

Site Investigation Issues

Federal Remediation Technology Roundtable
Washington D.C.
November 10, 2009

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US EPA/ERT



Lines of Evidence:

- Groundwater spatial (and vertical profiling, if appropriate) data with modeling
- 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

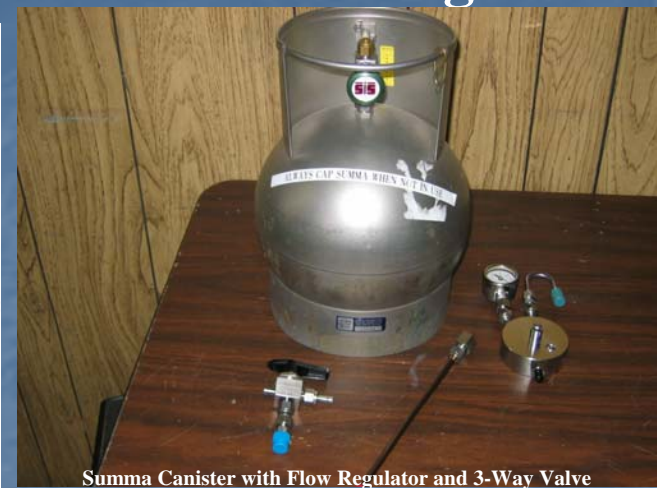


Membrane Interface Probe with Geoprobe



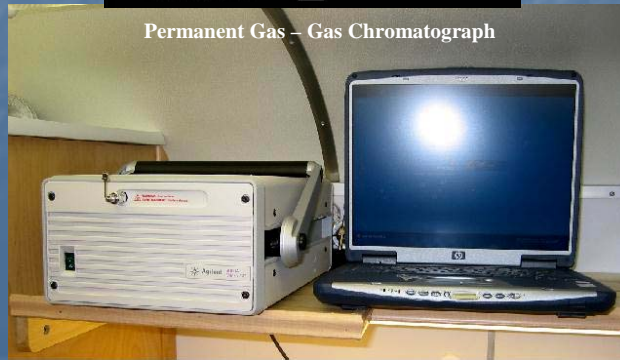
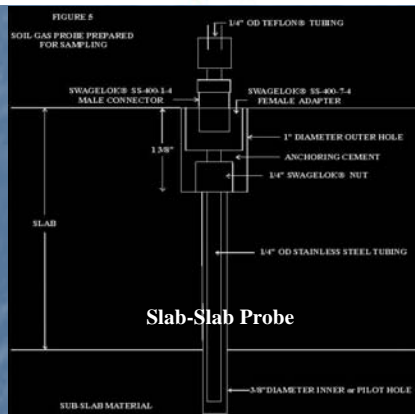
Drilling Operations

Soil Gas Spatial Concentrations (And Vertical Profiling, If Appropriate), Including Subslab, With Vertical Profiling



Sampling &

Analyses



Ambient, Crawlspace, And Inside Air Concentrations And Source Determinations



Ambient Air Sampling

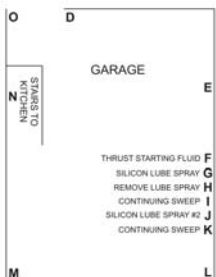


Crawlspace Air Sampling



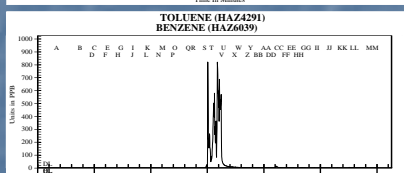
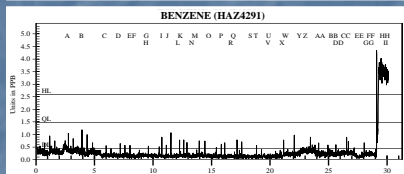
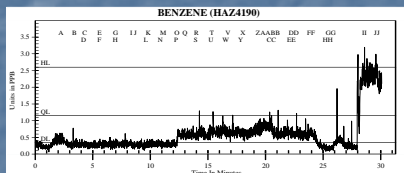
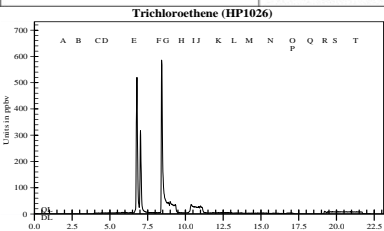
Indoor Air Sampling

INVESTIGATION Monitoring Lifestyle Sources

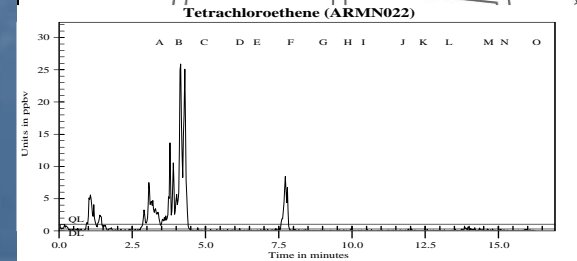
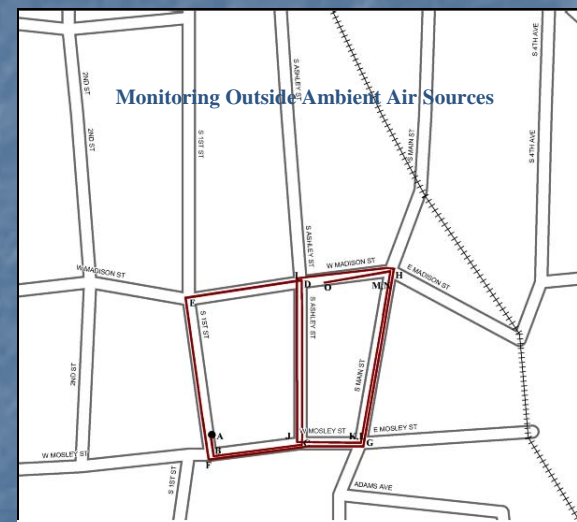
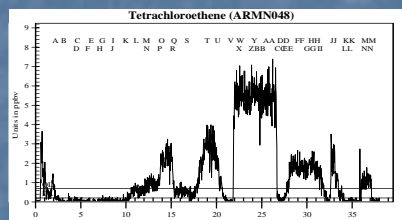
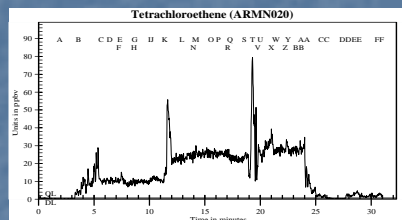


QR - AMBIENT
AB - ENTER
C - ENTER
P - EXIT

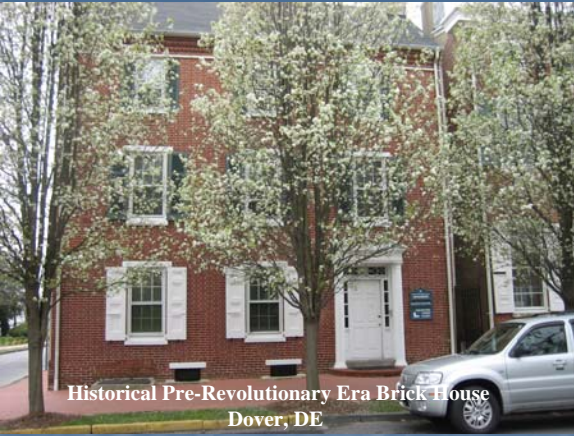
UNIT 010
UNIT INVESTIGATION
HP 1026
HOPEWELL PRECISION SITE
HOPEWELL JUNCTION, NY



MONITORING FOR
ACCIDENTAL OR INTENTIONAL
RELEASES



Building Construction And Conditions



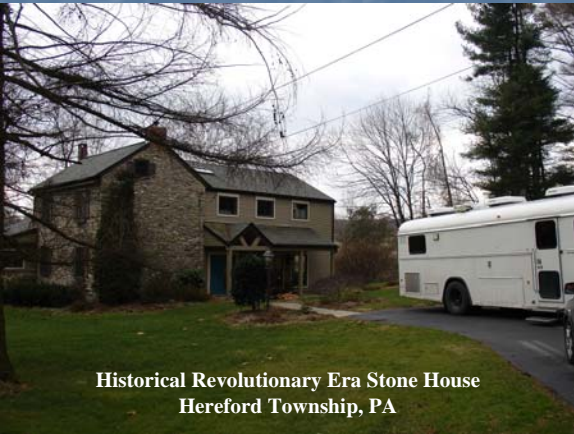
Historical Pre-Revolutionary Era Brick House
Dover, DE



Split-Level House
Hopewell, NY



Multi-Apartment Building
Ann Arbor, MI



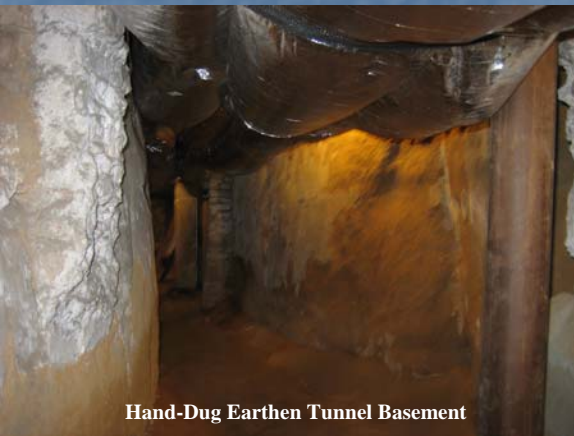
Historical Revolutionary Era Stone House
Hereford Township, PA



Single-story House with Crawlspace
San Antonio, TX



2-Story New Construction House
Hopewell, NY



Hand-Dug Earthen Tunnel Basement



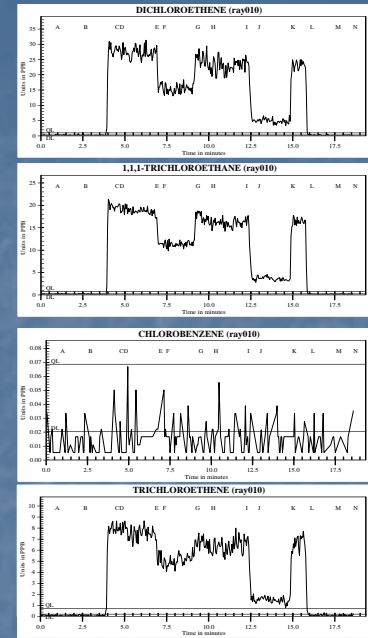
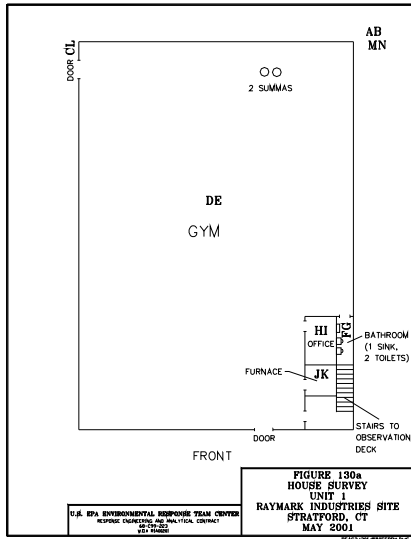
Stone-Walled Basement



