

Vapor Intrusion (VI) Investigation Using the TAGA Mobile Laboratories

CLU-IN Webinar
29 August 2018



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US EPA/ERT



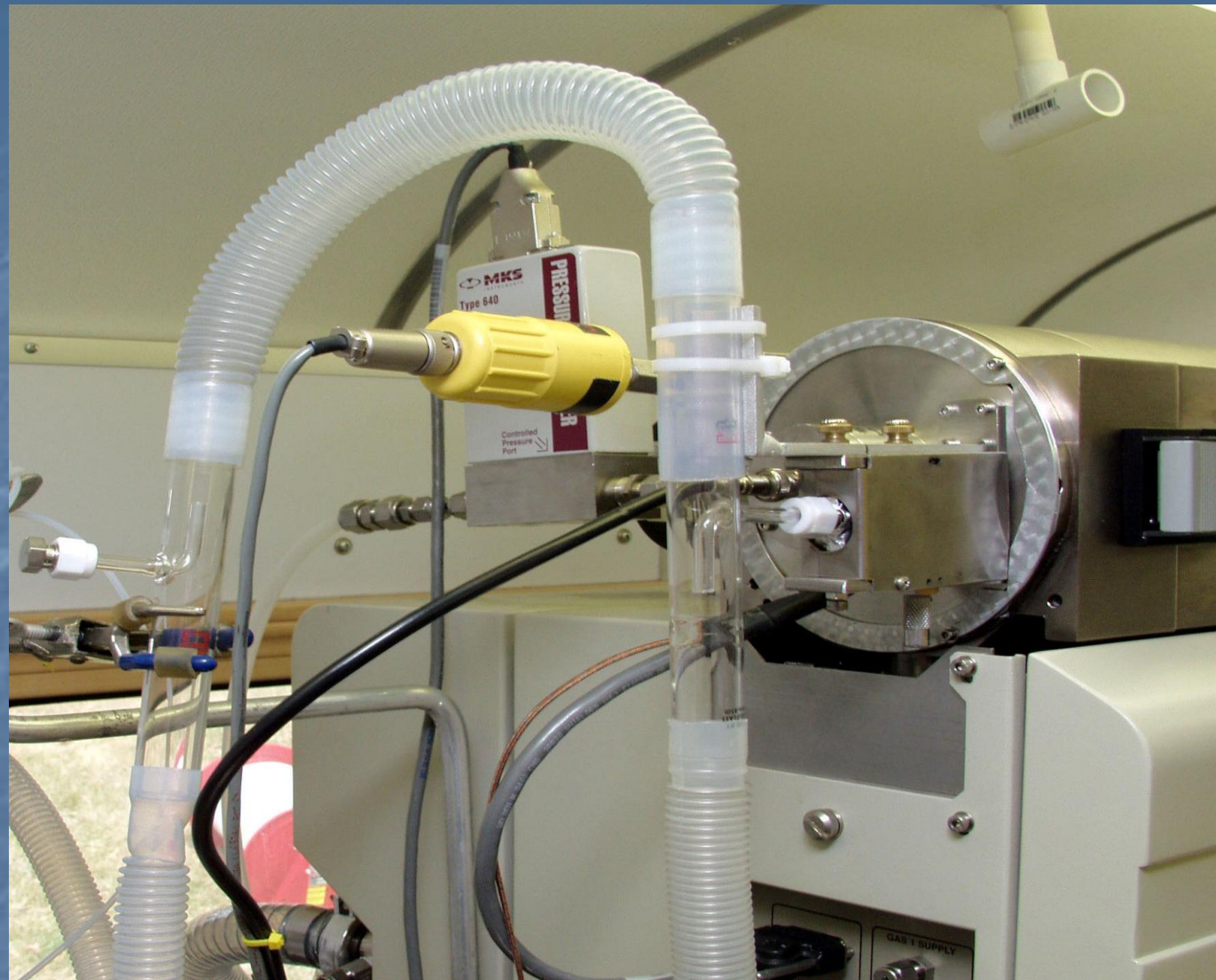
TAGA MOBILE LABORATORY



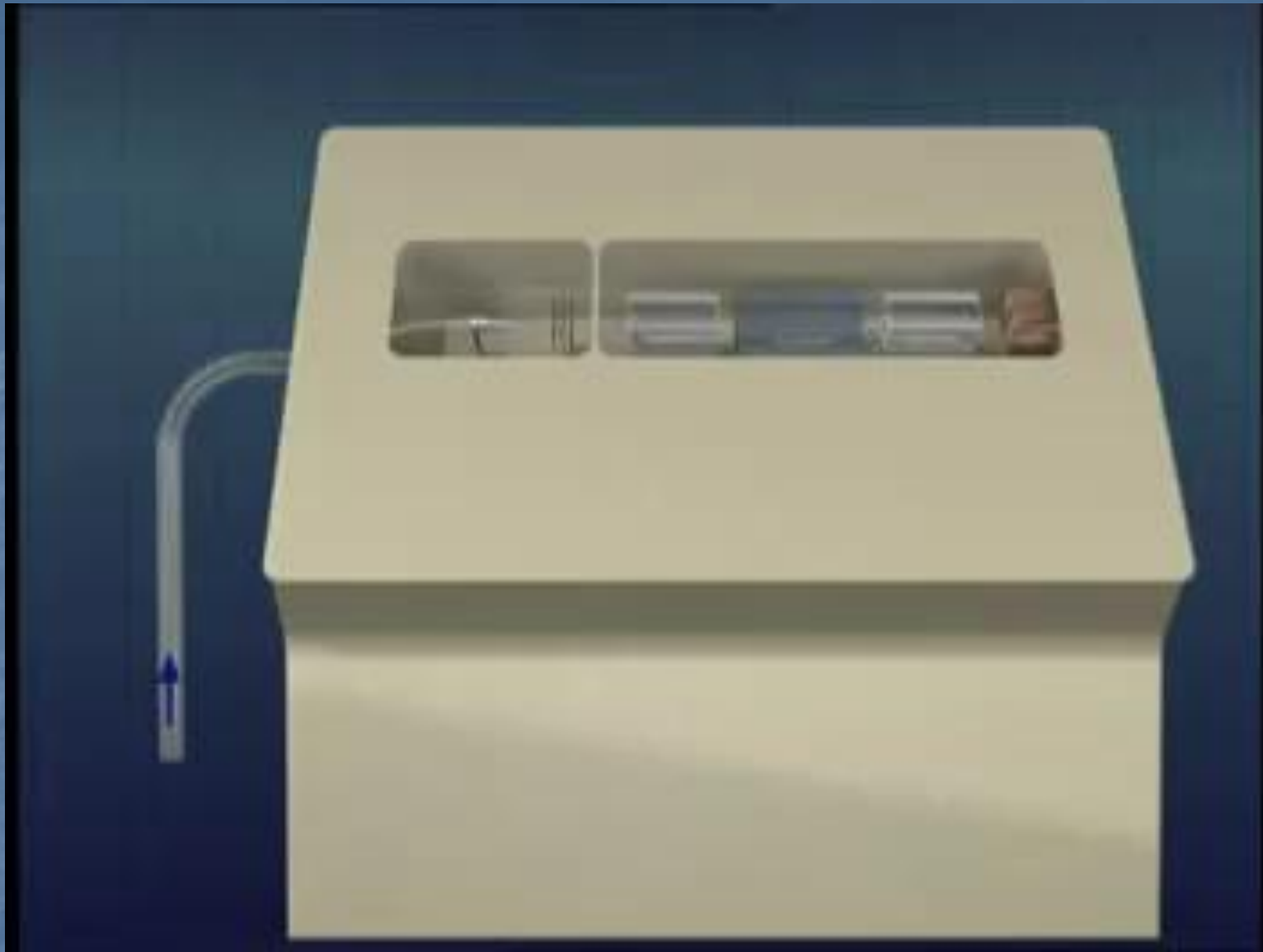
Trace Atmospheric Gas Analyzer (TAGA) Mobile Laboratories



Trace Atmospheric Gas Analyzer (TAGA)

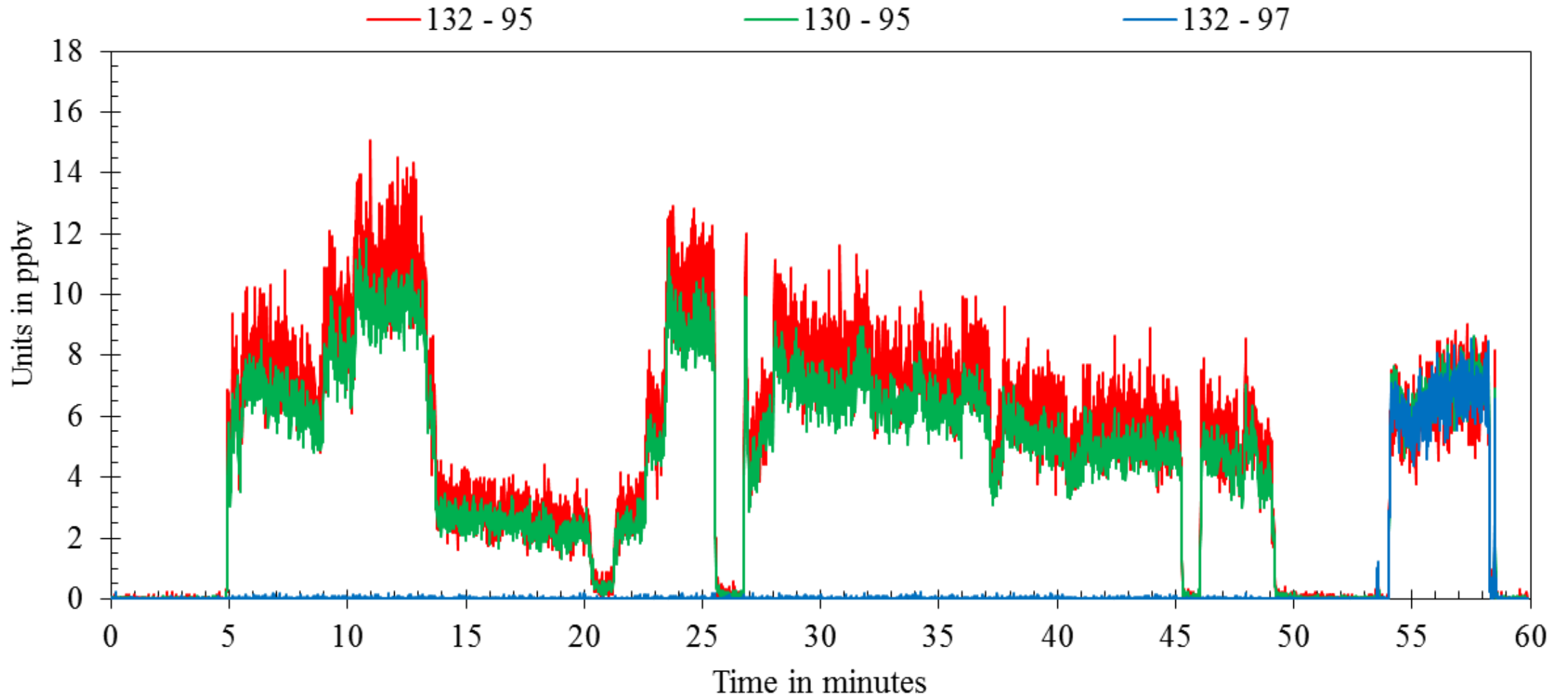


Low Pressure Chemical Ionization (LPCI) Source



TAGA Operational Process Animation

Trichloroethene (64MSMS00577)

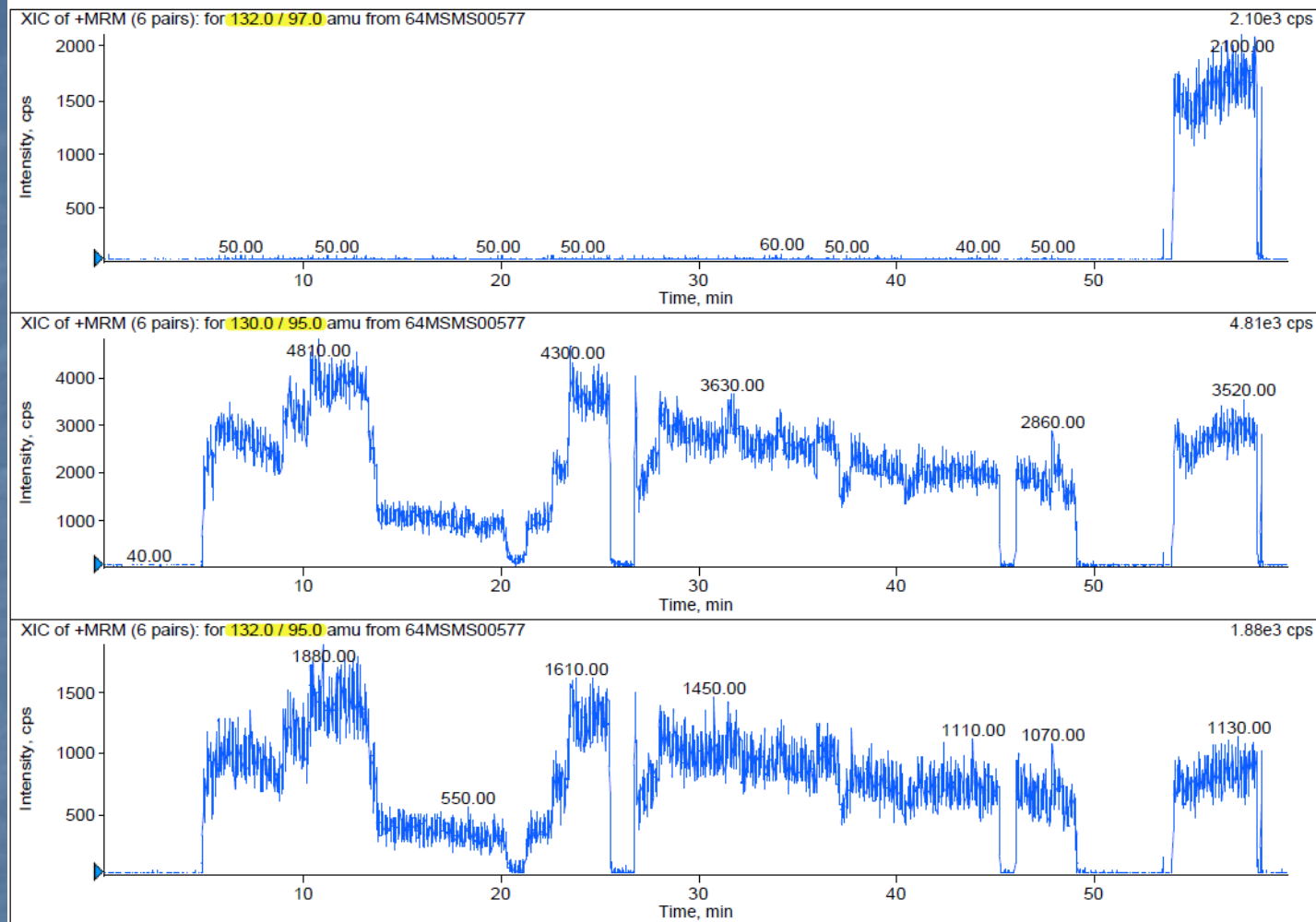


Parent/Daughter Ion Concentration Profile for Trichloroethene

Info for pane 1: 64MSMS00577

Period 1, Expt. 1; Dwell: 100.0 ms; Pause: 5.0 ms

Acq. Time: Wed, Feb 28, 2018 at 8:32:12 PM; Exp. Comment: nalyst: BPK



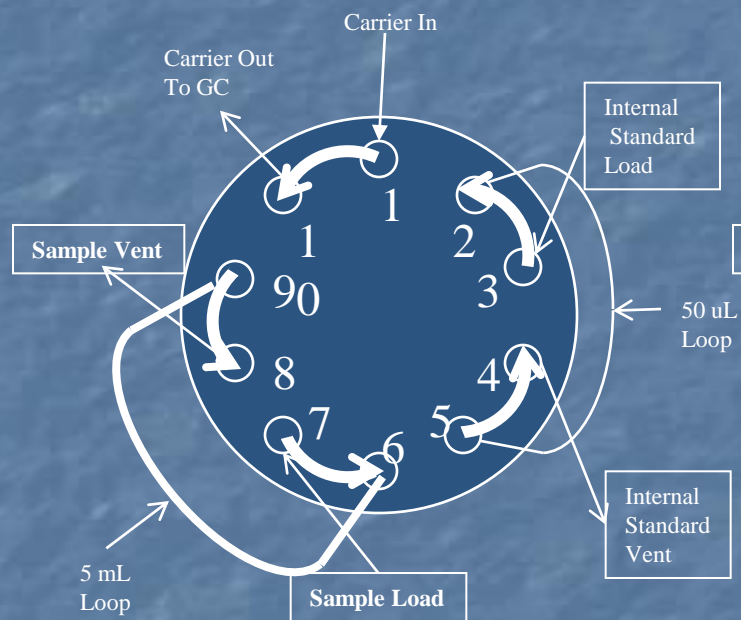
Parent/Daughter Ion Profile for Trichloroethene



