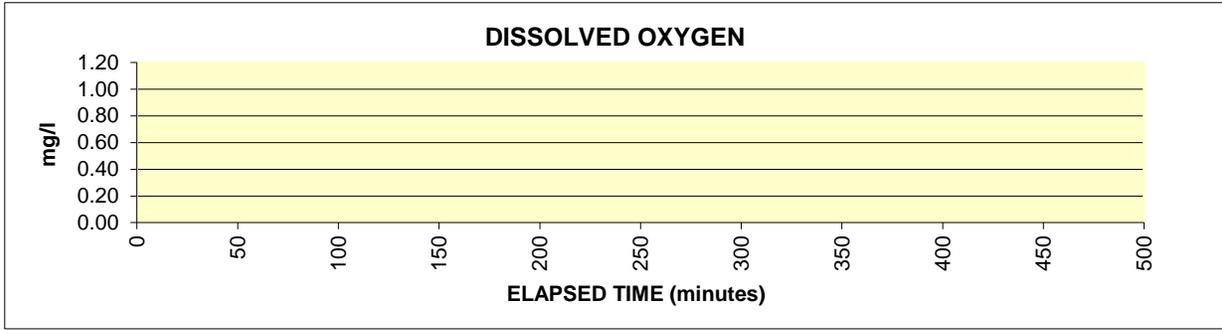
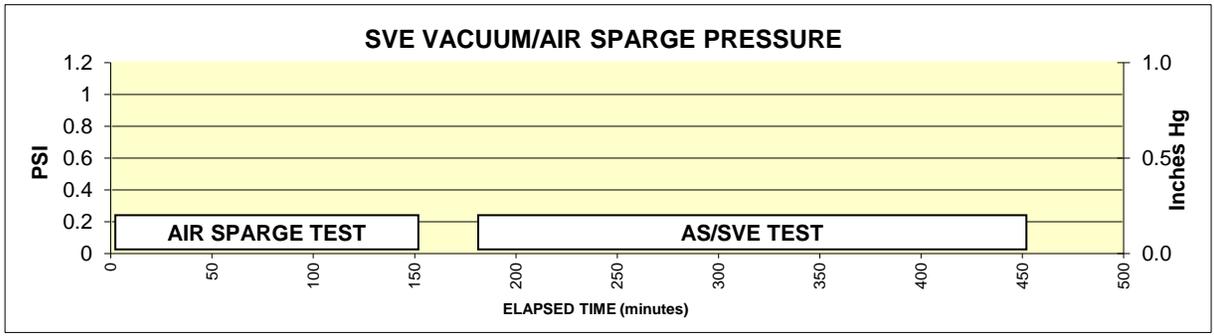
AS-1



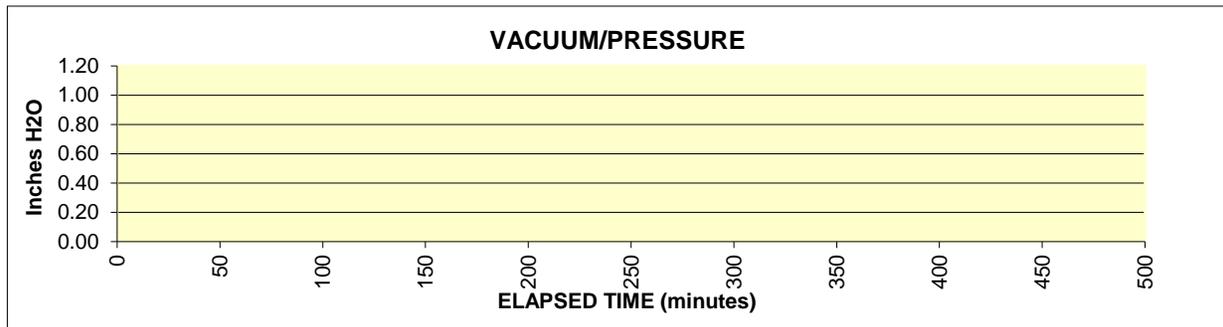