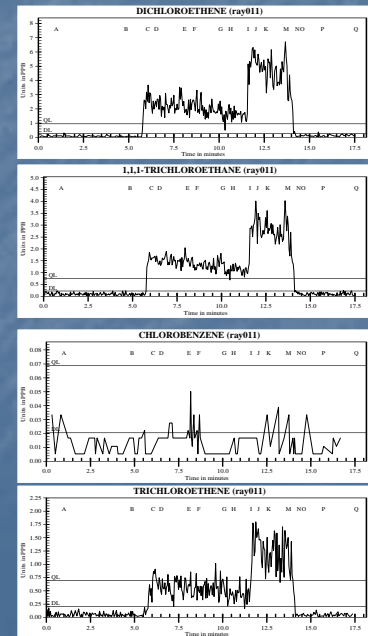
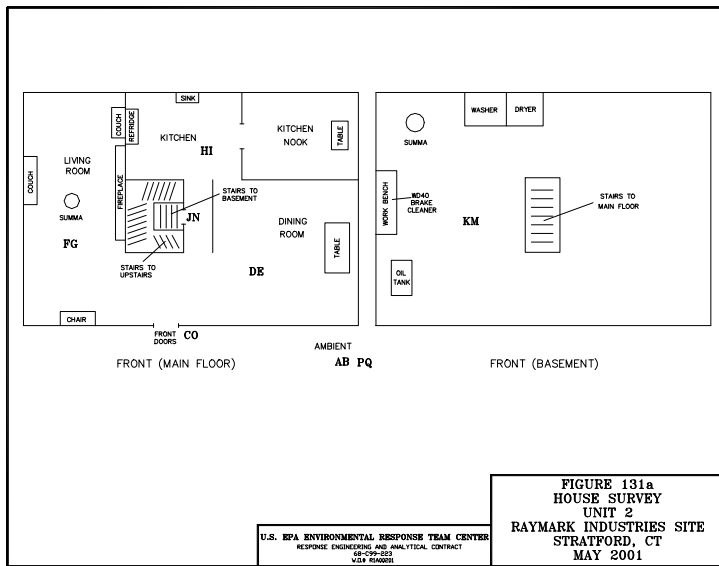
Rough Poured Cement Floor with Hand-Hewn Posts

Constituent Ratios

Children's Gymnasium



Residence Adjacent to the Gymnasium



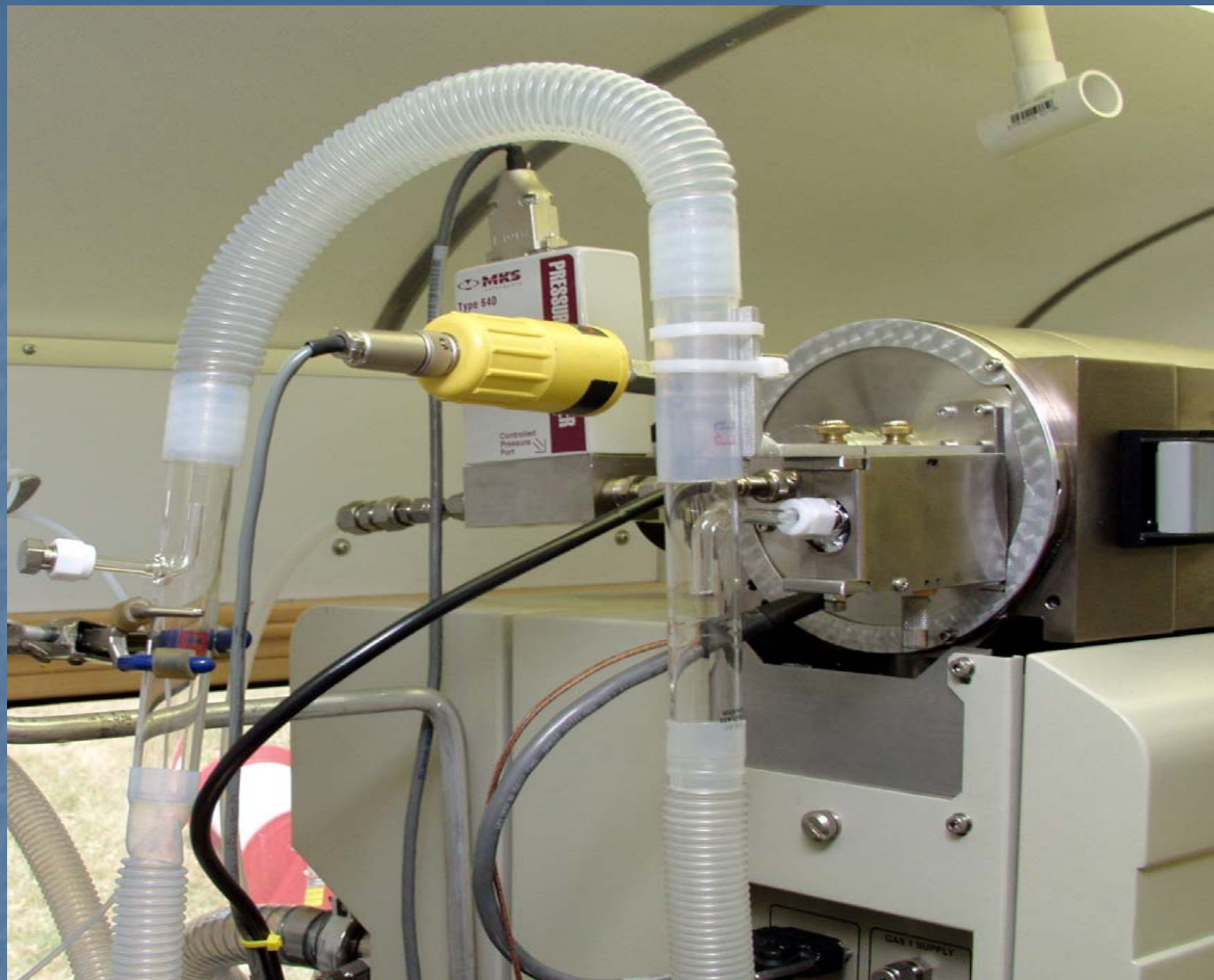
TAGA MOBILE LABORATORY



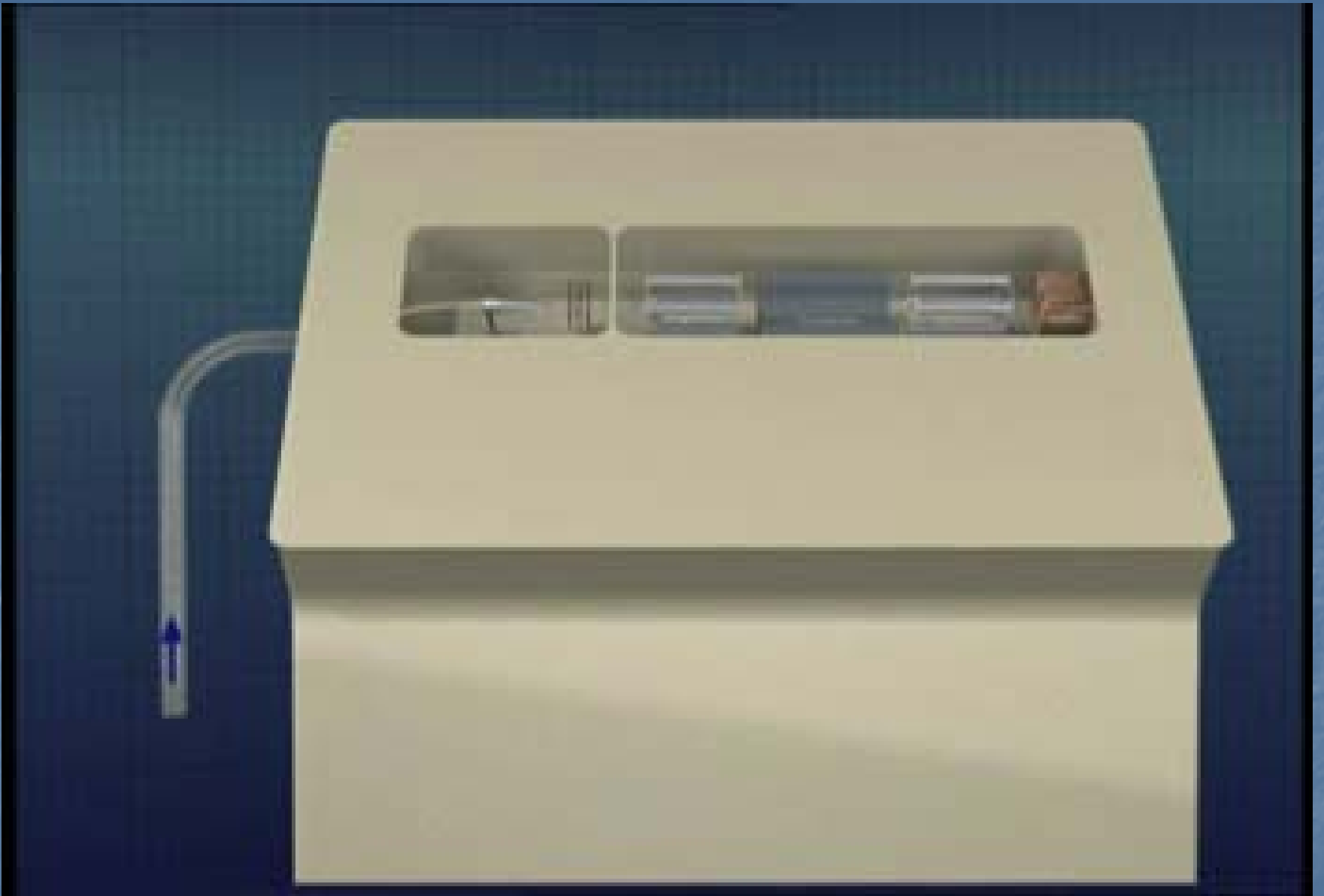
Trace Atmospheric Gas Analyzer (TAGA) Mobile Laboratory



Trace Atmospheric Gas Analyzer (TAGA)