Gas Chromatograph/Mass Spectrometer with Loop Injector for Analysis of Volatiles Compounds Collected in Tedlar Bags

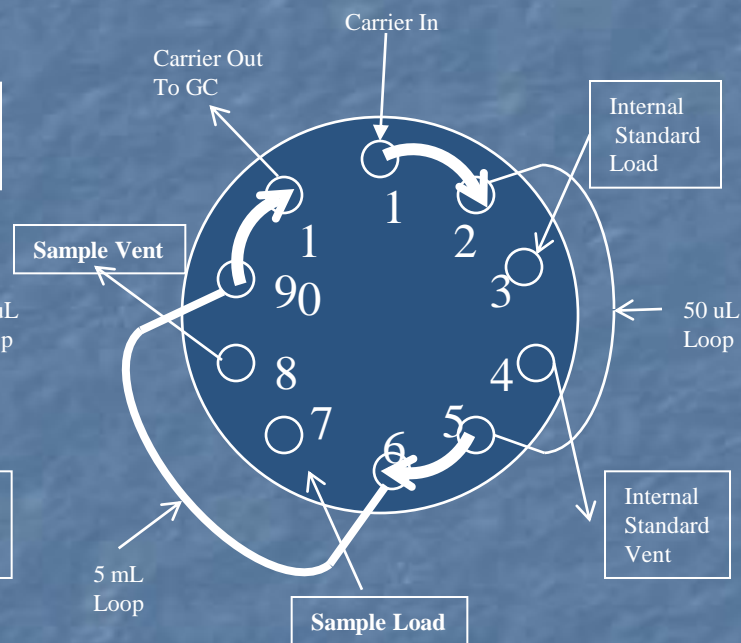
10-Port Valve Load Position

(flow in direction of arrow)



10-Port Valve Injecton Position

(flow in direction of arrow)



10-Port Gas Valve Sample Introduction System For The GC/MS



Driver and Passenger Seating with Monitor

VAPOR INTRUSION

Comparison Between Water And Air Contamination

WATER

Basis: 2 liters/day

Assume: TCE concentration is 5 ppb or 5 micrograms/liter ($\mu\text{g/L}$)

Daily impact: $2 \text{ L/day} * 5 \mu\text{g/L} = 10 \mu\text{g/day}$

AIR

Basis: 20 cubic meters/day

Assume: TCE concentration is 1 ppbv or 5.4 micrograms/cubic meter ($\mu\text{g/m}^3$)

Daily impact: $20 \text{ m}^3/\text{day} * 5.4 \mu\text{g/m}^3 = 108 \mu\text{g/day}$

Lines of Evidence:

- Groundwater spatial (and vertical profiling, if appropriate) data with modeling
- Potable groundwater analysis
- Soil gas spatial concentrations (and vertical profiling, if appropriate), including subslab, with vertical profiling
- Ambient, crawlspace, and inside air concentrations and source determinations
- Building construction and conditions
- Constituent ratios

Groundwater Spatial (and Vertical Profiling, if Appropriate) Data With Modeling



Overburden Groundwater Installation



Oil Bailer Operations



Drilling Operations



Well Field Site



Groundwater Sampling Operations



Soil Gas Probe Installation



Hollow Stem Augers with Geoprobe



Membrane Interface Probe with Geoprobe



Drilling Operations

Soil Gas Spatial Concentrations (and Vertical Profiling, if Appropriate), Including Subslab, with Vertical Profiling



Tedlar Bag Sampling

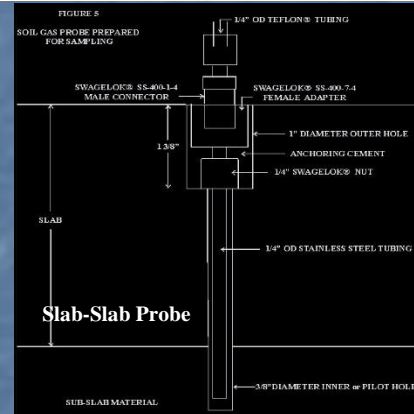


Sorbent Tubes



Summa Canister with Flow Regulator and 3-Way Valve

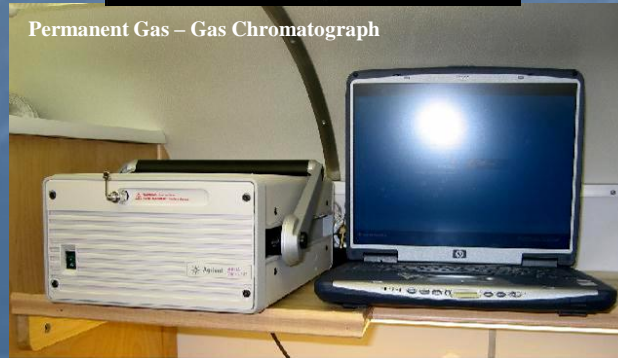
Sampling



Analyses



TAGA Mobile Laboratory

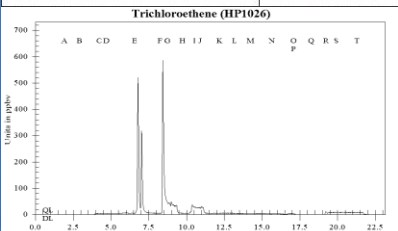
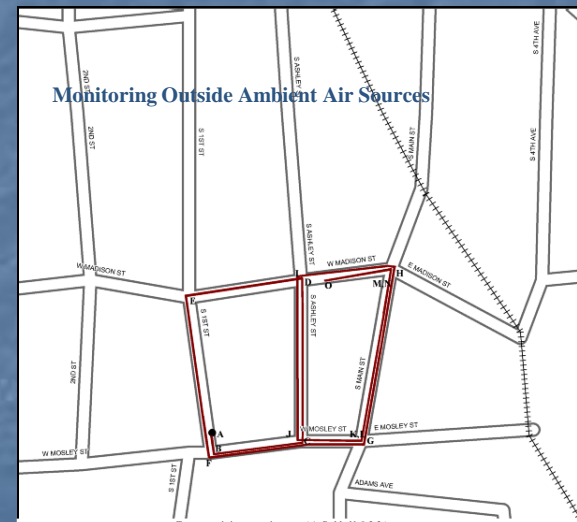
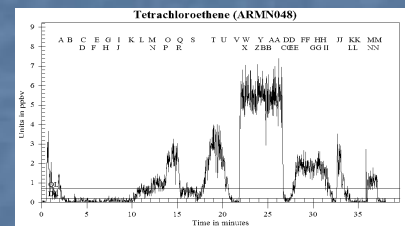
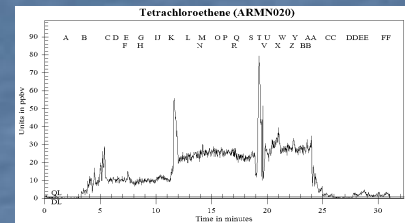
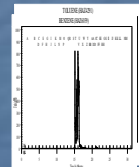
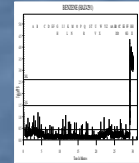
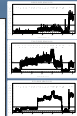
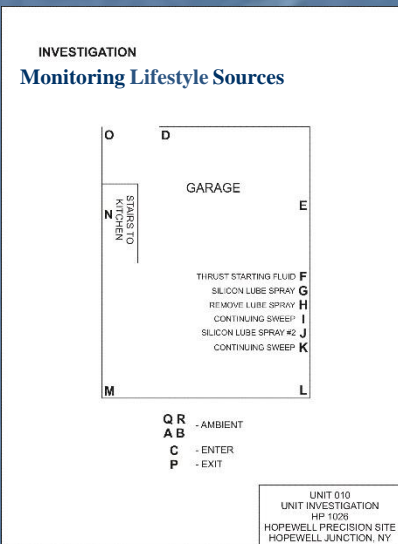


Permanent Gas – Gas Chromatograph



Volatile Organic Compounds – Gas Chromatograph/Mass Spectrometer

Ambient, Crawlspace, and Inside Air Concentrations and Source Determinations



**MONITORING FOR
ACCIDENTAL OR INTENTIONAL
RELEASES**

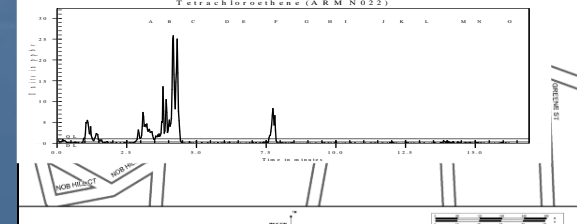
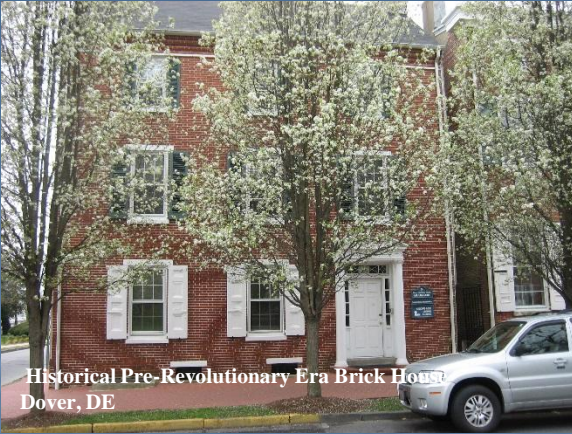


Figure 18a Mobile Monitoring Path Two, ARMN022

Building Construction And Conditions



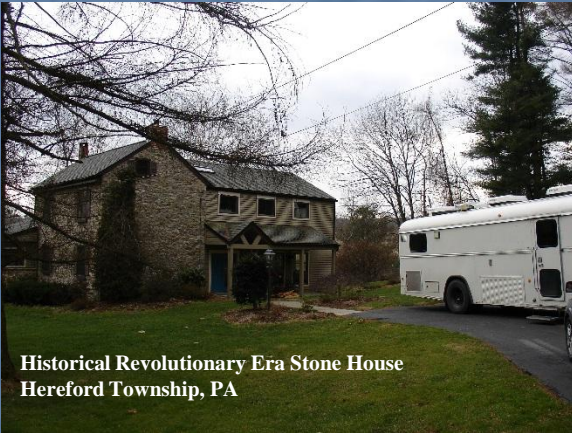
Historical Pre-Revolutionary Era Brick House
Dover, DE



Split-Level House
Hopewell, NY



Multi-Apartment Building
Ann Arbor, MI



Historical Revolutionary Era Stone House
Hereford Township, PA



Single-story House with Crawlspace
San Antonio, TX



2-Story New Construction House
Hopewell, NY



Hand-Dug Earthen Tunnel Basement



Stone-Walled Basement



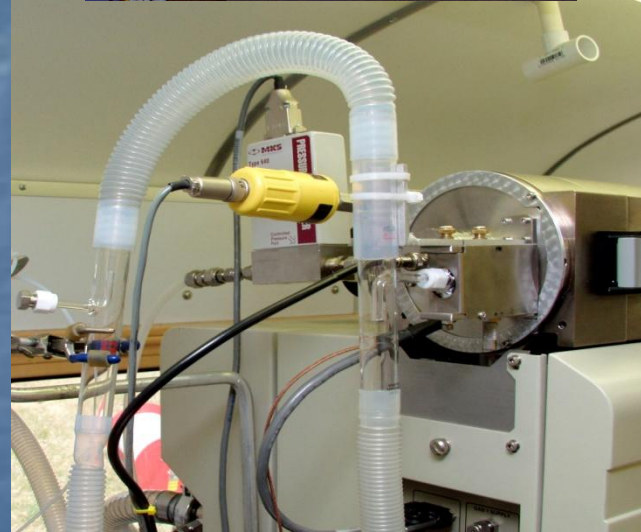
Rough Poured Cement Floor with Hand-Hewn Posts

Vapor Intrusion Sites

ABC One Hour Cleaners, Jacksonville, NC – Region 4
Armen Cleaners Site, Ann Arbor, MI – Region 5
Army Corps of Engineers Raritan Center Site, Edison, NJ – Region 2
Berkley Products Site, Akron, PA – Region 3
Brewster Site, Brewster, NY – Region 2
Brick Township Landfill, Ocean City, NJ – Region 2
Brook Industries Bound Brook, NJ – Region 2
Butz Landfill Site, Jackson, PA – Region 3
Carter Carburetor Site, St. Louis, MO – Region 7
Charlevoix Groundwater Site, Charlevoix, MI – Region 5
Chemical Leaman Site, Gloucester, NJ – Region 2
Chillum Site, Chillum, MD – Region 3
Coldwell Trucking Site, Essex City, NJ – Region 2
Conell Dublier Site, South Plainfield, NJ – Region 2
Corry Site, Corry, PA – Region 3
Crossley Farm Site, Hereford Township, PA – Region 3
Crown Cleaners Site, Carthage, NY – Region 2
Delforge Site, Grand Prairie, TX – Region 6
Delmar Water Supply Well Site, Dalmar, DE - Region 3
Diaz Site, Holley, NY – Region 2
Dover Gas Light Site, Dover, DE - Region 3
Facet Enterprise Site, Elmira Heights, NY – Region 2
Federal Creosote Site, Manville, NJ – Region 2
Former Kelly Air Force Base, San Antonio, TX – Region 6
Former Manufactured Gas Plant Site, West Palm Beach, FL – Region 4
Fulton Site, Garden City, NY - Region 2
Garden State Cleaners Site, Buena Borough, NJ – Region 2
Grenada Manufacturing Site, Grenada, MS - Region 4
Georgia Street Site, Washington DC - Region 3
Glendive Site, Glendive, MT – Region 8
Grand Rapids VIER, Grand Rapids, MI - Region 5
Grand Traverse Overall Supply Site, Traverse City, MI – Region 5
Grants Site, Grants NM – Region 6
Henry's Dry Cleaners Site, Laconia, NH – Region 1
Hidden Lane Landfill, Sterling, VA - Region 3
Higgins Disposal Site, Franklin Township, NJ – Region 2
Highway 71/72 – Region 6
Hopewell Precision Site, Hopewell Junction, NY – Region 2
Kaufman and Minter Site, Jobstown, NJ – Region 2
Kentucky Avenue Site, Horseheads, NY – Region 2
Laureldale Groundwater Site – Grants Pass, OR – Region 10
Lawrence Aviation Site, Port Jefferson, NY – Region 2
Lehigh Valley Railroad Derailment Site, LeRoy, NY – Region 2
Liberty Industrial Finishings Site, Oyster Bay, NY – Region 2
Lillis Drive Site, Cudahoga, Falls, OH - Region 5
Little Valley Site, Little Valley, NY – Region 2