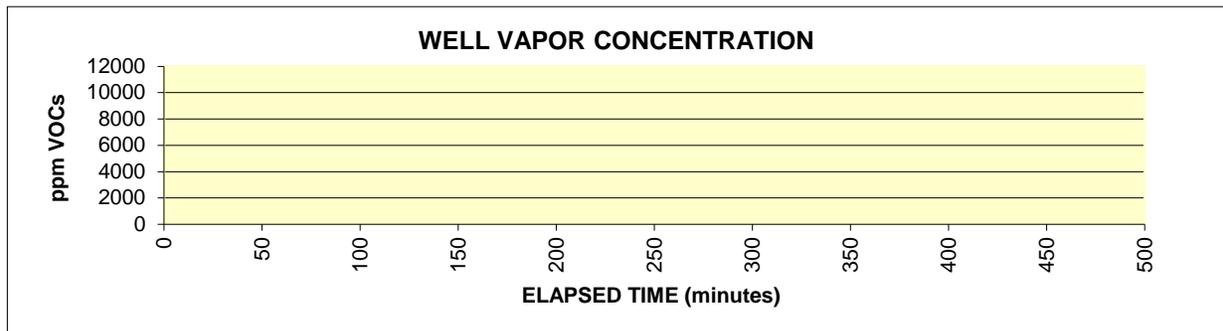
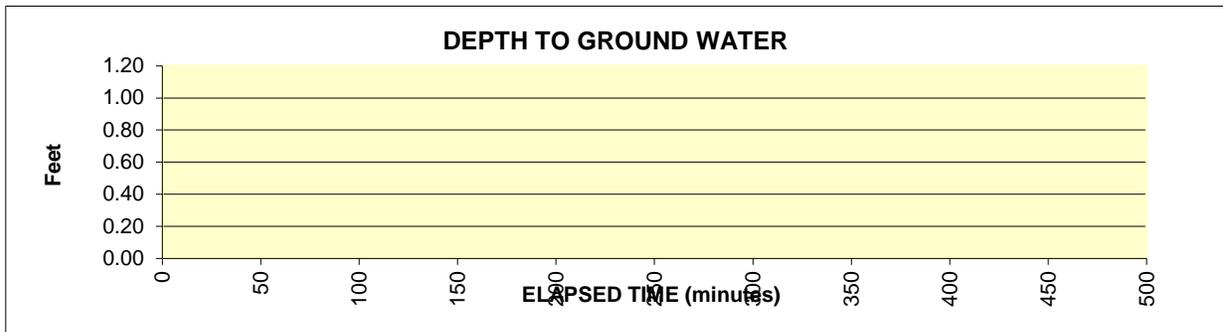
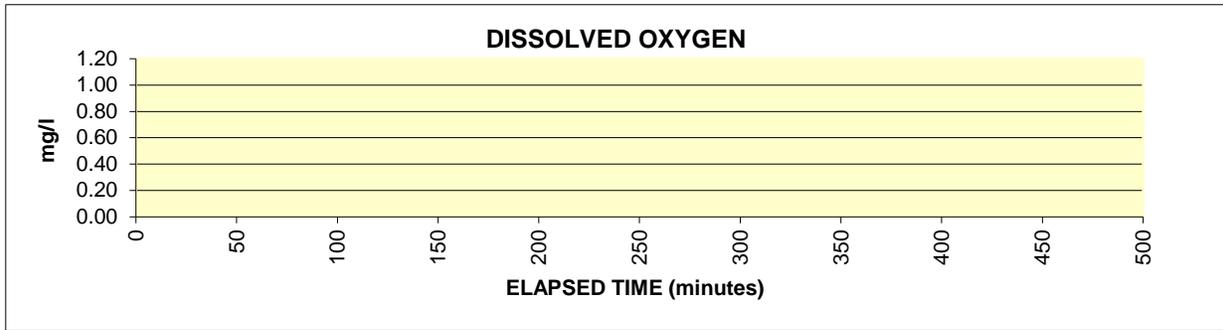