Low Pressure Chemical Ionization (LPCI) Source



TAGA Operational Process



Gas Chromatograph with Concentrator for Volatiles



Gas Chromatograph for Permanent Gases



Driver and Passenger Seating with Monitor

**INVESTIGATIVE PROCESS TO DETERMINE
IF SUBSURFACE GAS IS IMPACTING**

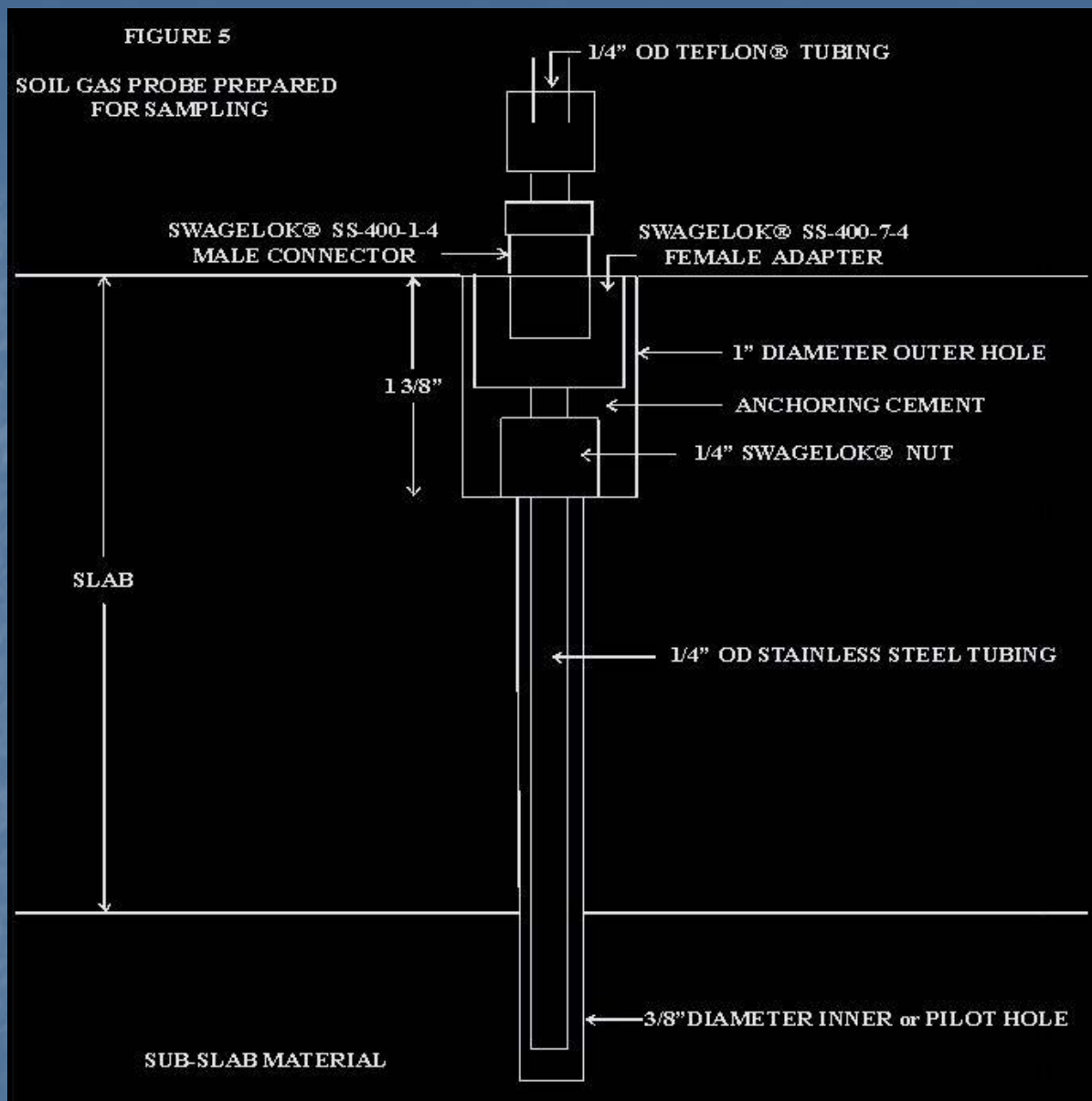
MONITORING AND SAMPLING STRATEGY

**1. INITIAL SAMPLING
Subslab Location**

**2. INITIAL TAGA MONITORING
Ambient Air Investigation
Lifestyle Source Investigation
Subsurface Source Investigation**

**3. SUBSEQUENT SUMMA CANISTER SAMPLING
Subslab Location
Basement Location
First Floor Location
Ambient Air Location**

INITIAL SUBSLAB SAMPLING



Subslab Sampling Probe



Drilling



Placement and Cementing of the Probe

INITIAL TAGA MONITORING

MONITORING FOR SUBSURFACE INTRUSION SOURCE

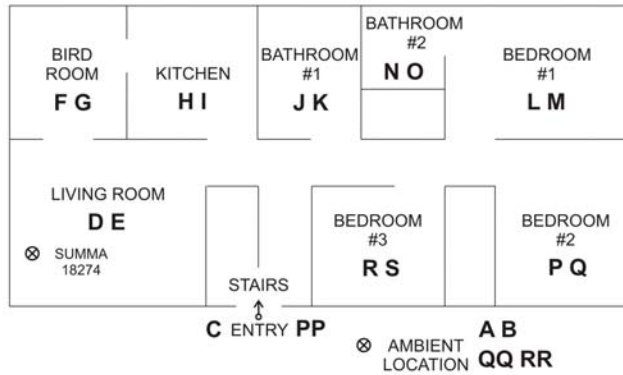
TCE Site

Region 2

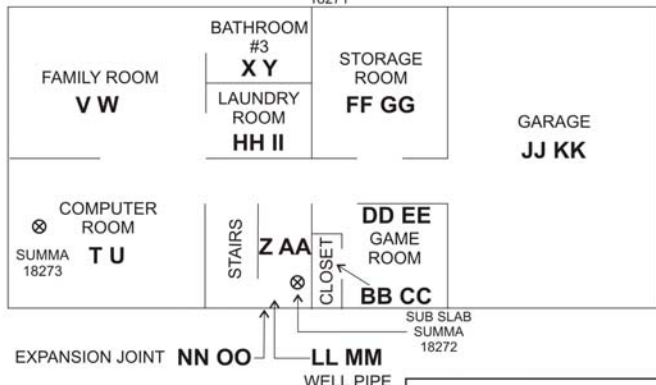


Region 2 - TCE Site

1st FLOOR

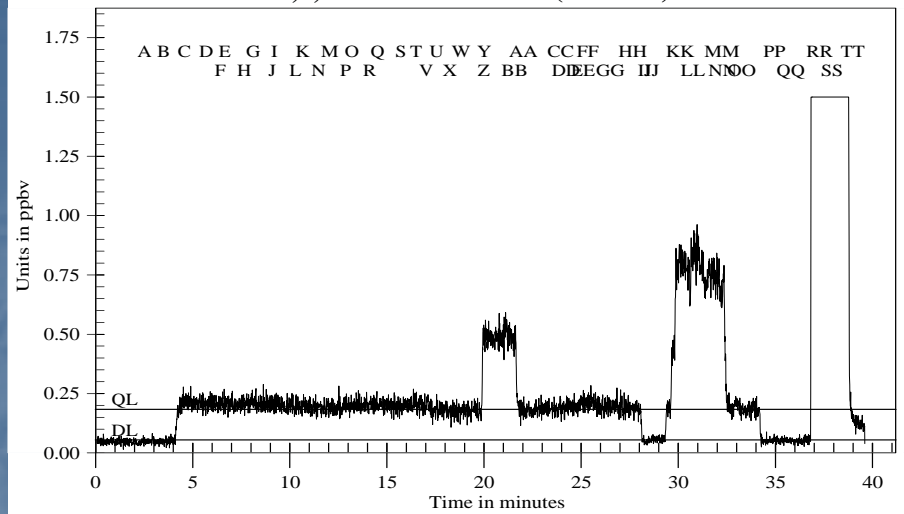


BASEMENT

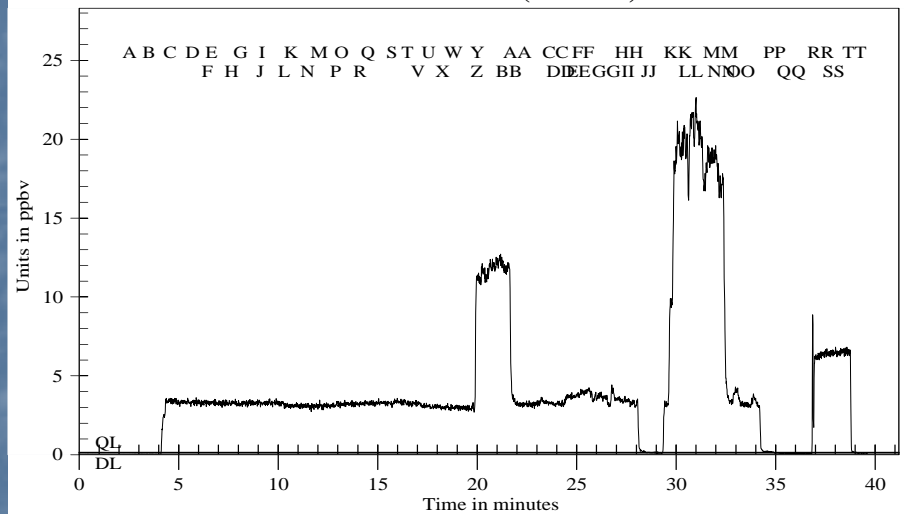


UNIT 001
 UNIT SURVEY
 1st Floor and Basement
 HP 1003
 HOPEWELL PRECISION SITE
 HOPEWELL JUNCTION, NY

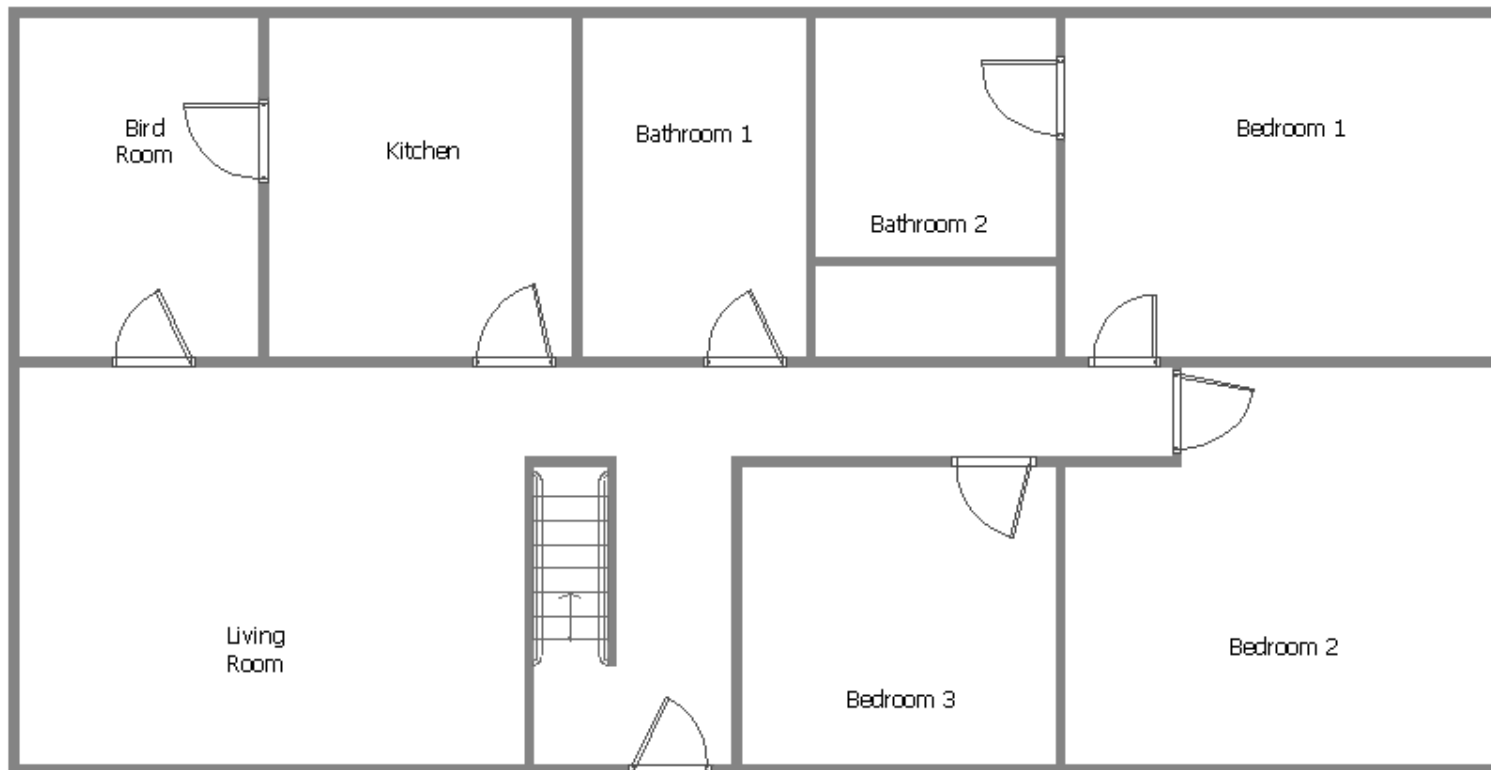
1,1,1-Trichloroethane (HP1003)