Love Canal, Love Canal, NY – Region 2
Mackenzie Chemical Works, Suffolk County, NY – Region 2
Macon Naval Ordnance Plant, Macon, GA - Region 4
Mansfield Dump Site, Byram Township, NJ – Region 2
Marathon Battery Site, Putman City, NY – Region 2
Mattiace Site, Glen Cove, NY – Region 2
Mayfield Road Site - Mayfield Heights, OH - Region 5
McGaffey and Main Site, Roswell, NM – Region 6
MEW Site, Mountain View, CA – Region 9
Mills Gap Road Site, Skyland, NC - Region 4
Mitral Site, Harwinton, CT – Region 1
Moffett Field, Moffett, CA – Region 9
Mohonk Site – High Falls, NY – Region 2
Motorola 52nd Street Site, Phoenix, AZ – Region 9
Mueller Copper Tubing Site, Wynne, AR- Region 6
Murray Laundry Site, Salt Lake City, UT – Region 8
Nebraska Former Ordnance Plant Site, Mead, NE – Region 7
Olean Cleaners, Olean, NY – Region 2
Parker Solvent Site, Little Rock, AR – Region 6
Passyunk Soil Gas Site, Philadelphia, PA – Region 3
Peninsula Blvd Site, Hewlett, NY – Region 2
Perkasie Site, Perkasie, PA – Region 3
Pohatcong Site, Franklin Township, NJ – Region 2
Port Washington Site, North Hemstead, NY – Region 2
Radiation Technologies Site, Rockaway, NJ – Region 2
Railroad TCE, Warminster, PA - Region 3
Raritan Arsenal, Edison, NJ – Region 2
Raymark Site, Stratford, CT – Region 1
Rittenhouse Road, Norristown, PA - Region 3
Rockaway Boro Site, Rockaway Township, NJ – Region 2
San Gabriel Valley Site, Eouth El Monte, CA - Region 9
Scientific Chemical Processing Site, Carlstadt, NJ – Region 2
Scovill Schrader Site, Dickson, TN - Region 4
Shenandoah Road Site, East Fishkill, NY – Region 2
Sherwin Williams, Gibbsboro, NJ - Region 2
South Jersey Clothing Site, Buena Borough, NJ – Region 2
St. Louis Park Site, St. Louis Park, MN - Region 5
Sugarhouse VI PCE Site, Salt Lake City, UT - Region 8
Tranguch Site, Hazleton, PA – Region 3
Trex Properties Site, Charlotte, NC - Region 4
Trex Site, Grand Rapids, MI - Region 5
USMC Camp Lejeune, Jacksonville, NC – Region 4
Valmont Site, Hazleton, PA – Region 3
Vestal Site, Vestal, NY -Region 2
White Swan Site, Wall Township, NJ – Region 2

TAGA Monitoring



TAGA Monitoring with the Teflon Tube Using the Low Pressure Chemical Ionization (LPCI) Source

Vapor Intrusion Discussion Points

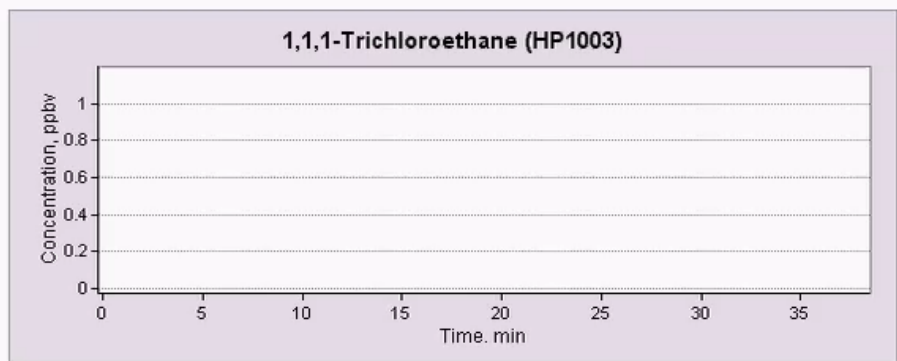
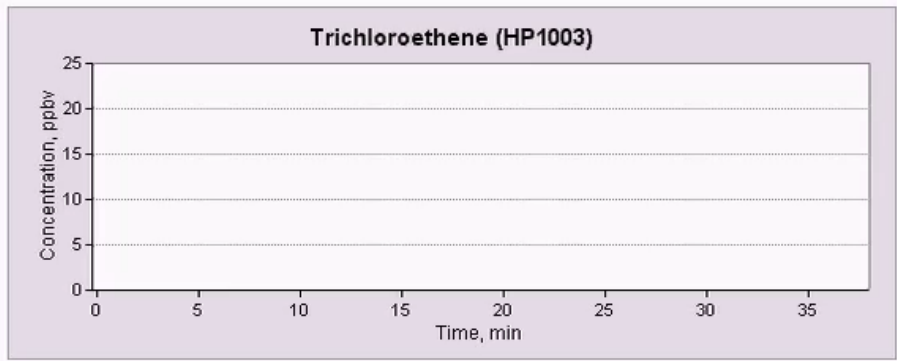
- Impacts Due to Vapor Intrusion
- Impacts Due to Household Material Impacts
- Impacts Due to Adjacent Building
- Impacts Due to Adjoining Buildings
- Impacts Due to Contaminated Potable Well Water
- Impacts Due to Crawlspace Concentrations
- Impacts Due to Presence in Contaminated Water in Sumps
- Impacts Due to Same Source - Constituent Ratios
- Impacts Due to Self-Polluting Operations
- Impacts Due to Accidental/Intentional Releases
- Impacts Due to Releases at Distances
- Impacts Due to Groundwater Becoming Surface Water
- Impacts Due to Groundwater Being Used for Irrigation
- Impacts Due to Sub-slab Contamination

Impacts Due to Vapor Intrusion Sources

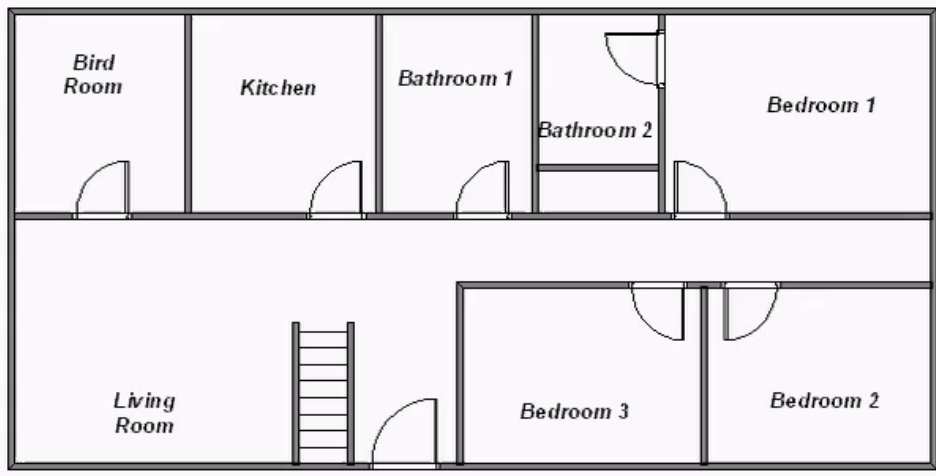
TCE Site
Region 2



Region 2 - TCE Site



1ST FLOOR



Legend

Trichloroethene

- 0.000 - 2.165
- 2.166 - 5.183
- 5.184 - 8.869
- 8.870 - 15.024
- 15.025 - 22.648

1,1,1-Trichloroethane

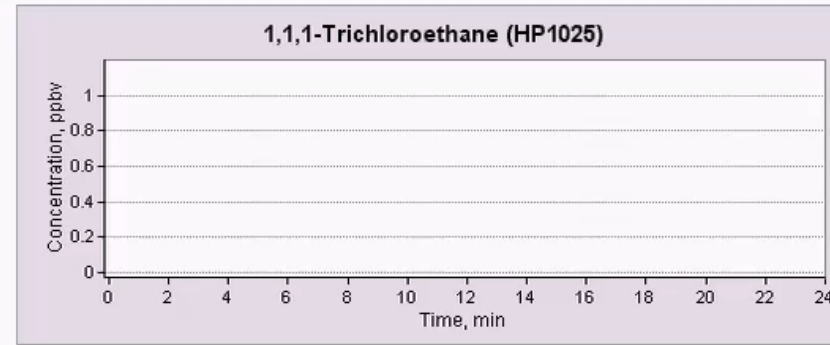
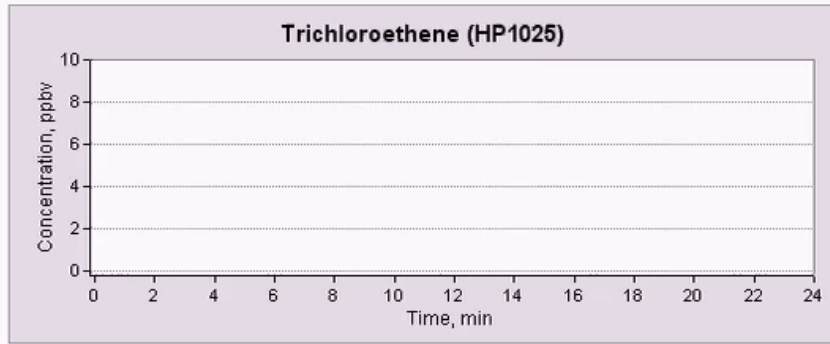
- 0 - 0.728
- 0.729 - 6.098
- 6.099 - 10.55

Impacts Due to Lifestyle Sources

TCE Site
Region 2

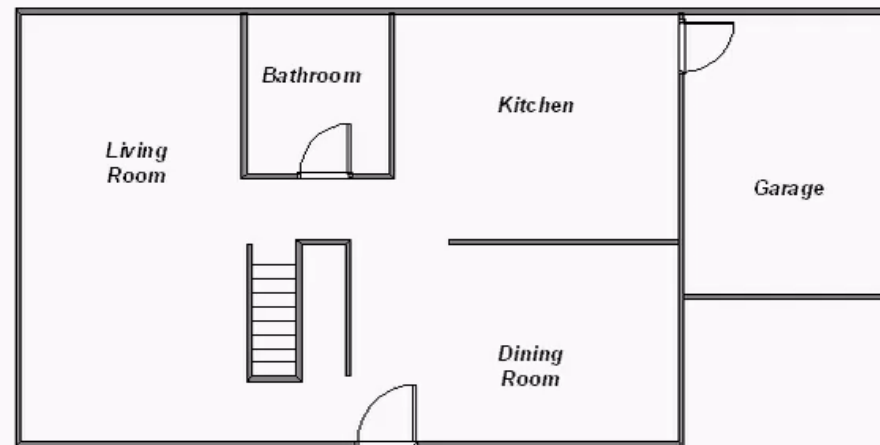


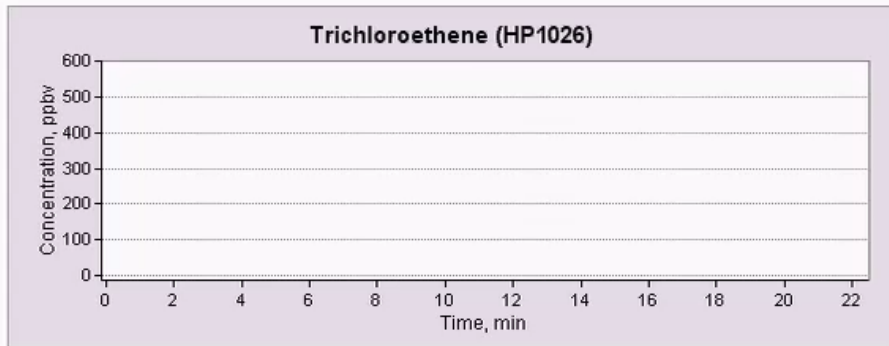
Region 2 - TCE Site



1st Floor

Legend	
Trichloroethene	
●	0 - 0.765
●	0.766 - 2.85
●	2.851 - 4.925
●	4.926 - 7.119
●	7.12 - 9.013
1,1,1-Trichloroethane	
●	0 - 0.965
●	0.966 - 6.68
●	6.681 - 9.492





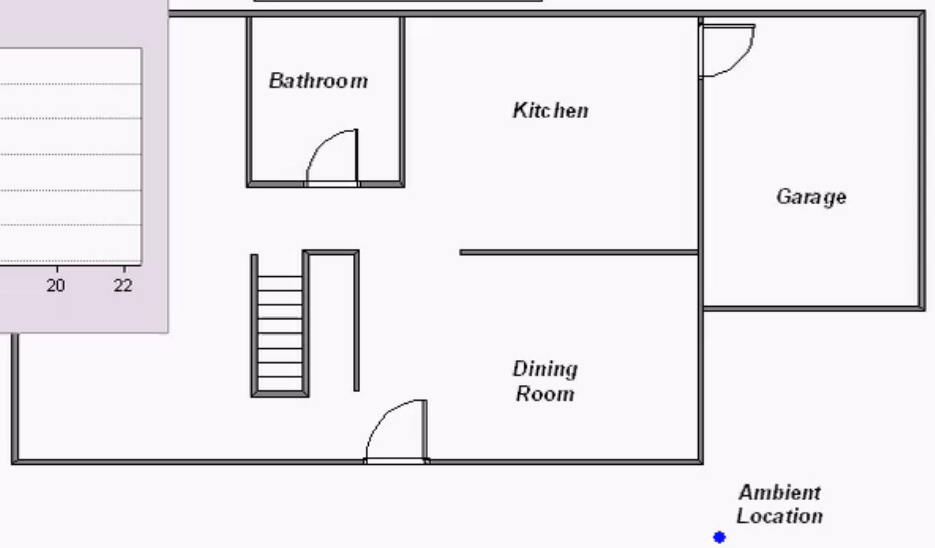
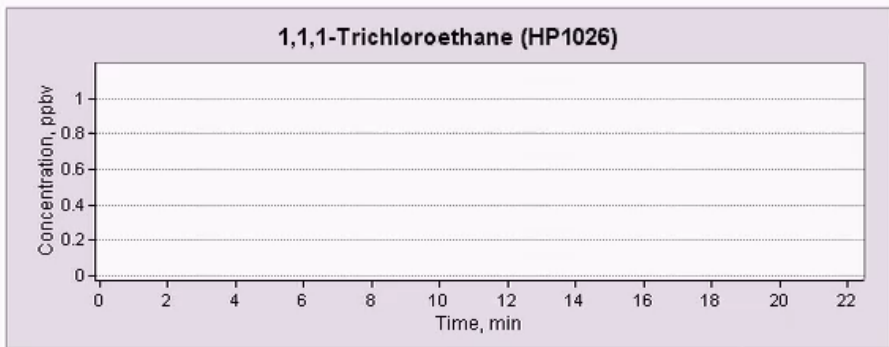
Legend

Trichloroethene

- 0 - 0.721
- 0.722 - 20.999
- 21 - 44.999
- 45 - 99.999
- 100 - 590

1,1,1-Trichloroethane

- 0 - 0.959
- 0.96 - 9.84
- 9.85 - 12.4

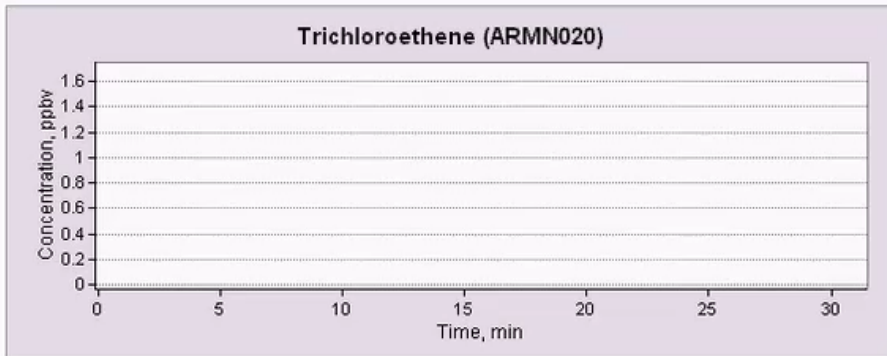
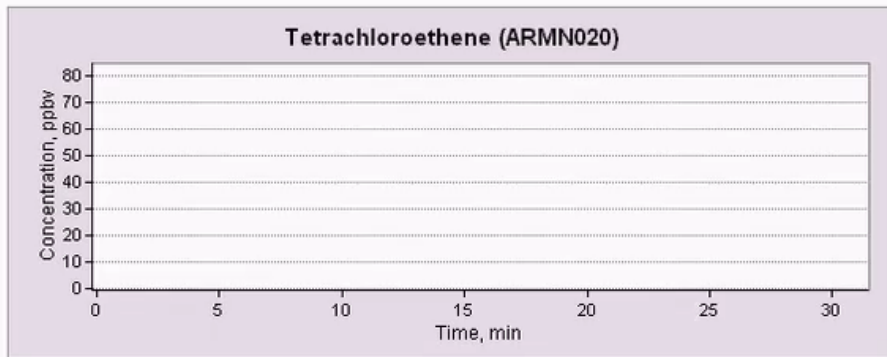