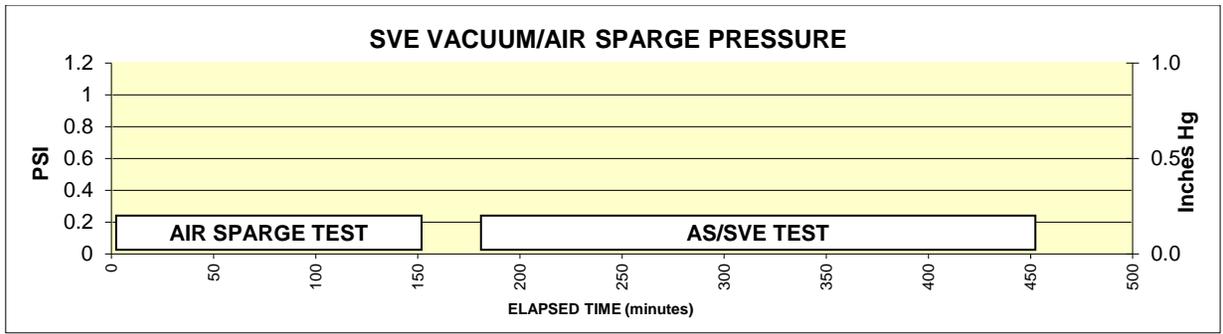
SVE SYSTEM



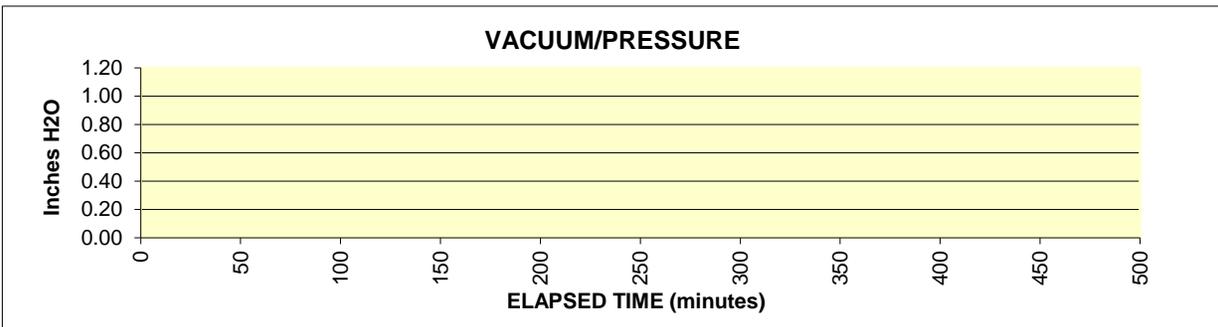
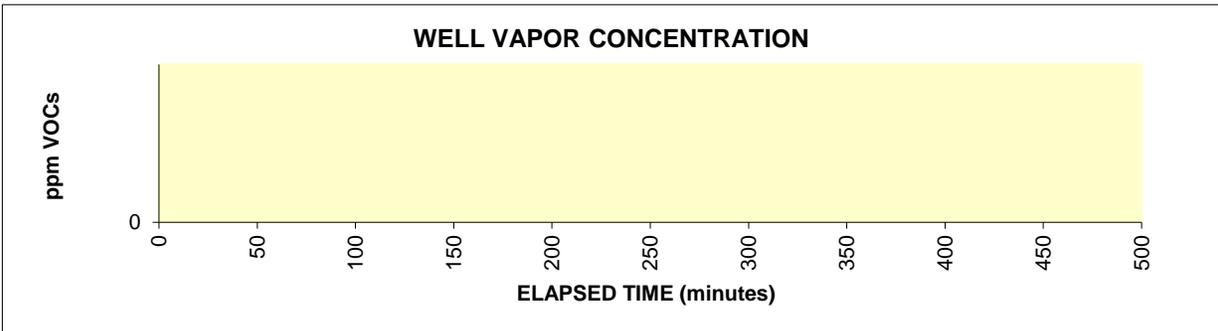