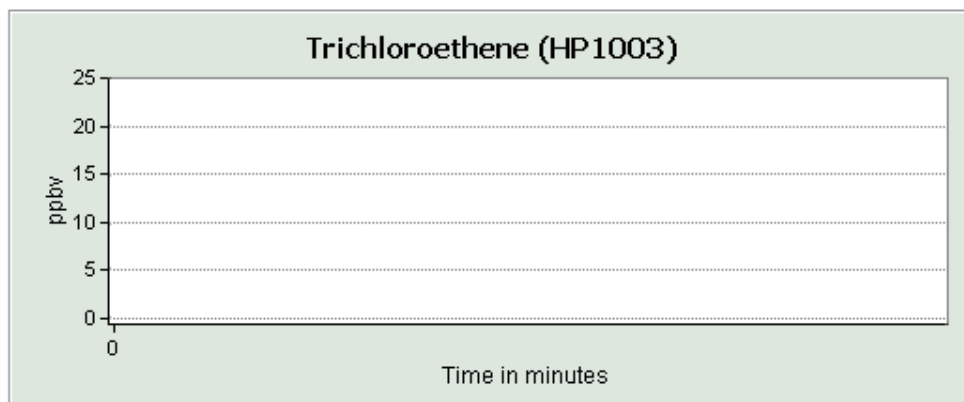
Trichloroethene (HP1003)



Residence Schematics and Compound Concentrations



1/26/2004 9:17:03 AM



Legend

TCE Concentration (ppbv)

- 0.00 - 1.64
- 1.65 - 4.78
- 4.79 - 8.87
- 8.88 - 15.02
- 15.03 - 22.65

**MONITORING FOR SIGNATURE
COMPOUNDS TO DETERMINE SUBSURFACE
GAS INTRUSION
Chlorinated Solvent Site
Region 1**

SELECTION OF PARENT/DAUGHTER IONS

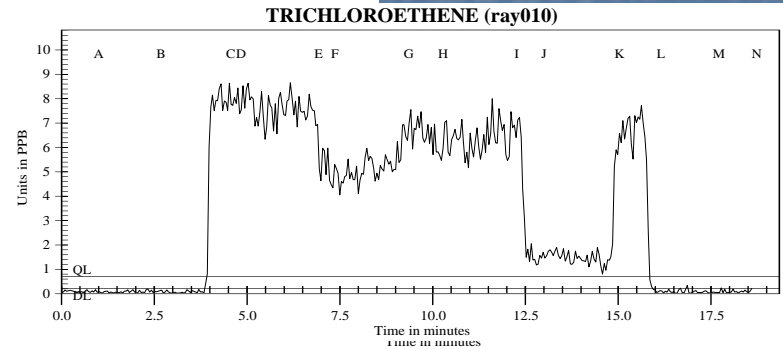
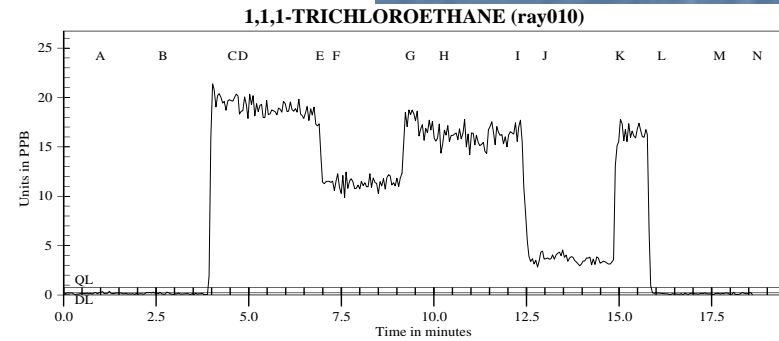
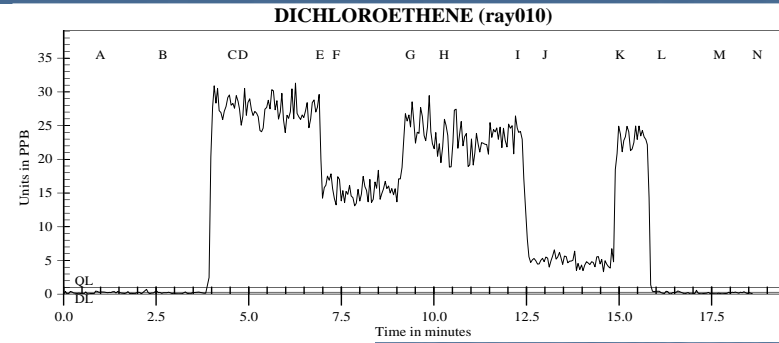
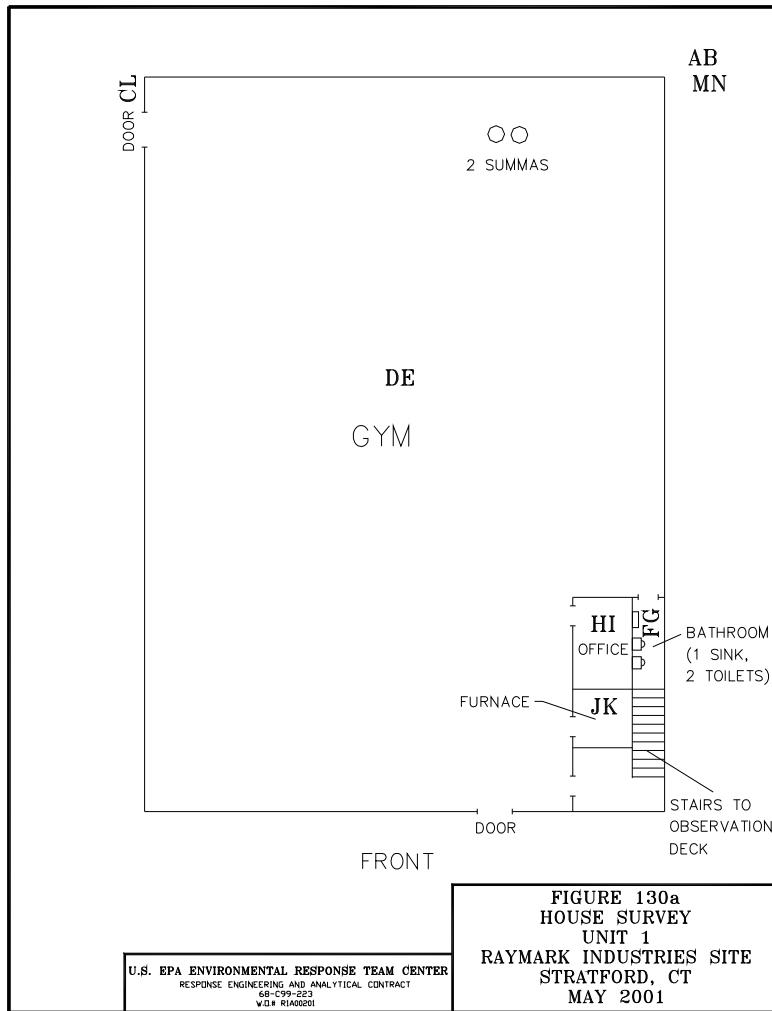
Compounds

Parent/Daughter Masses

Vinyl Chloride	62/27
Vinyl Chloride	64/27
Benzene	78/39
Benzene	78/52
Toluene	92/39
Toluene	92/51
1,1-Dichloroethene	96/61
1,1-Dichloroethene	98/61
1,1-Dichloroethene	98/63
1,1,1-Trichloroethane	97/61
1,1,1-Trichloroethane	99/61
1,1,1-Trichloroethane	99/63
Chlorobenzene	112/77
Chlorobenzene	114/77
Trichloroethene	130/95
Trichloroethene	132/95
Trichloroethene	132/97