Impacts Due to Outside Ambient Air Sources

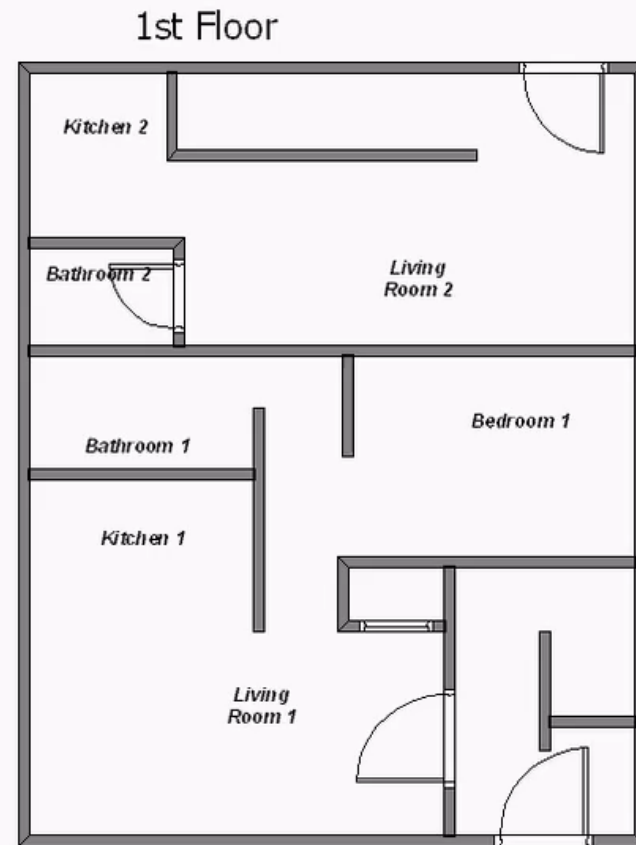
PCE Site
Region 5

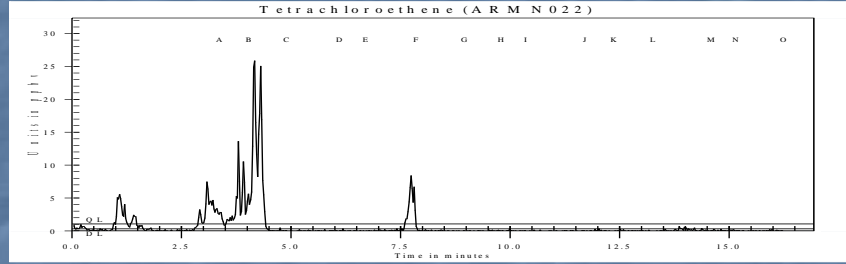


Region 5 – PCE Site



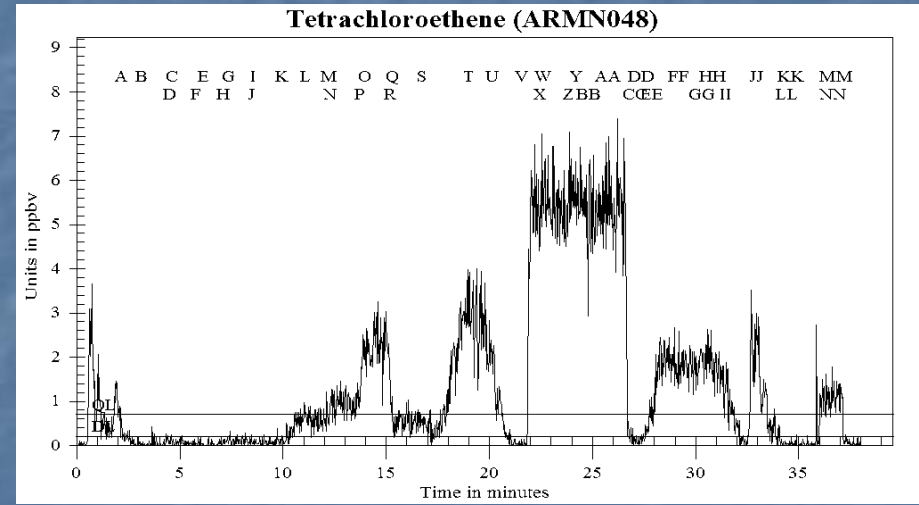
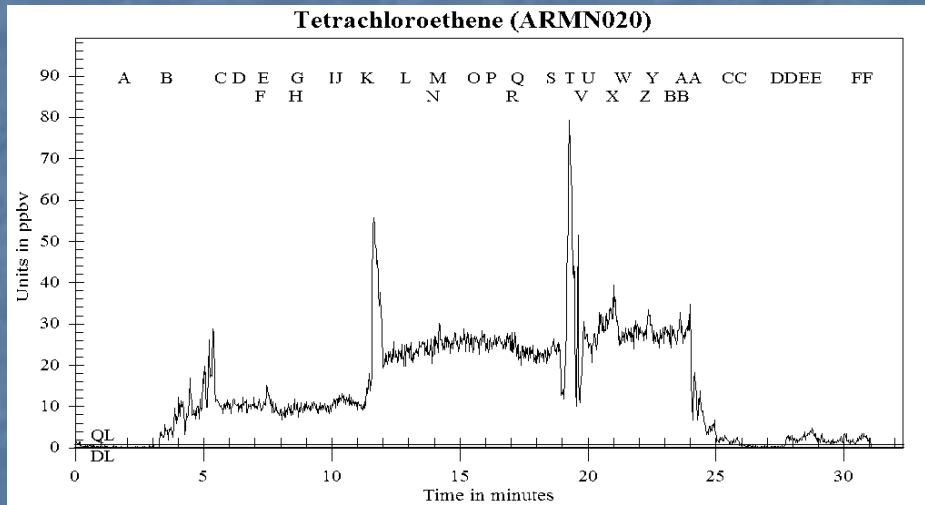
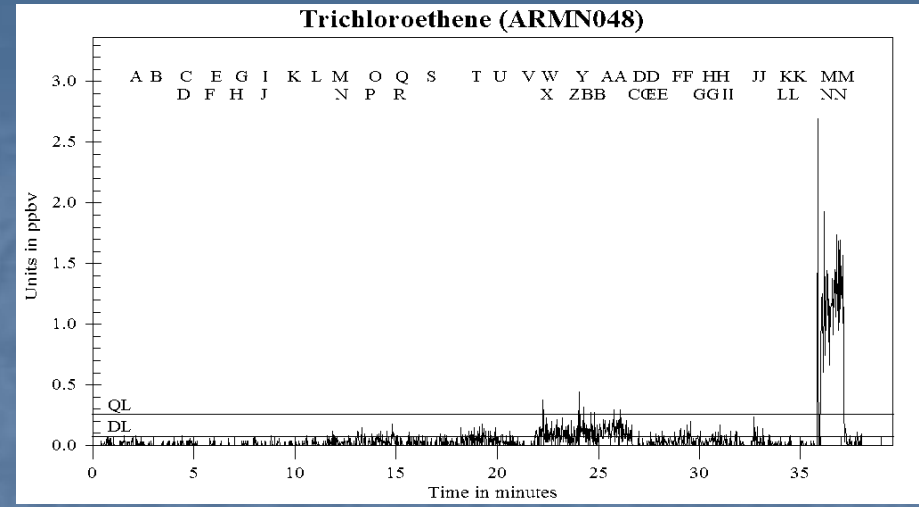
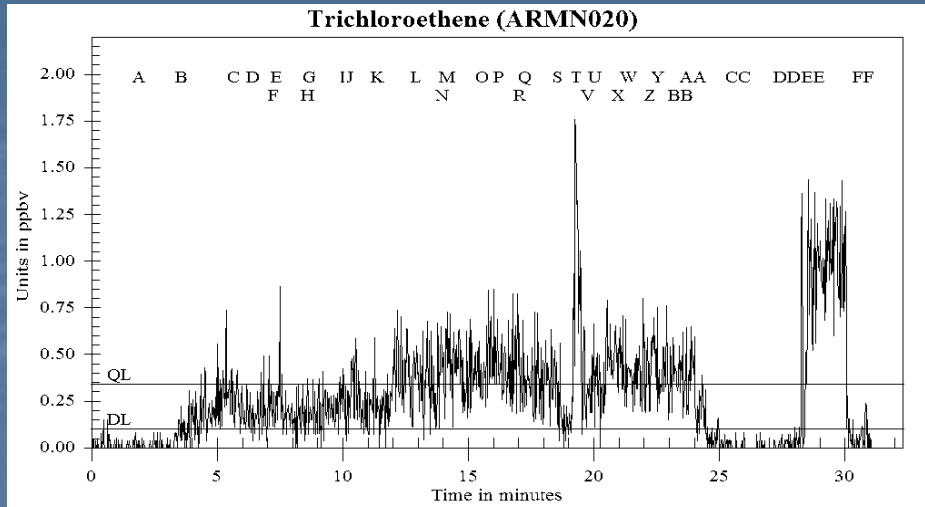
Legend	
Tetrachloroethene	
●	0 - 0.875
●	0.876 - 14
●	14.001 - 30
●	30.001 - 38
●	38.001 - 80
Trichloroethene	
●	0 - 0.777
●	0.778 - 1.315
●	1.316 - 2





Wind: 10 mph/050°

Figure 18a Mobile Monitoring Path Two, ARM N022

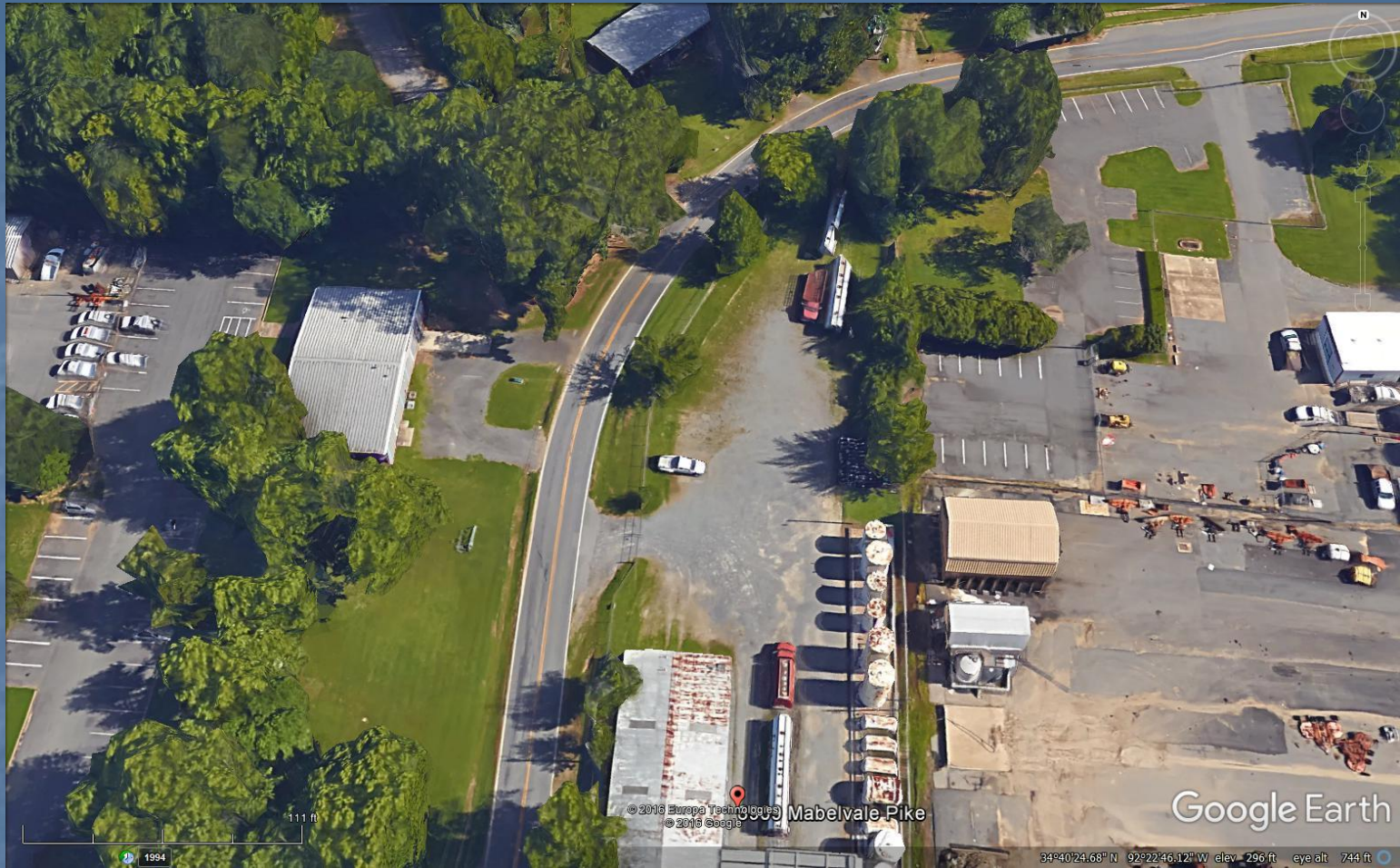


Northeast – 13 mph

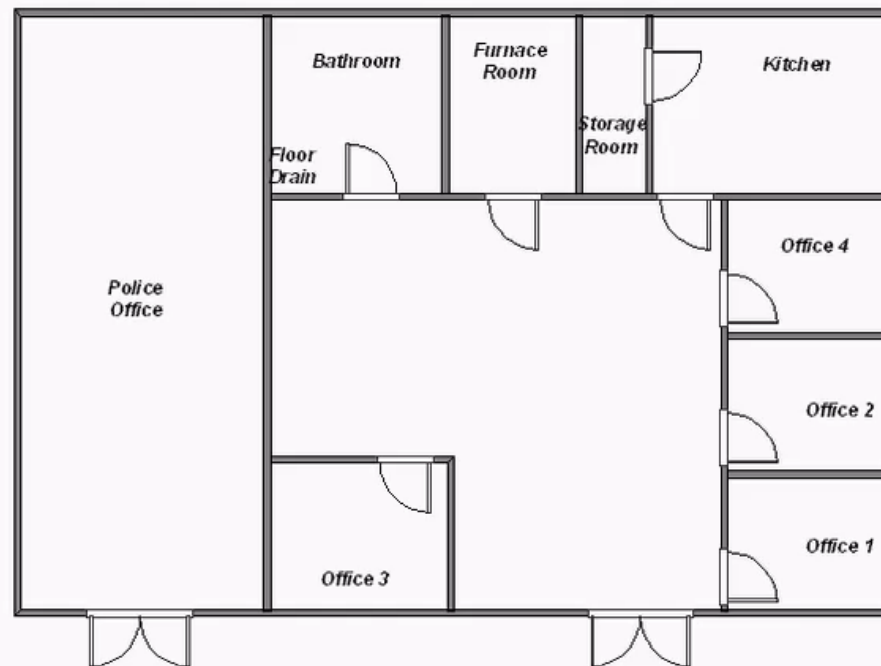
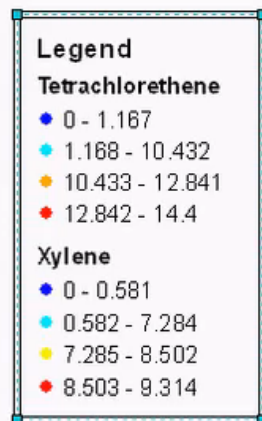
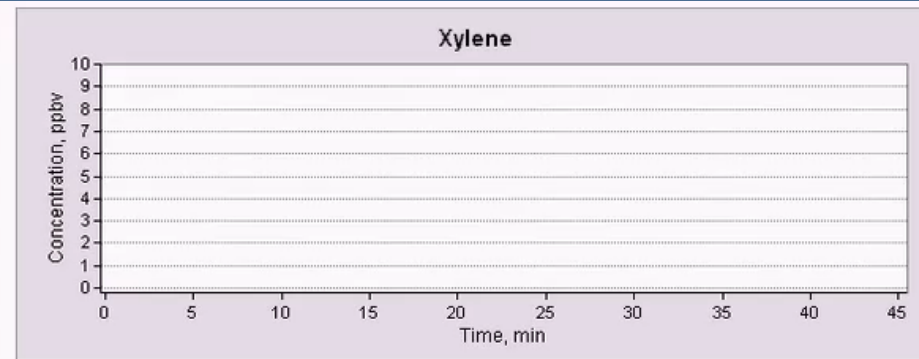
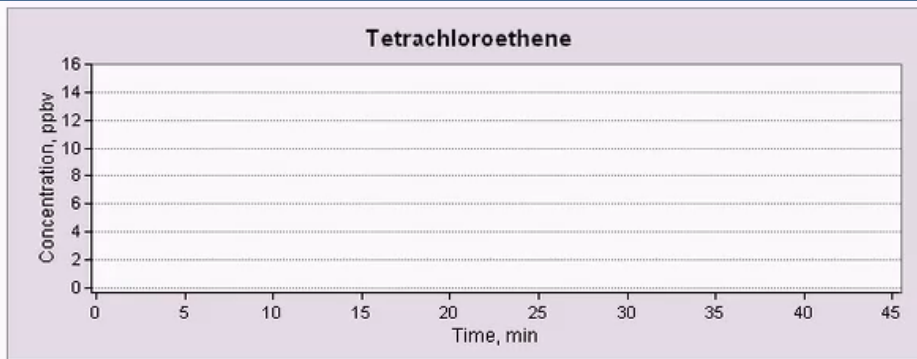
North – 12 mph