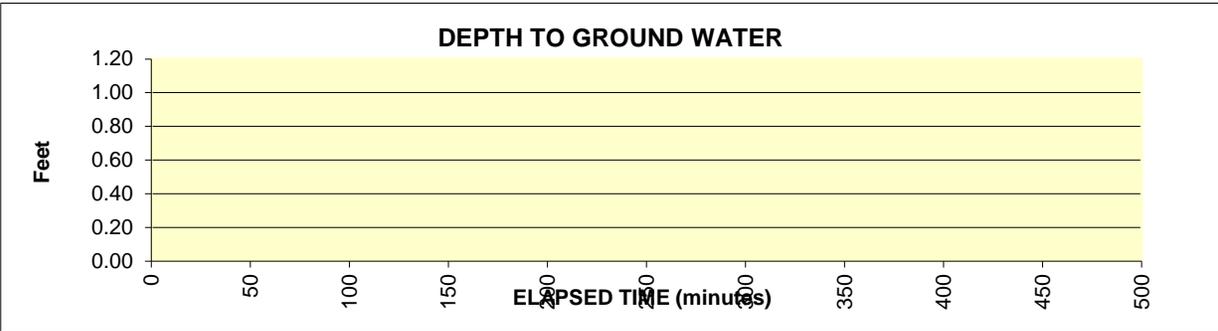
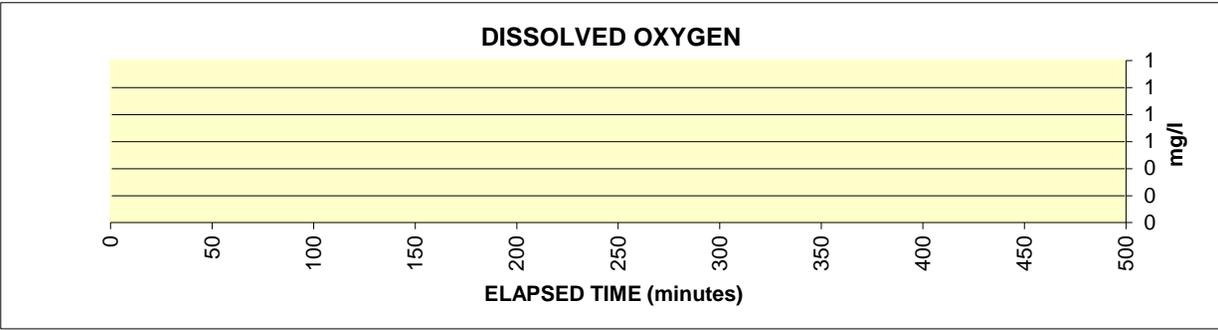
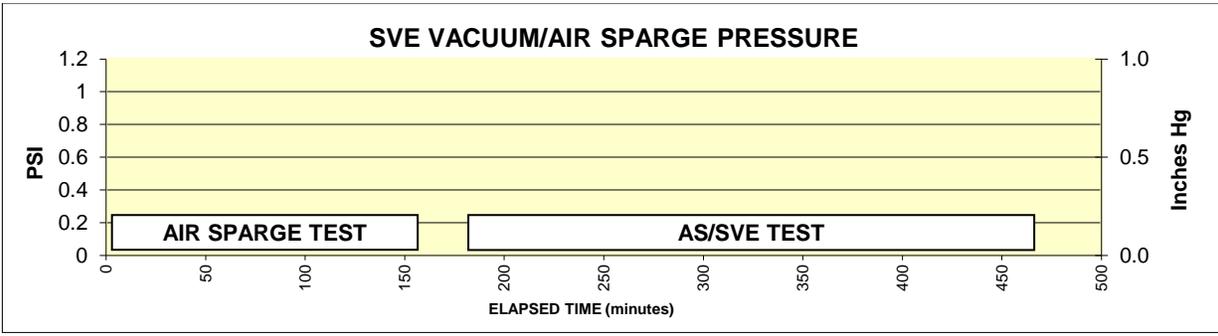
OB-1A



OB-1B



OB-2A



OB-2B