Unit 1

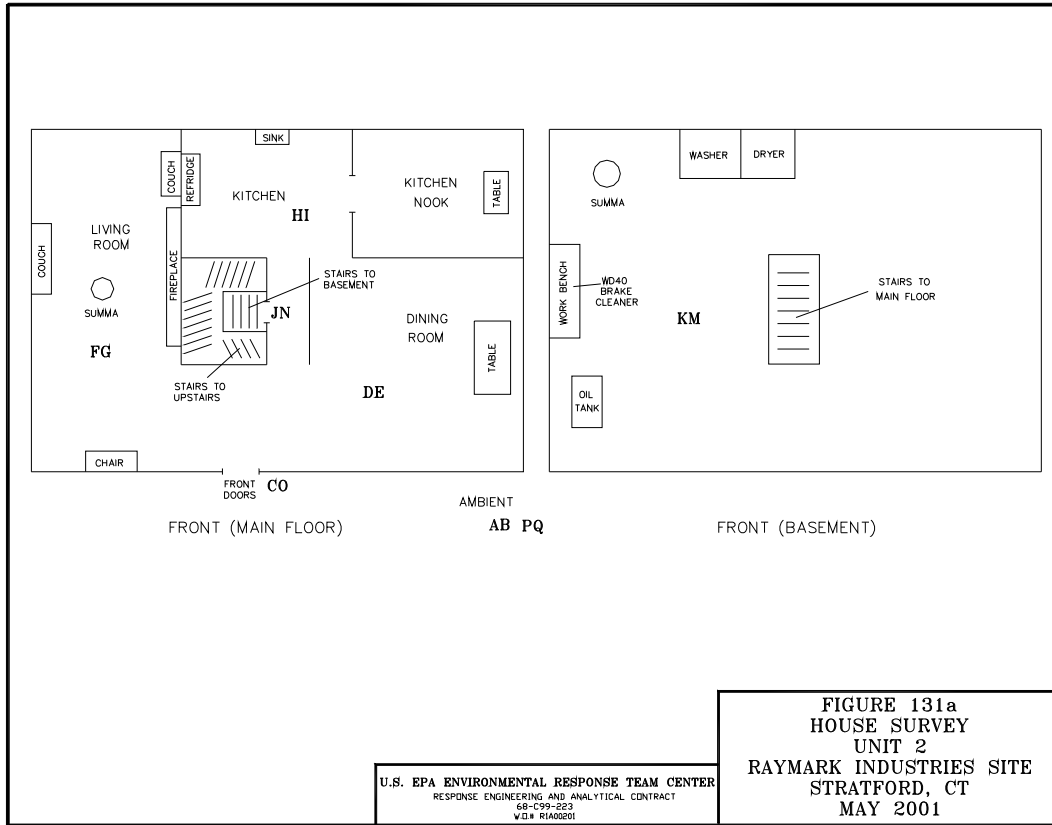
Gymnastic Facility For Children



Building Schematic and Compound Concentrations

Unit 2

Residence Adjacent to the Gymnastic Facility

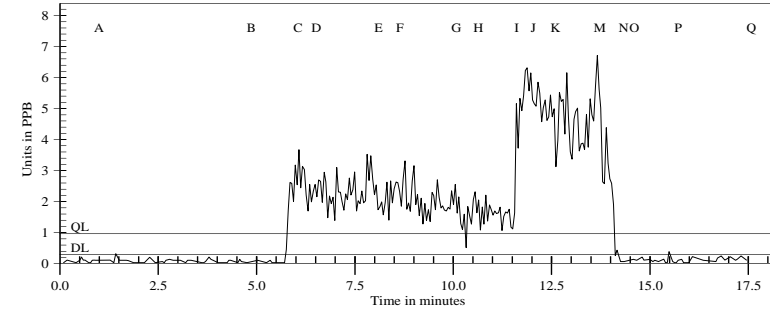


U.S. EPA ENVIRONMENTAL RESPONSE TEAM CENTER
 RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
 68-C99-223
 WQ# R1A00201

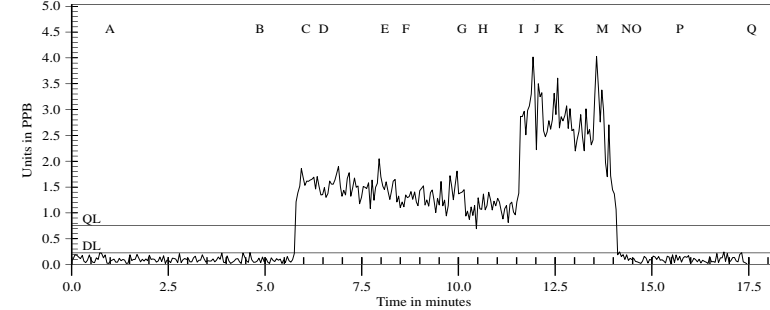
FIGURE 131a
 HOUSE SURVEY
 UNIT 2
 RAYMARK INDUSTRIES SITE
 STRATFORD, CT
 MAY 2001

2012/07/05/FARR/CUNIT2/DMG 3/19/01

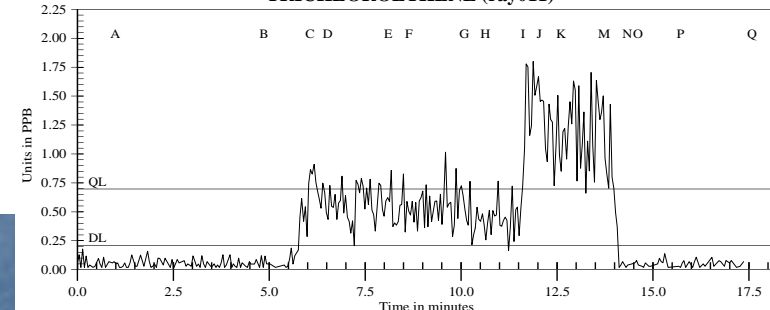
DICHLOROETHENE (ray011)



1,1,1-TRICHLOROETHANE (ray011)



TRICHLOROETHENE (ray011)



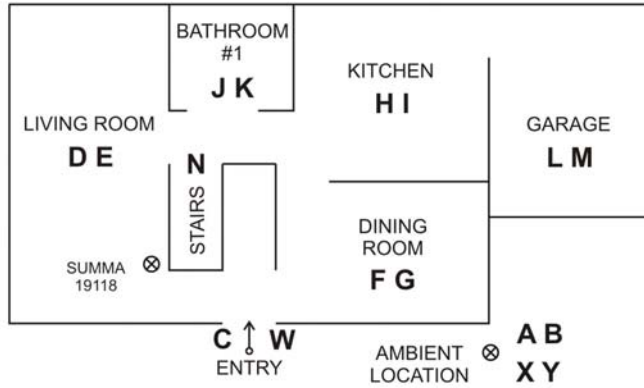
Residence Schematic and Compound Concentrations

MONITORING FOR LIFESTYLE SOURCES
TCE Site
Region 2

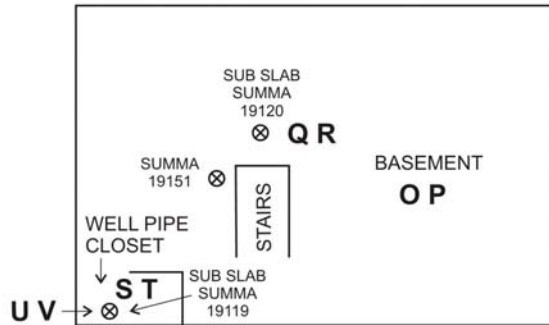


Region 2 - TCE Site

1st FLOOR

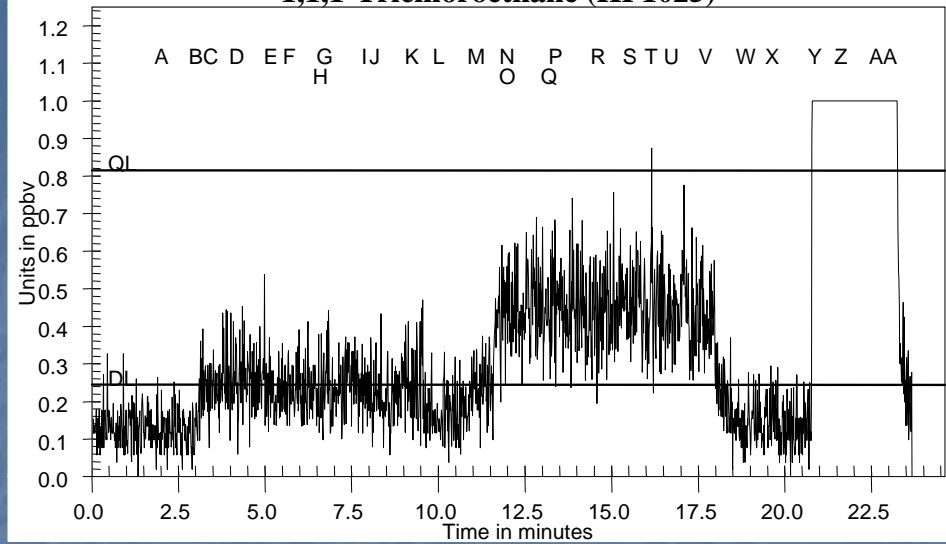


BASEMENT

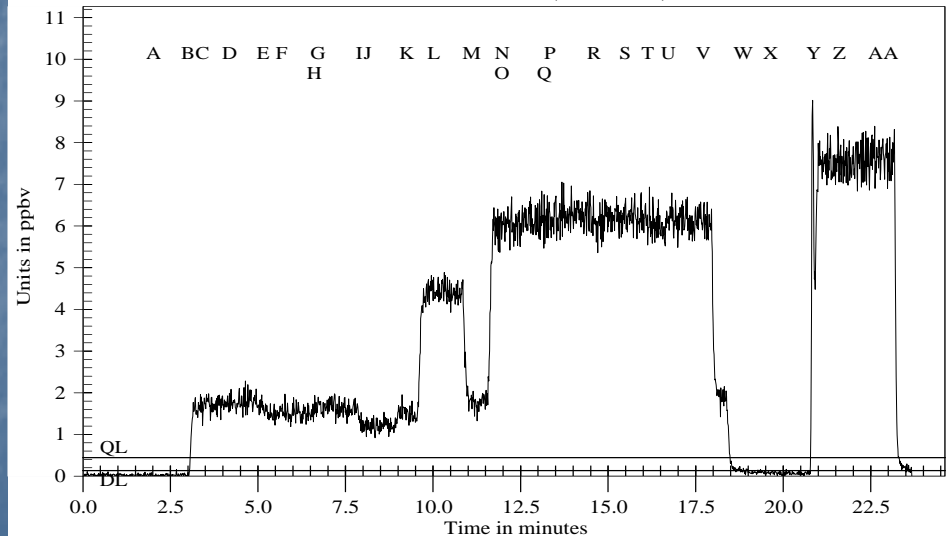


UNIT 010
 UNIT SURVEY
 1st Floor and Basement
 HP 1025
 HOPEWELL PRECISION SITE
 HOPEWELL JUNCTION, NY

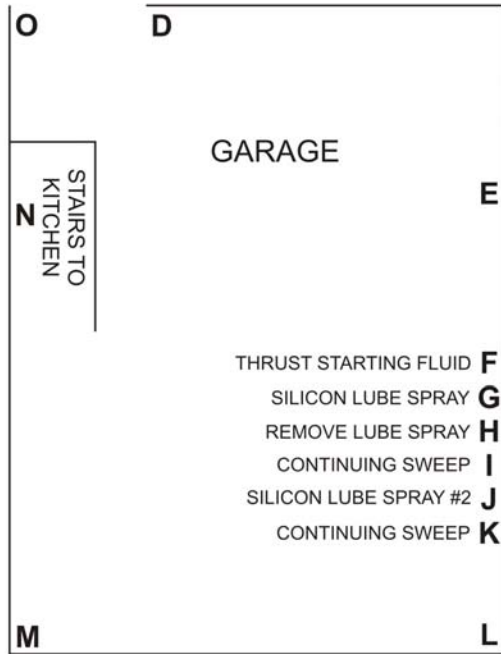
1,1,1-Trichloroethane (HP1025)



Trichloroethene (HP1025)