Impacts Due to Attached Facilities

Solvent Site
Region 6

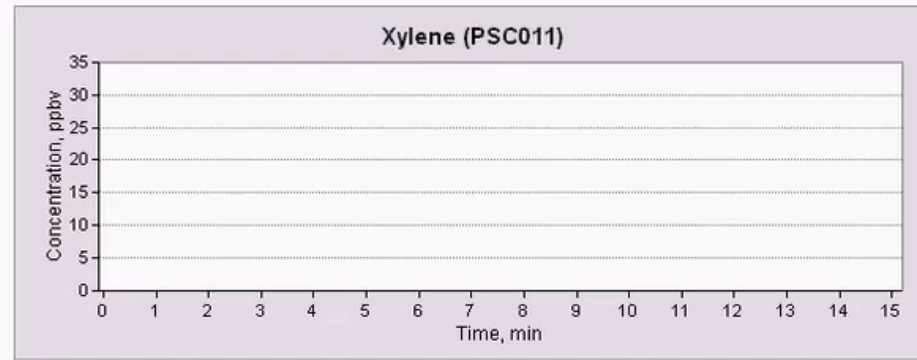
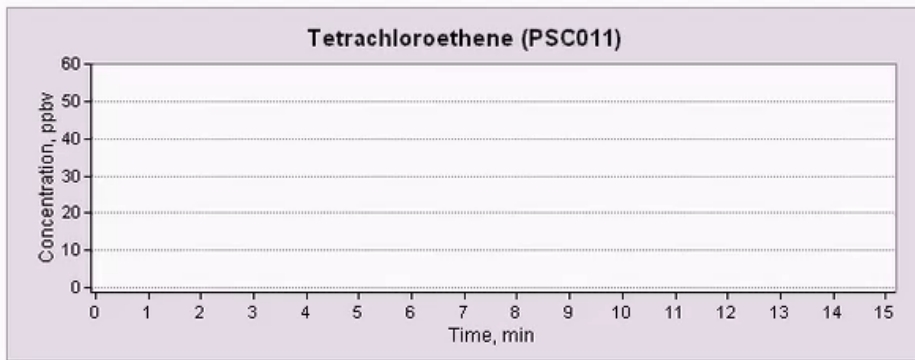


Region 6 – PCE/Xylene Site

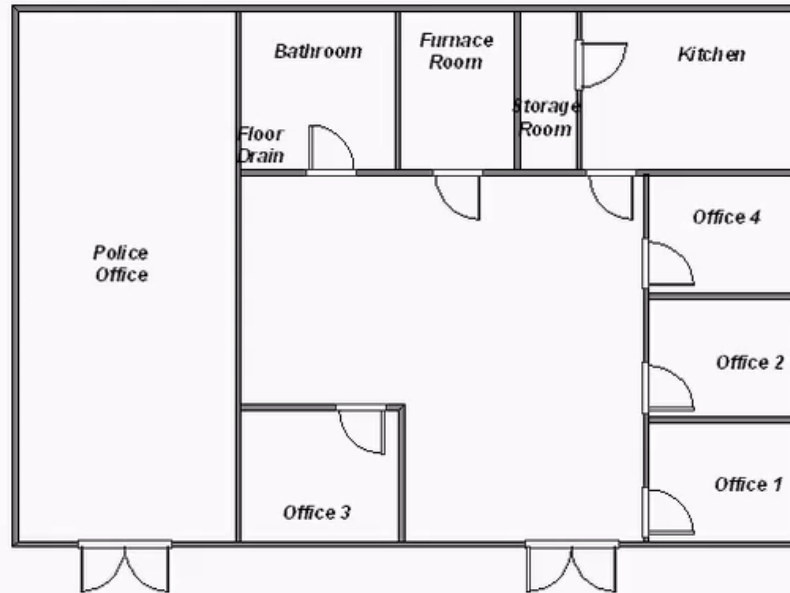


Ambient Location





- Legend**
- Tetrachloroethene**
- 0 - 0.978
 - 0.979 - 6.83
 - 6.831 - 37.028
 - 37.029 - 55.605
- Xylene**
- 0.015 - 0.869
 - 0.87 - 5.279
 - 5.28 - 16.73
 - 16.731 - 32.911



Ambient Location

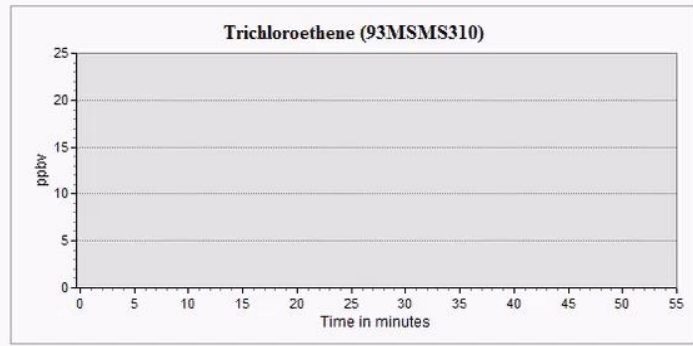
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Impacts Due to Contaminated Well Water

TCE Site
Region 3



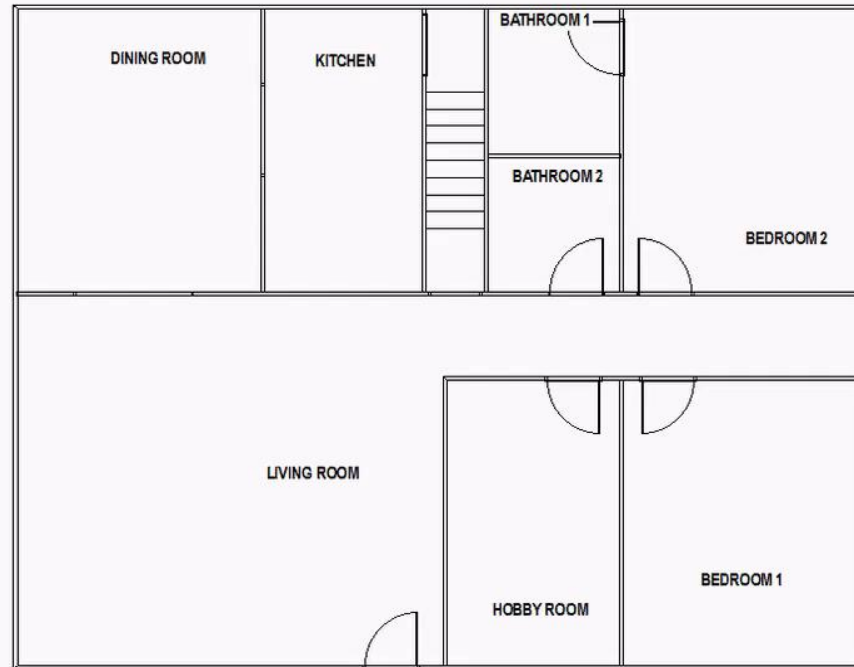
Region 3 - TCE Site



Legend

Trichloroethene

- 0.00 - 2.00
- 2.01 - 5.00
- 5.01 - 12.0
- 12.1 - 23.3



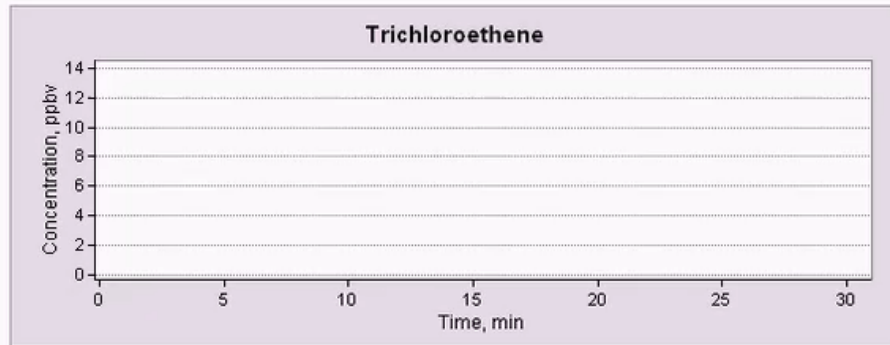
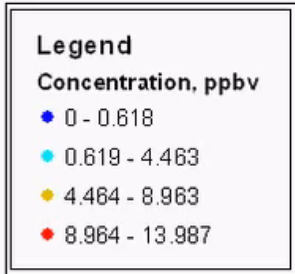
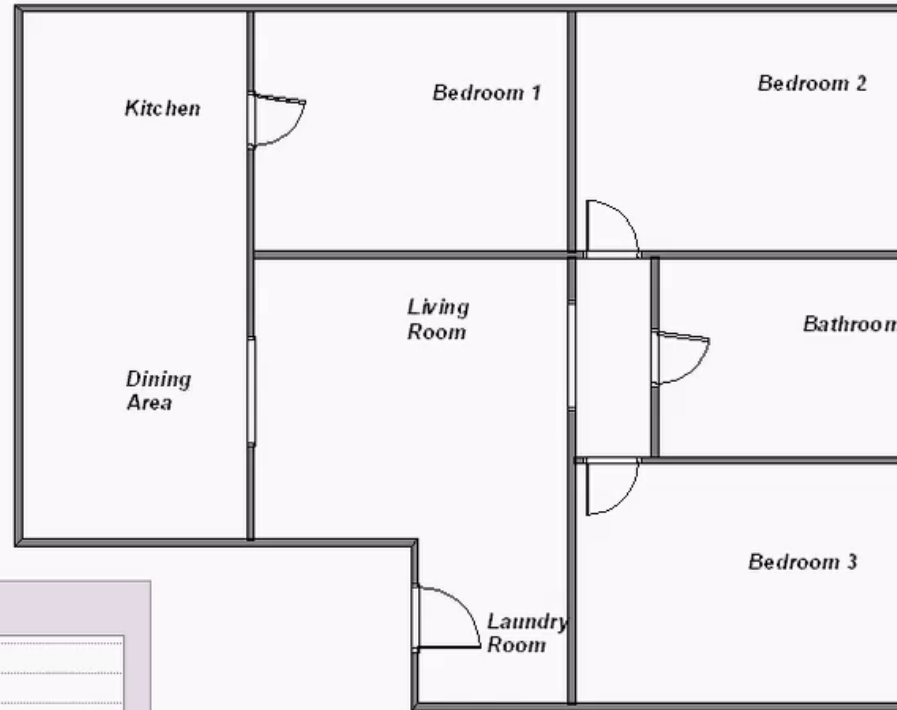
Impacts Due to Crawlspace Areas