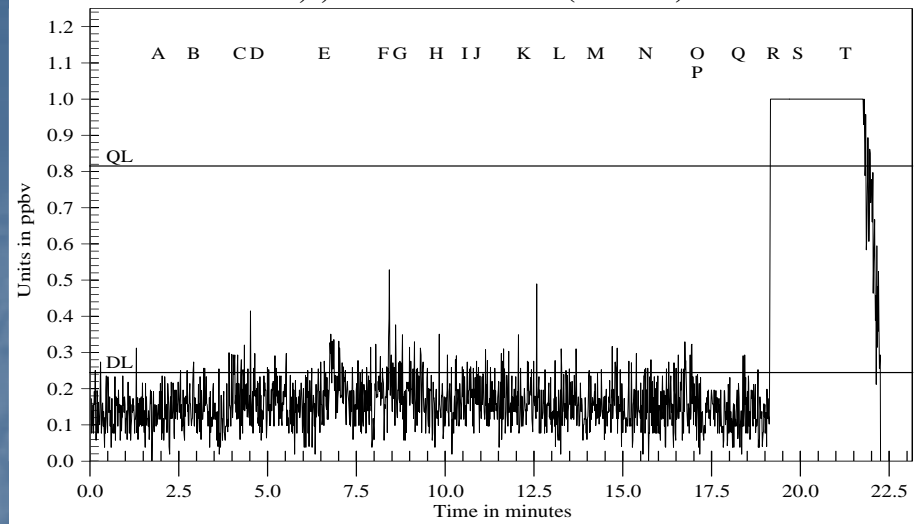
INVESTIGATION



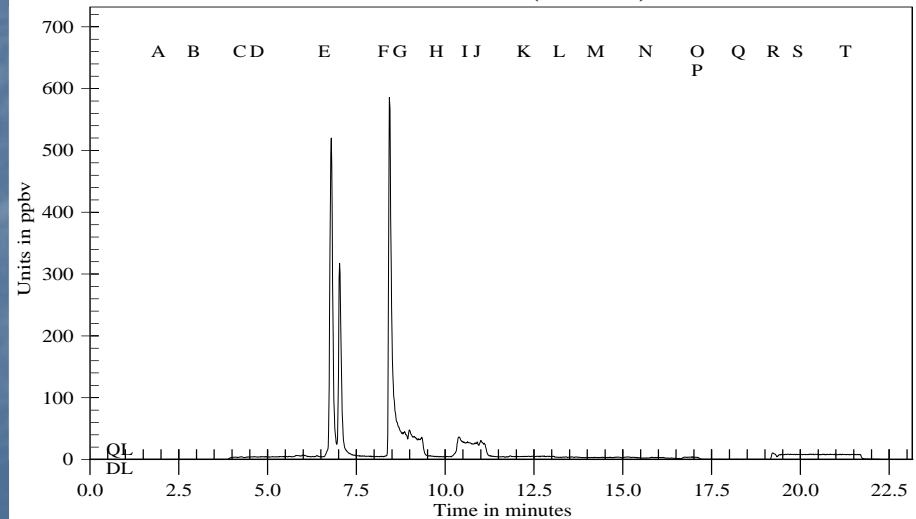
QR - AMBIENT
AB
C - ENTER
P - EXIT

UNIT 010
 UNIT INVESTIGATION
 HP 1026
 HOPEWELL PRECISION SITE
 HOPEWELL JUNCTION, NY

1,1,1-Trichloroethane (HP1026)



Trichloroethene (HP1026)



**MONITORING FOR ACCIDENTAL OR
INTENTIONAL RELEASES**

Gasoline Spill Site

Region 3

1st

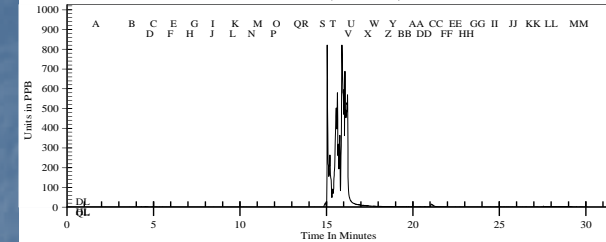
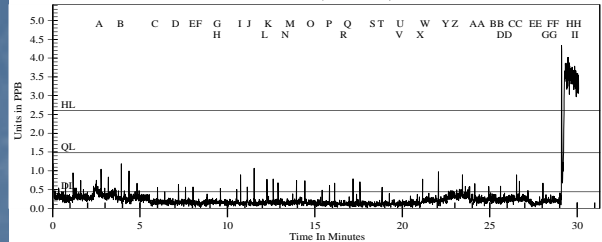
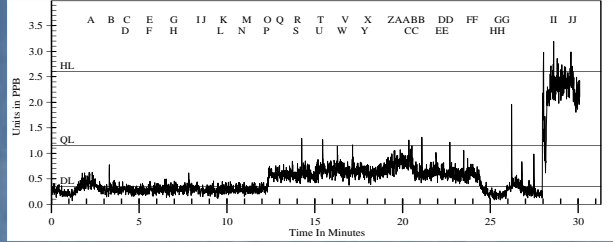
2nd

3rd

BENZENE (HAZ4190)

BENZENE (HAZ4291)

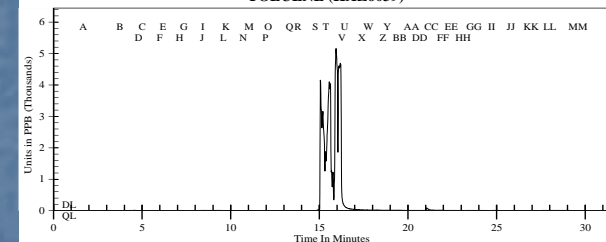
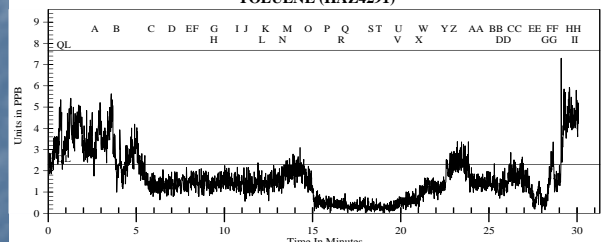
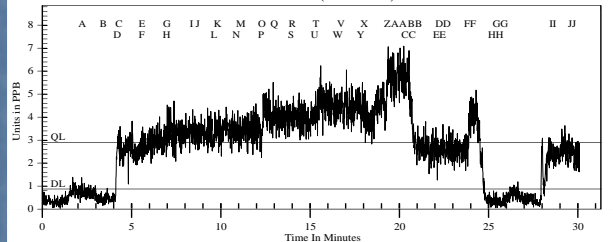
BENZENE (HAZ6039)



TOLUENE (HAZ4190)

TOLUENE (HAZ4291)

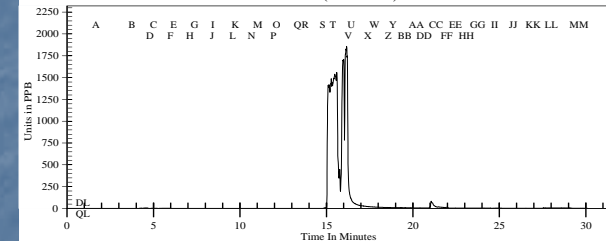
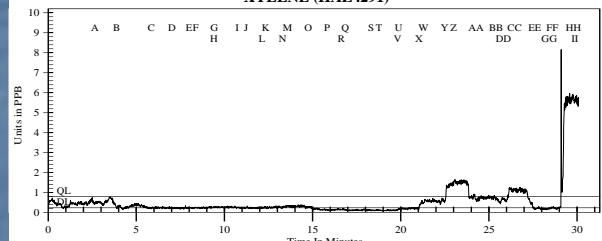
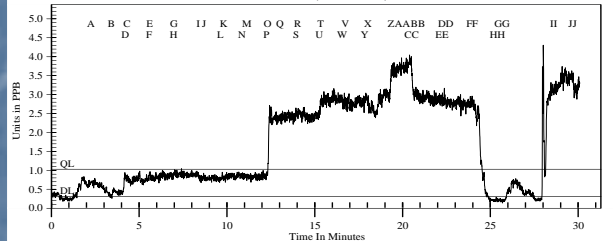
TOLUENE (HAZ6039)



XYLENE (HAZ4190)

XYLENE (HAZ4291)

XYLENE (HAZ6039)