TCE Site
Region 6



Region 6 - TCE Site

1st Floor

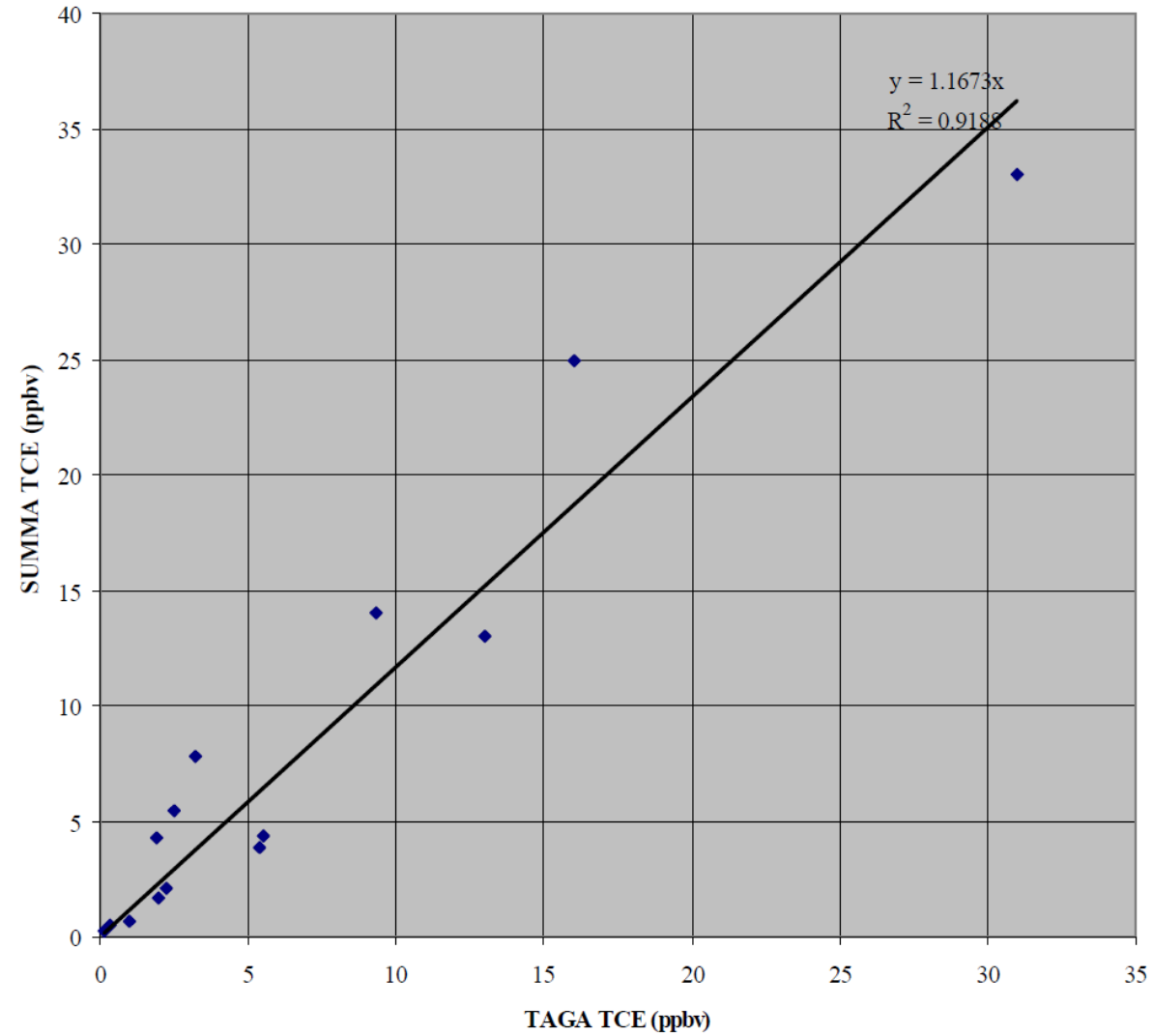


Ambient Location



FIGURE 1
Delfasco Forge Site
Grand Prairie, Texas
August 2008

Crawl Space Comparison
TAGA 1-minute vs. SUMMA 24-hour



Impacts Due to Meteorological Effects

TCE Site
Region 3

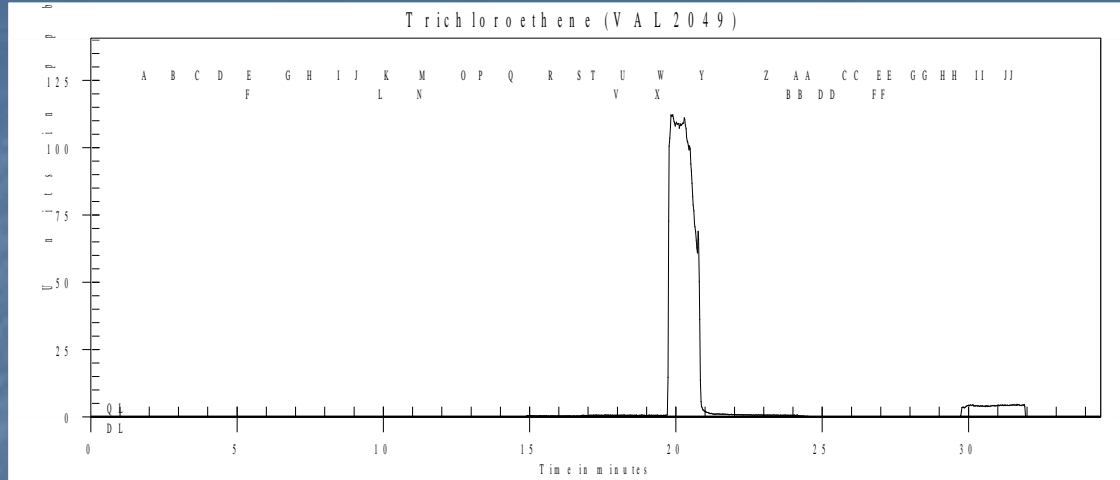


Region 3 - TCE Site

1ST

Rainfall - 0.9 inch
11/06 1500 – 2300
Wind ~ 5 mph
11/07 0000 – 1200

Wet Sumps

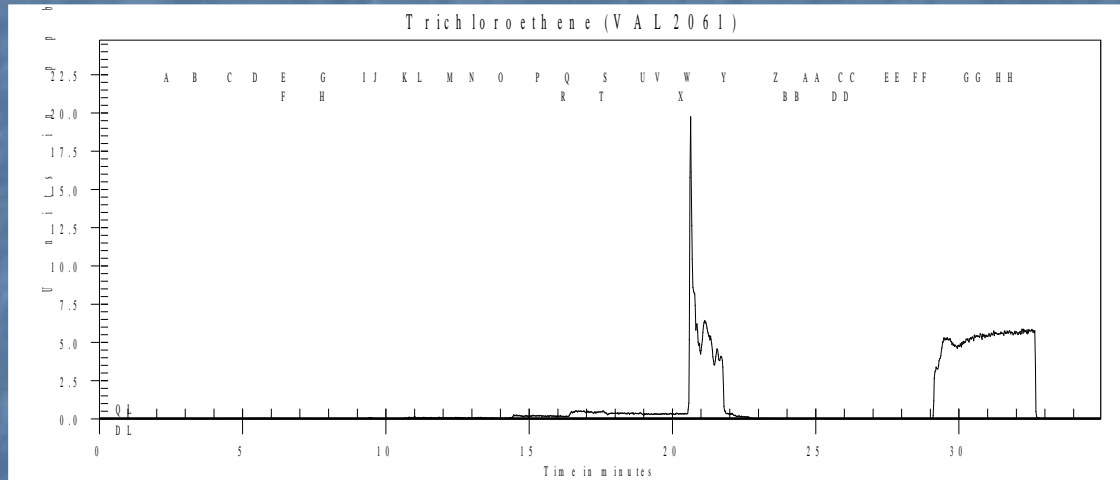


~ 120 PPBV

2ND

Rainfall - 1.9 inch
11/12 0500 – 2300
Wind ~ 25 mph
11/13 0000 – 1100

Dry Sumps

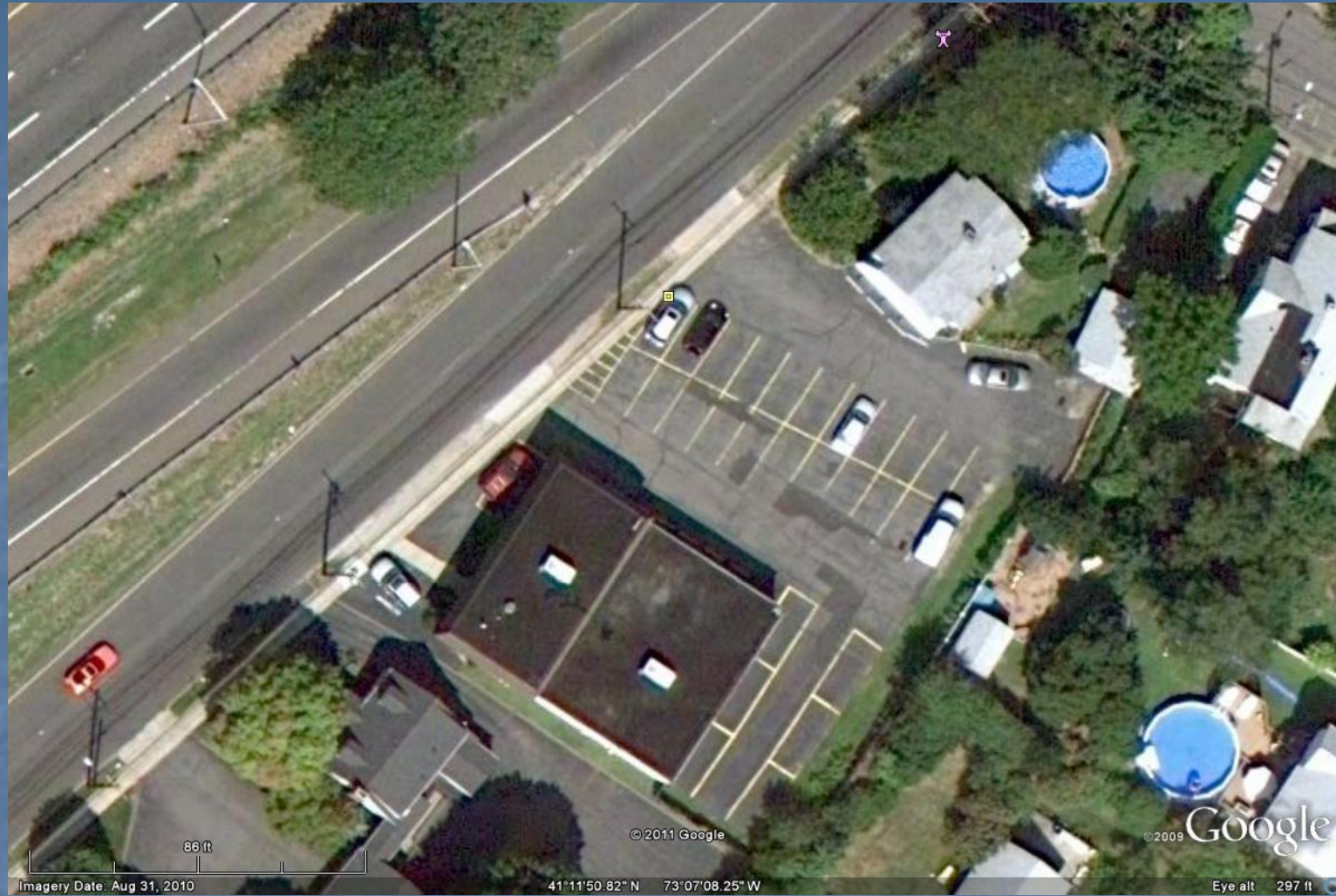


~21 PPBV

TRICHLOROETHENE CONCENTRATIONS

Impacts Due to Signature Compounds from Subsurface Gas Intrusion

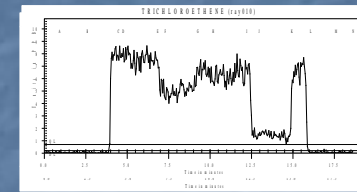
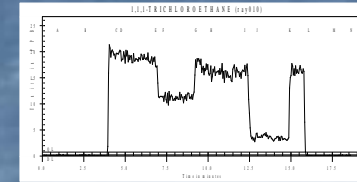
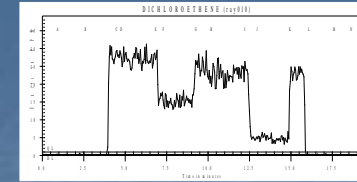
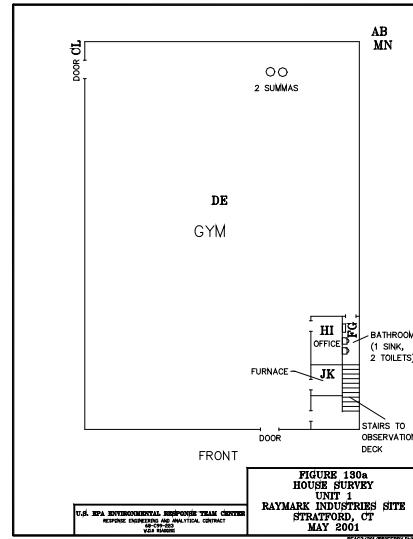
Chlorinated Solvent Site
Region 1



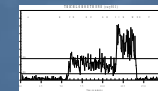
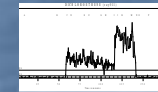
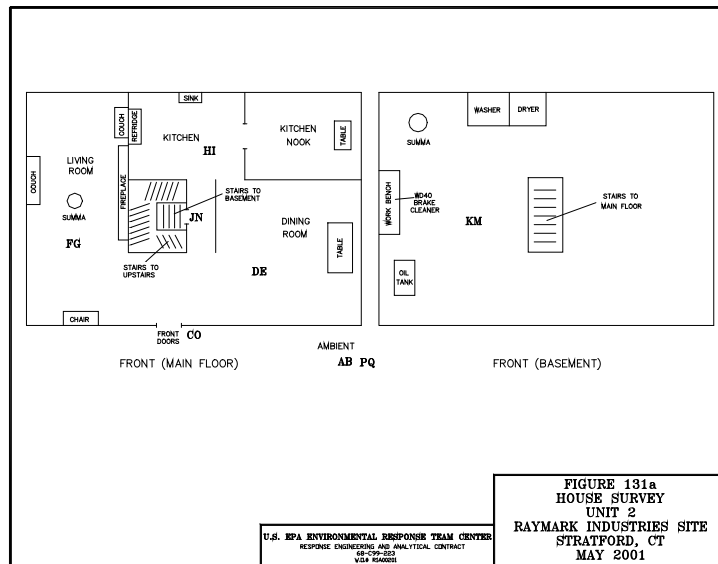
Region 1 – TCE Site

Constituent Ratios

Children's Gymnasium

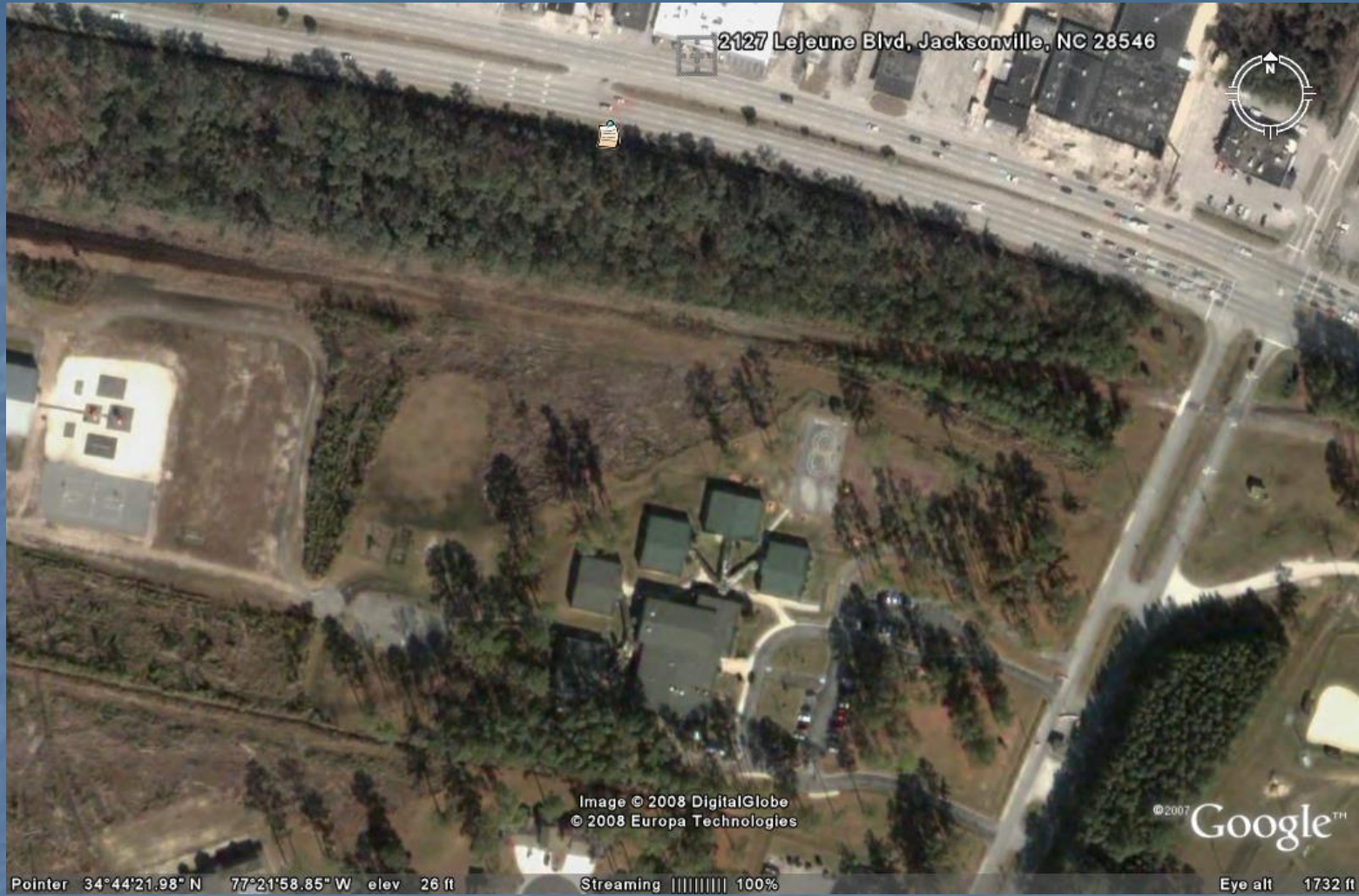


Residence Adjacent to the Gymnasium

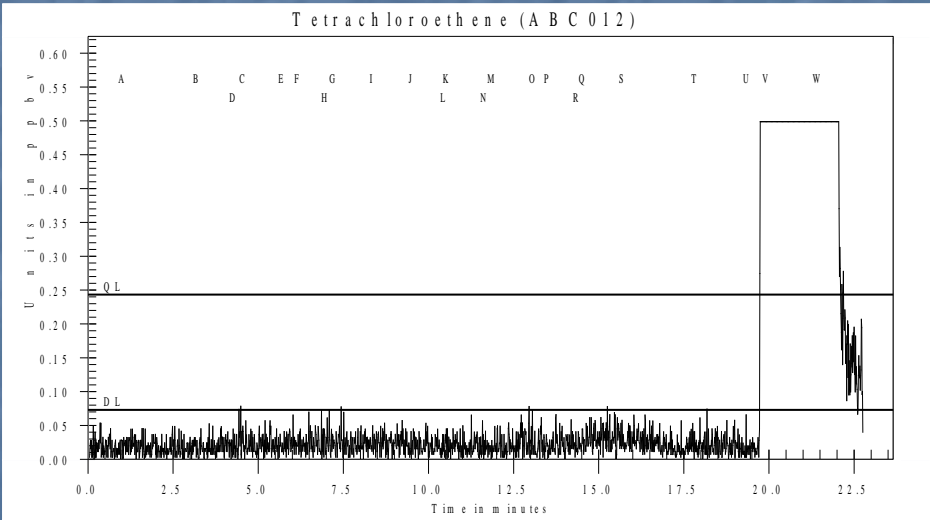
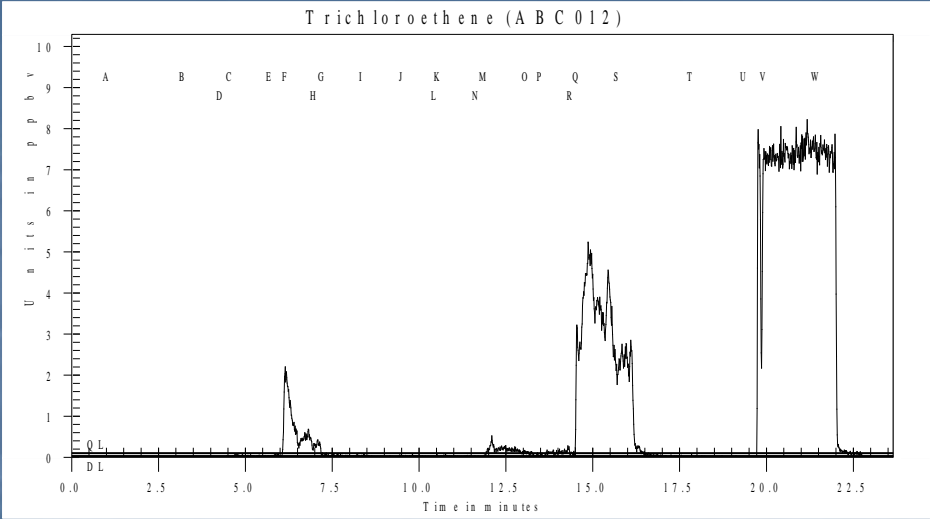
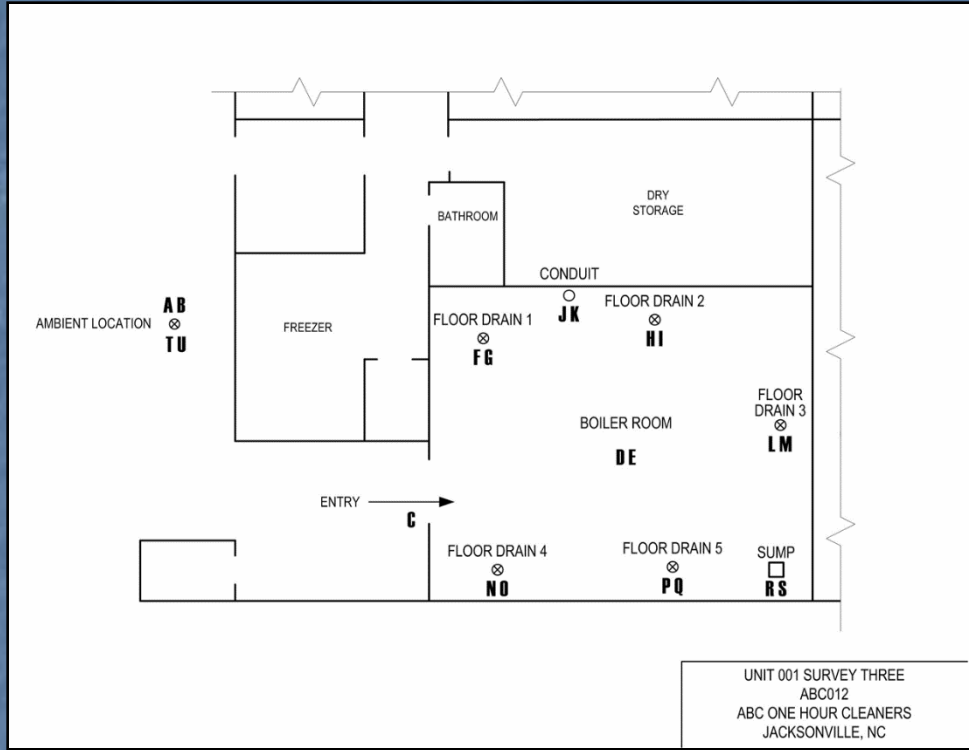


Impacts Due to Self-polluting Operations

PCE Site
Region 4



Region 4 – PCE Site



Region 4 PCE Site

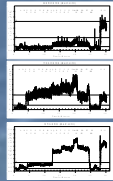
Impact Due to Accidental or Intentional Releases

Gasoline Spill Site
Region 3



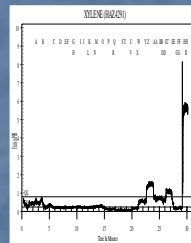
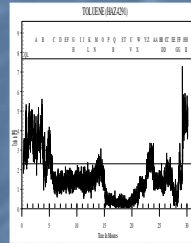
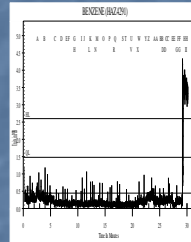
Region 3 - Benzene Site

1st



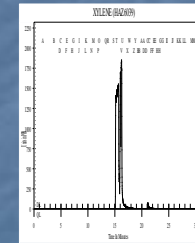
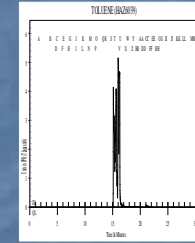
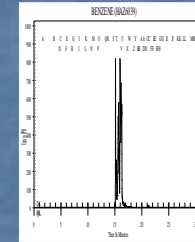
< 1.0 PPBV

2nd



< 1.0 PPBV

3rd



> 900 PPBV

BENZENE CONCENTRATIONS

Monitoring For Fractured Bedrock Contribution

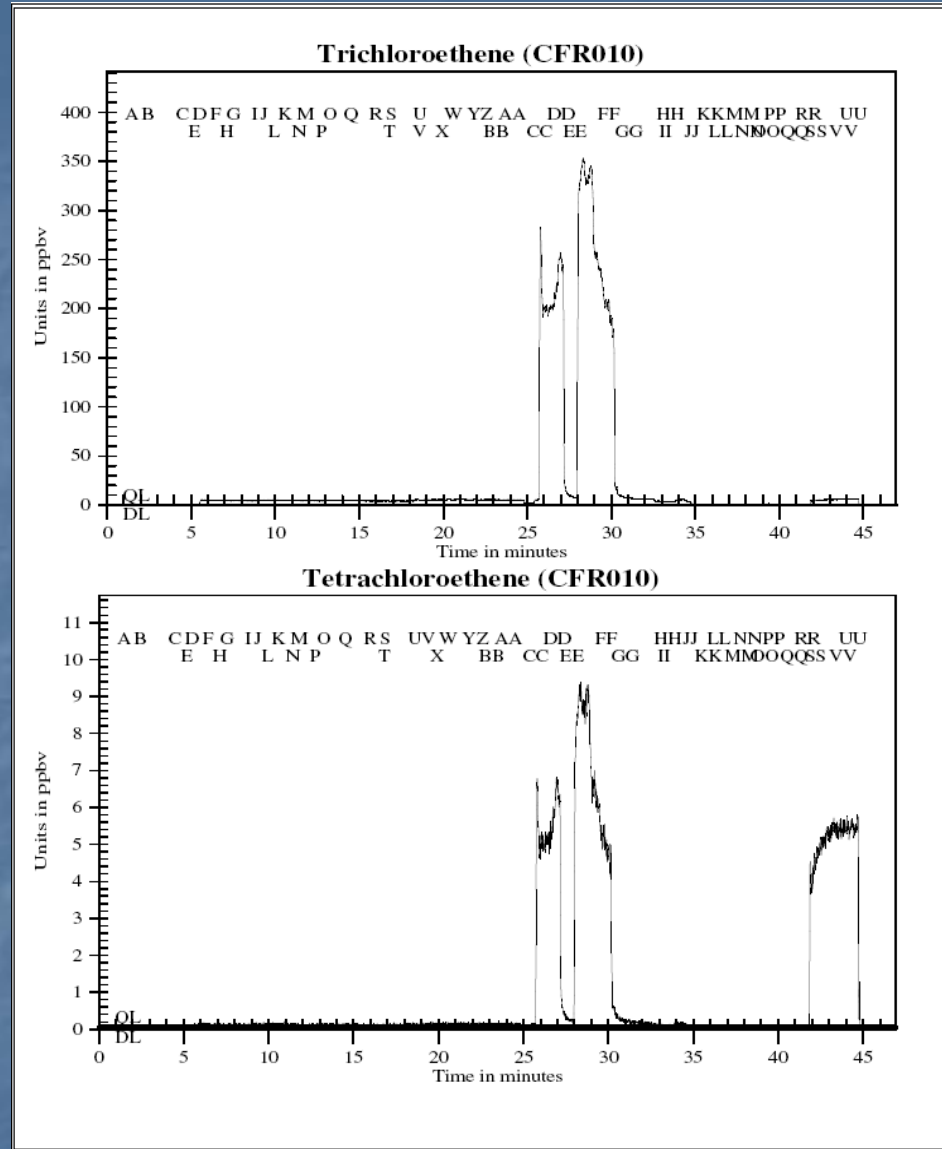
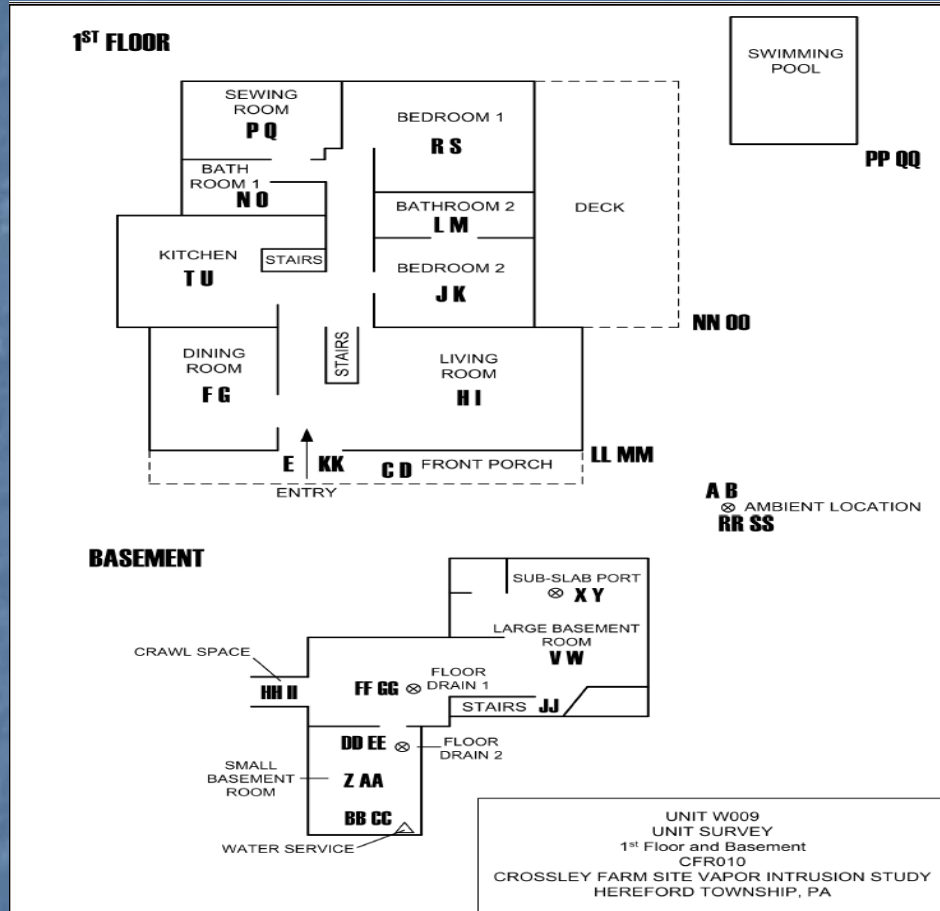
TCE Site
Region 3



Crossley Farm Site Satellite Overview



Region 3 - Trichloroethene Site



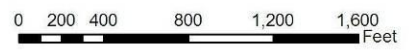
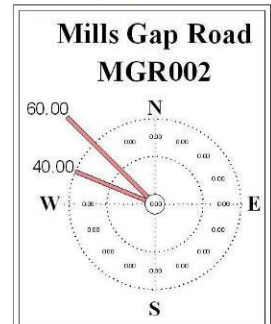
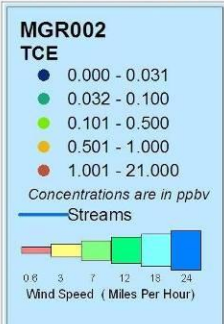
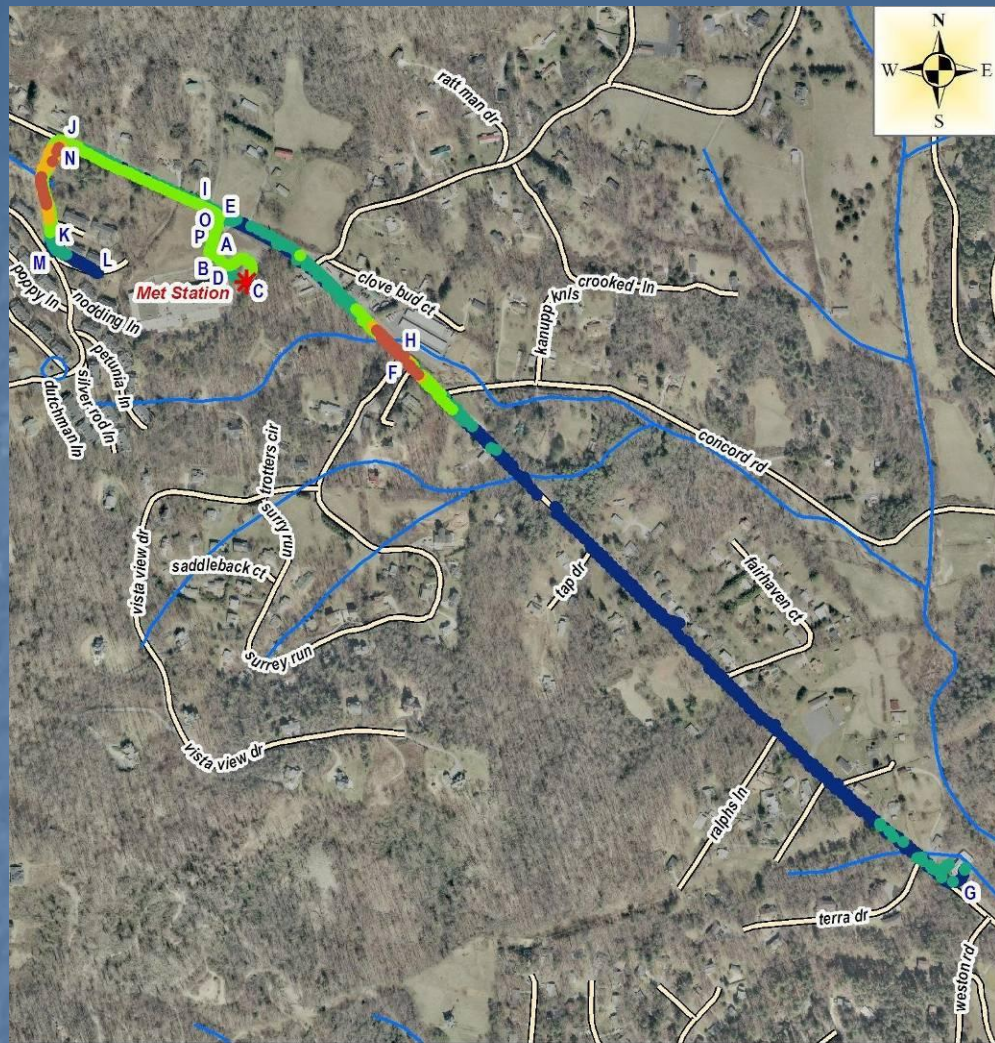
Region 3 - TCE and PCE Site