Benzene < 1.0 PPBV

Benzene < 1.0 PPBV

Benzene > 900 PPBV

Benzene, Toluene and Xylene Concentrations

**MONITORING FOR METEOROLOGICAL
EFFECTS
TCE Site
Region 3**

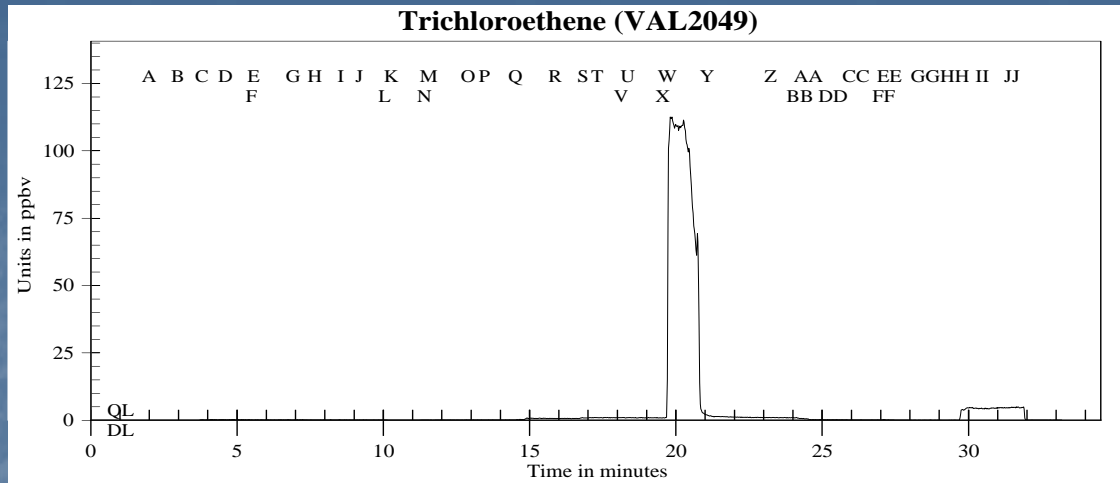


Region 3 - TCE Site

1ST

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

Wet Sumps

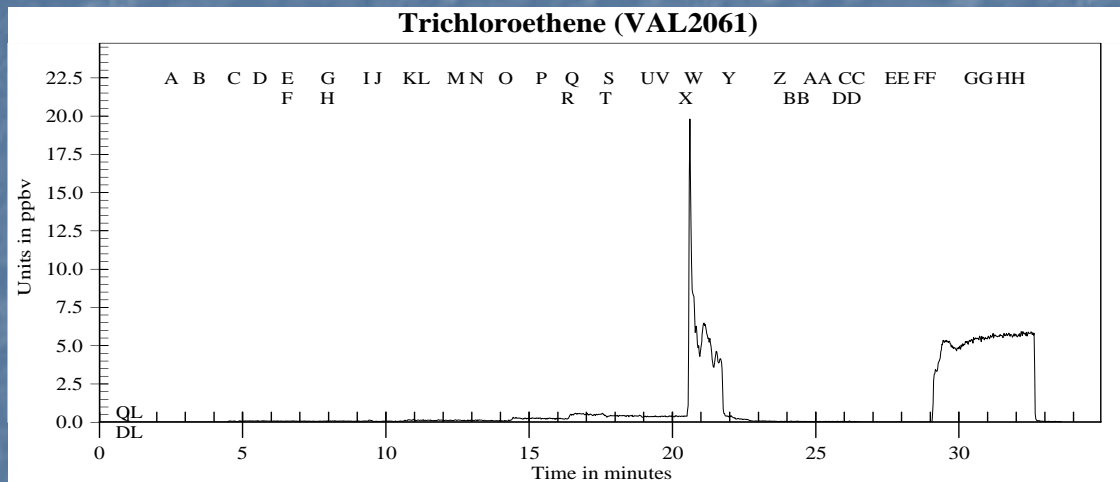


~ 120 PPBV

2ND

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

Dry Sumps



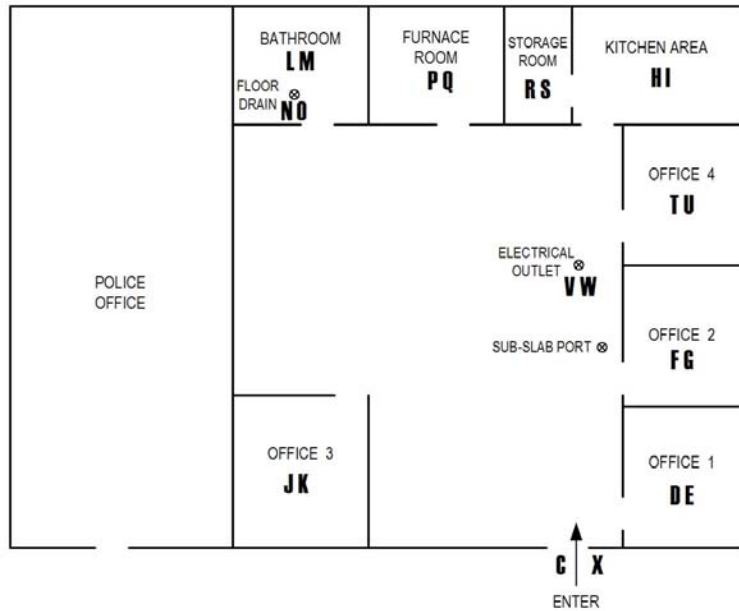
~21 PPBV

Trichloroethene Concentrations in the Sump Area

MONITORING FOR CONTRIBUTIONS FROM ATTACHED FACILITIES

Solvent Site

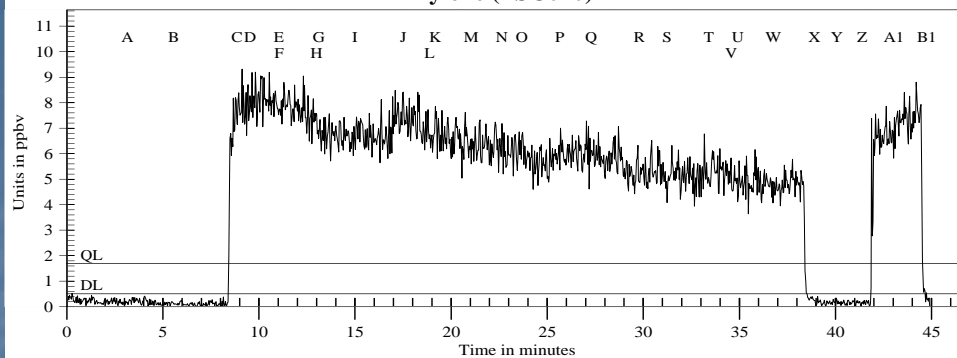
Region 6



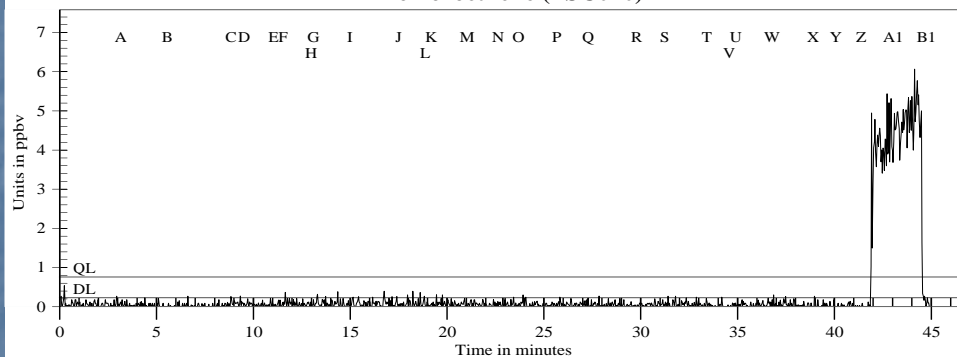
AMBIENT LOCATION
 ⊗ AB
 ⊗ YZ

UNIT 004 SURVEY ONE
 PSC010
 PARKER SOLVENTS COMPANY SITE
 LITTLE ROCK, ARKANSAS

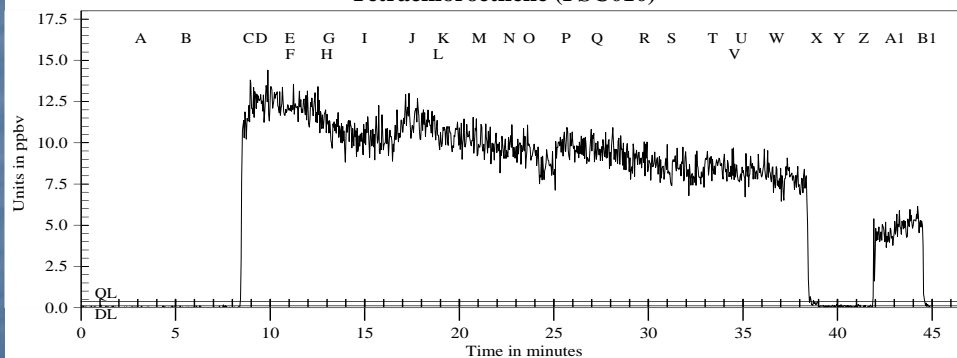
Xylene (PSC010)



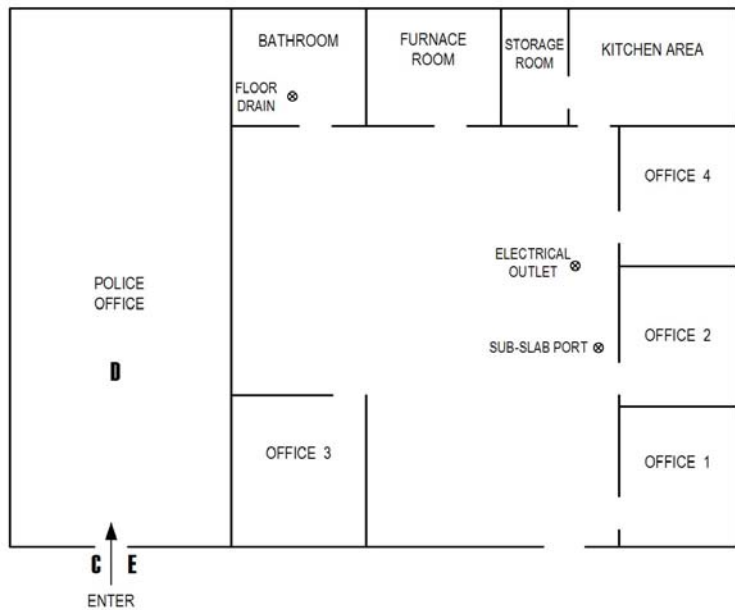
Trichloroethene (PSC010)



Tetrachloroethene (PSC010)



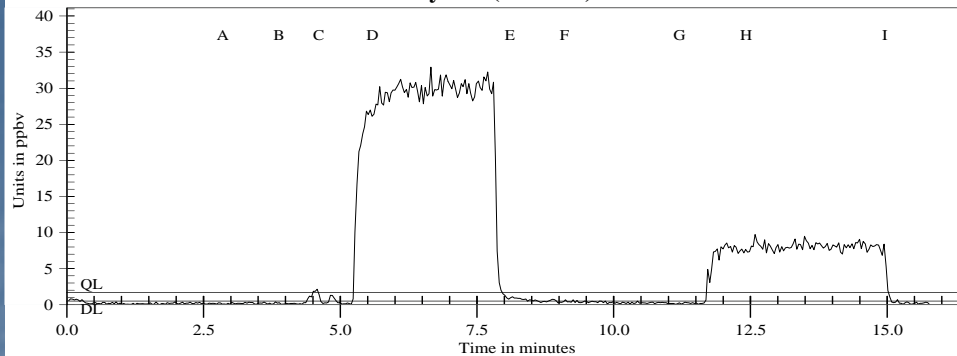
Building Schematics and Compound Concentrations



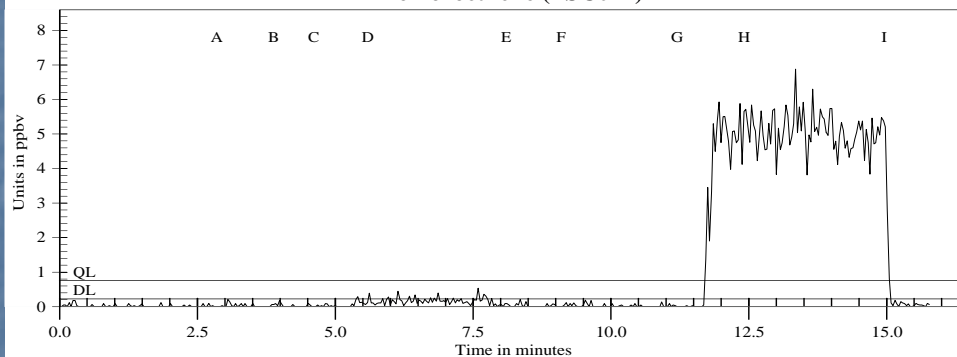
AMBIENT
LOCATION
⊗
⊙

UNIT 004 SURVEY TWO
PSC011
PARKER SOLVENTS COMPANY SITE
LITTLE ROCK, ARKANSAS

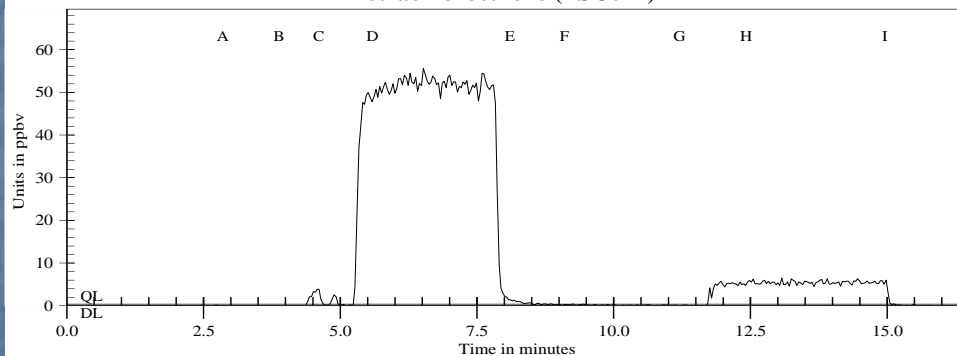
Xylene (PSC011)