Monitoring For Fractured Bedrock Contributions

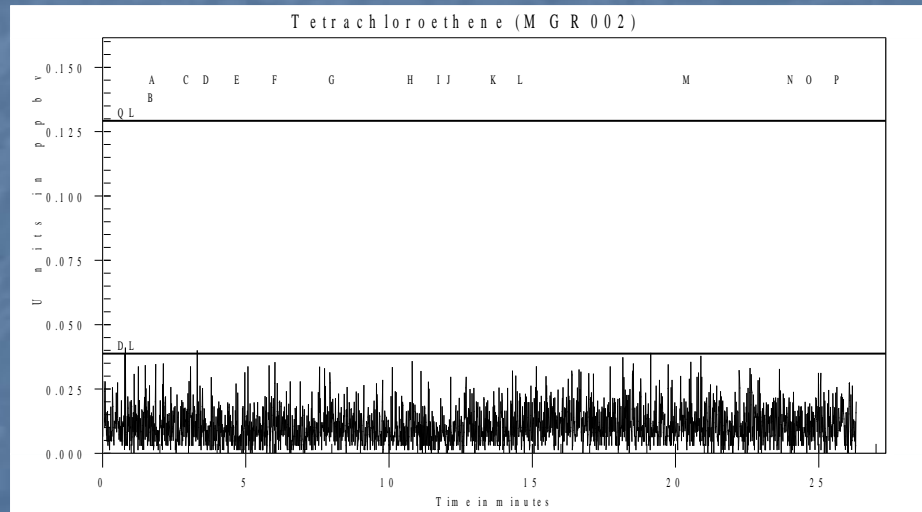
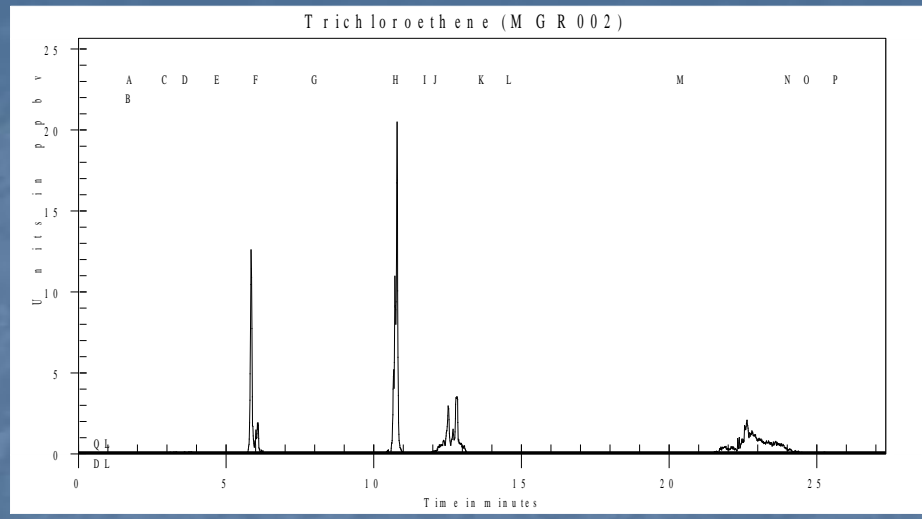
TCE Site
Region 4



Mills Gap Road Site Topographical Map



Mobile Monitoring at Mills Gap Rd
MGR002
Mills Gap Road
Asheville, NC

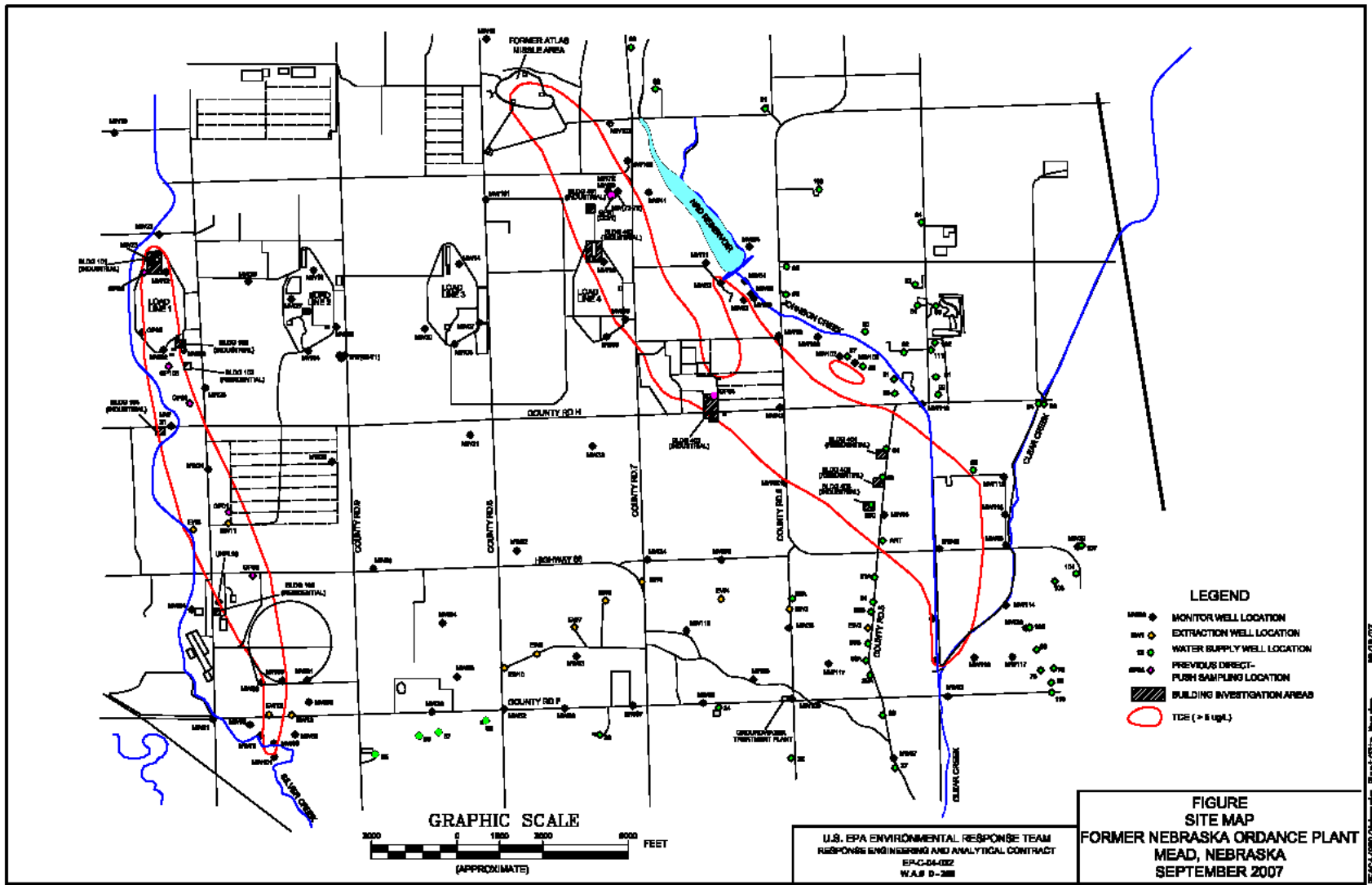


Mobile Monitoring Route

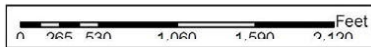
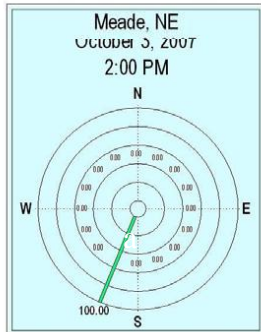
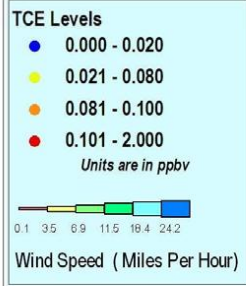
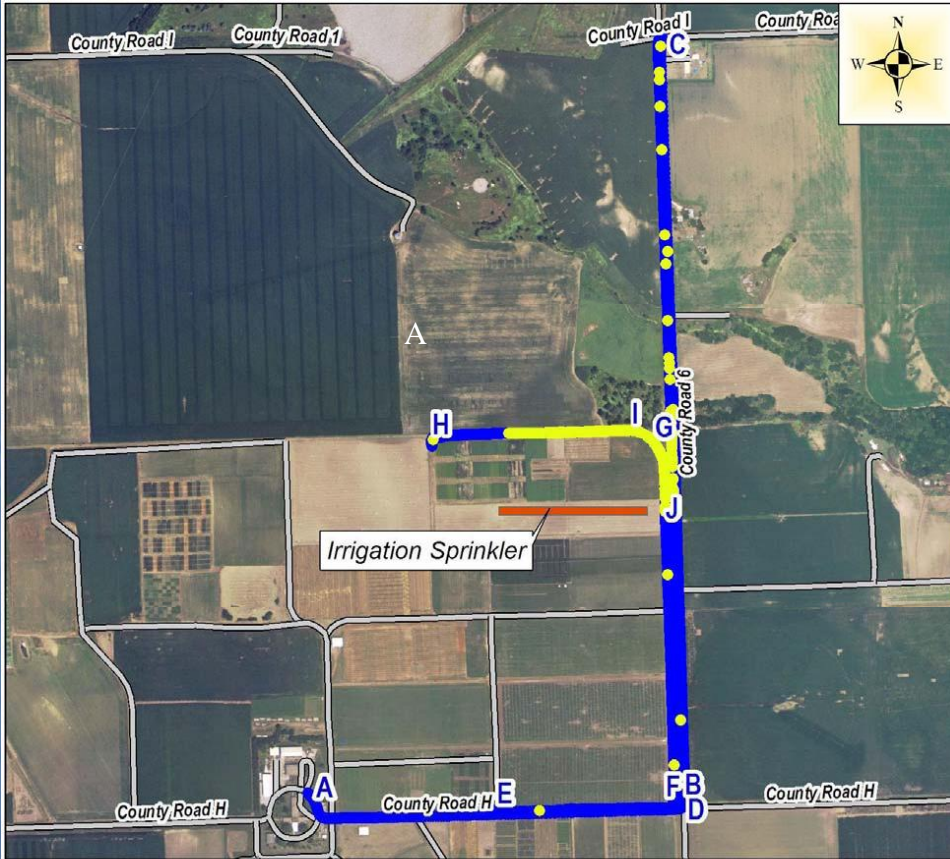
10 December 2007

Monitoring For Contributions From Activities Utilizing Contaminated Groundwater

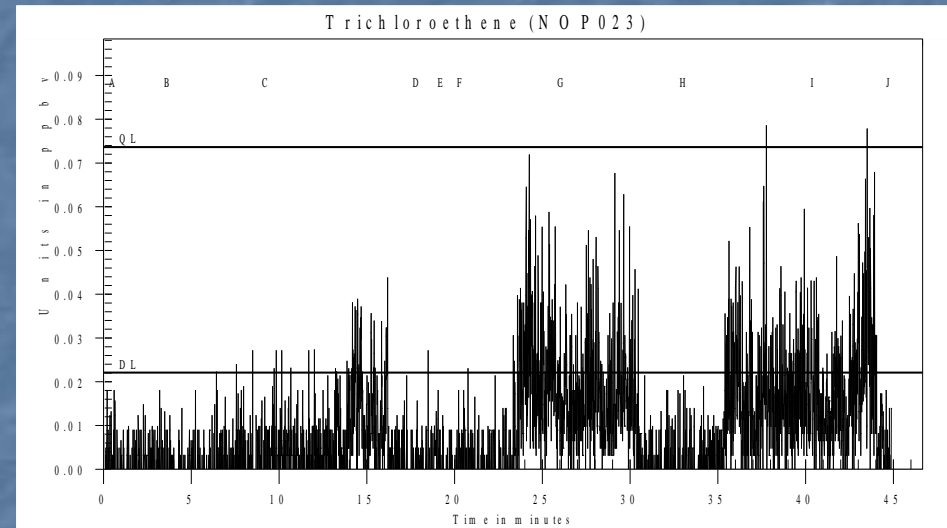
Chlorinated Contamination Site
Region 7



Site Map for Former Nebraska Ordnance Plant – Region 7-TCE Site



MOBILE MONITORING
NOP023
FORMER NEBRASKA ORDNANCE PLANT
MEAD, NE

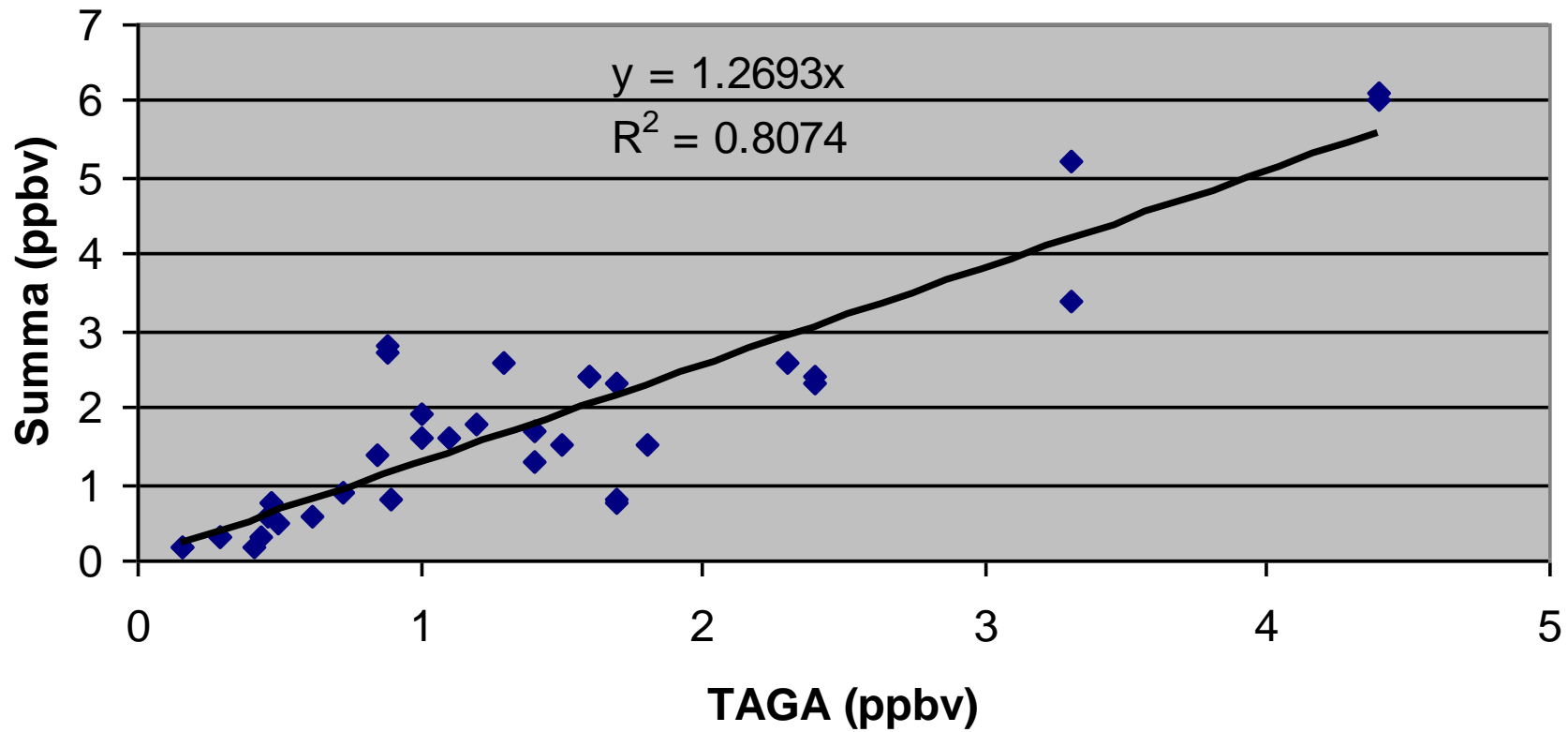


Mobile Monitoring Adjacent to an Active Irrigation Sprayer
Region 7 – TCE Site

INDOOR ANALYSIS

Comparison of the TAGA Triple Quadrupole Mass Spectrometer
Real-time Monitoring **1- Minute Average** Results to the Off-site
GC/MS Results of 6-Liter **24-Hour** Time-weighted-averaged
Summa Canister Samples

TCE TAGA vs Summa Data

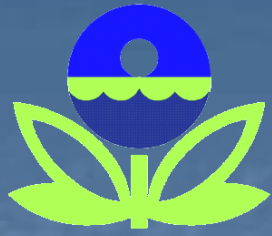


Hopewell Junction Site – Hopewell, NY
37 INDOOR LOCATIONS

Additional Information

ERT TAGA Website - <https://www.epa.gov/ert/environmental-response-team-trace-atmosphere-gas-analyzer-taga>

Video - https://www.ertvideo.org/content.aspx?video_id=7180



For further information concerning the scheduling, capabilities, and applications of the TAGA mobile laboratories, contact:

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E-mail - mickunas.dave@epa.gov.