Trichloroethene (PSC011)

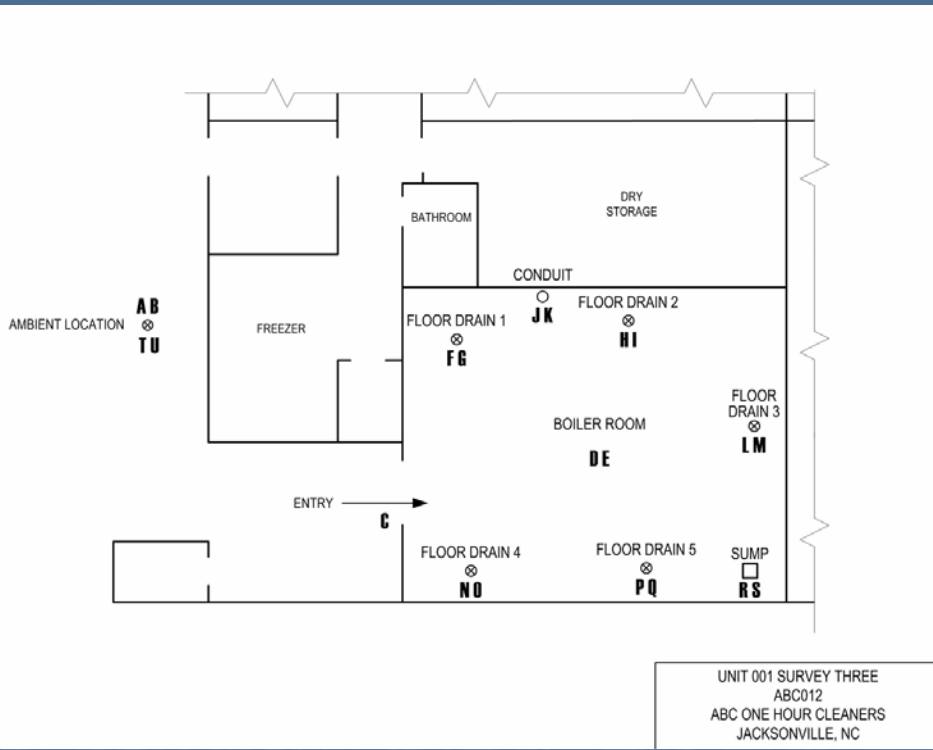


Tetrachloroethene (PSC011)

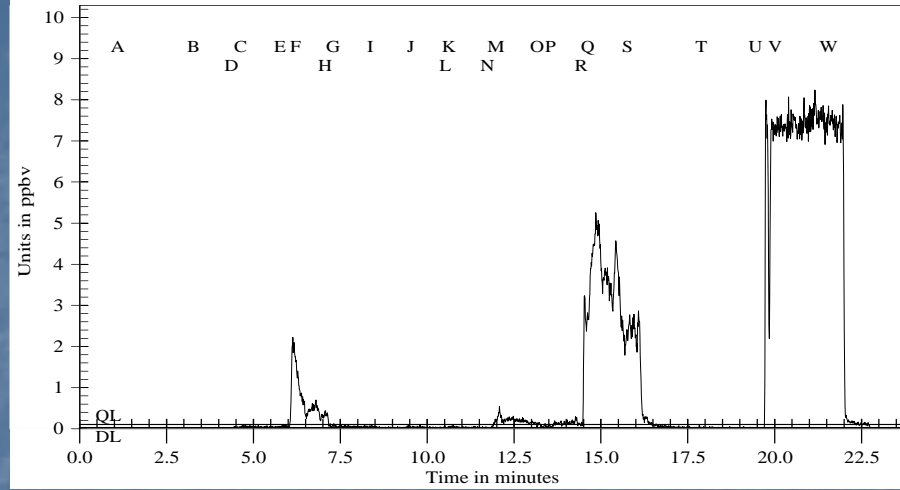


Building Schematic and Compound Concentrations

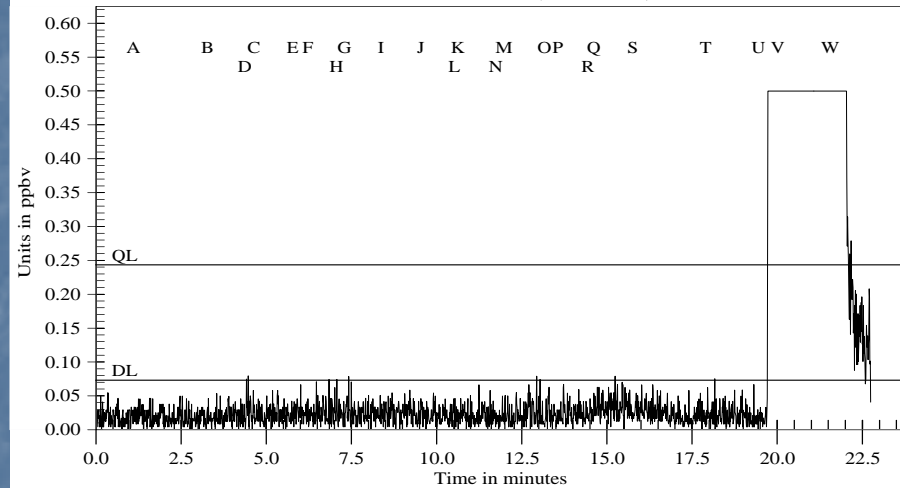
**MONITORING FOR CONTRIBUTIONS FROM
SELF-POLLUTING OPERATIONS AT THE
MARINE CORPS BASE CAMP LEJEUNE, NC**



Trichloroethene (ABC012)



Tetrachloroethene (ABC012)



Tarawa Terrace School - Marine Corps Base Camp Lejeune, NC

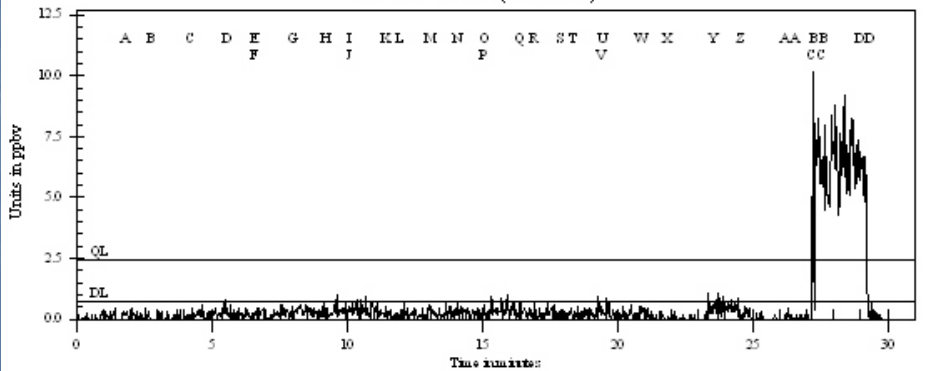
**MONITORING FOR CONTRIBUTIONS FROM
VAPOR INTRUSION AT THE FORMER NAVAL
AIR STATION MOFFETT FIELD, CA**



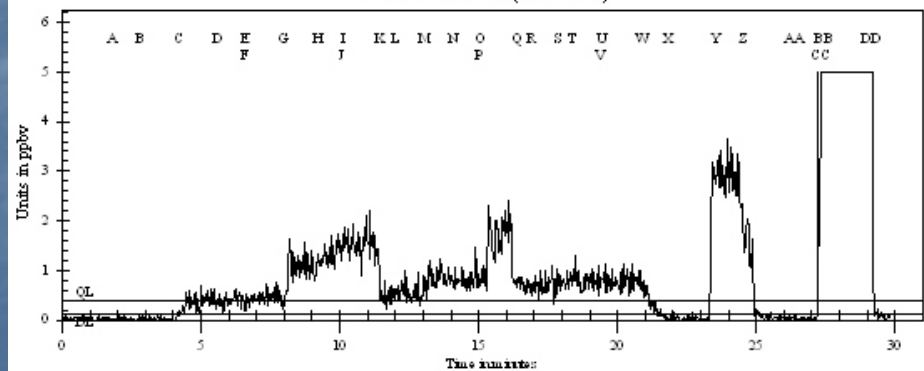
U.S. EPA ENVIRONMENTAL RESPONSE TEAM
 RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
 EPA-C-04-032
 W.A.# 0-152

UNIT 020
 UNIT SURVEY
 FIRST FLOOR
 MAS021
 MOFFETT AIR
 MT. VIEW, CA

Dichloroethene (MAS021)



Trichloroethene (MAS021)



**MONITORING FOR CONTRIBUTIONS FROM
VAPOR INTRUSION AT THE FORMER
RARITAN ARSENAL, NJ**

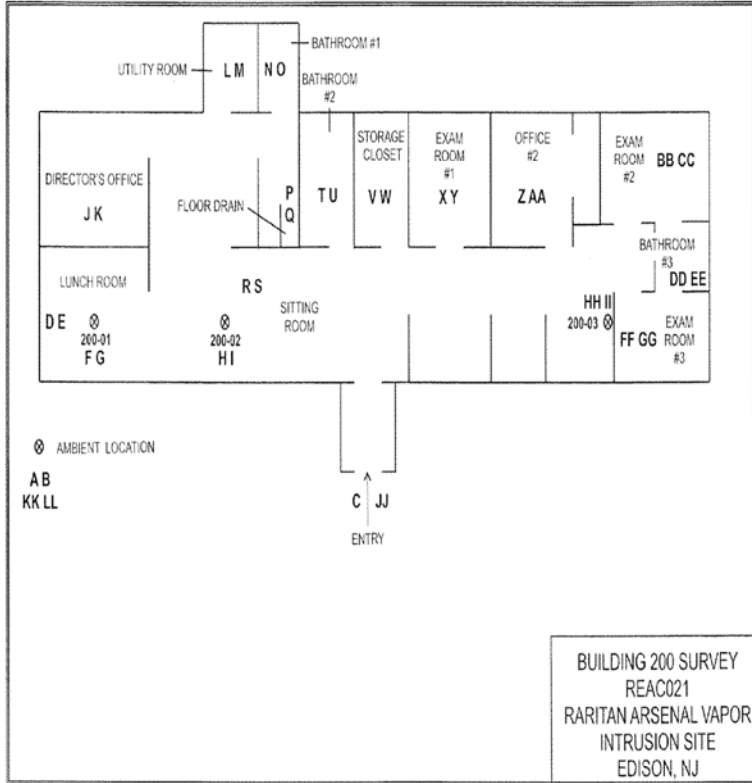


Figure 5a Building 200 Survey Floor Plan, REAC021

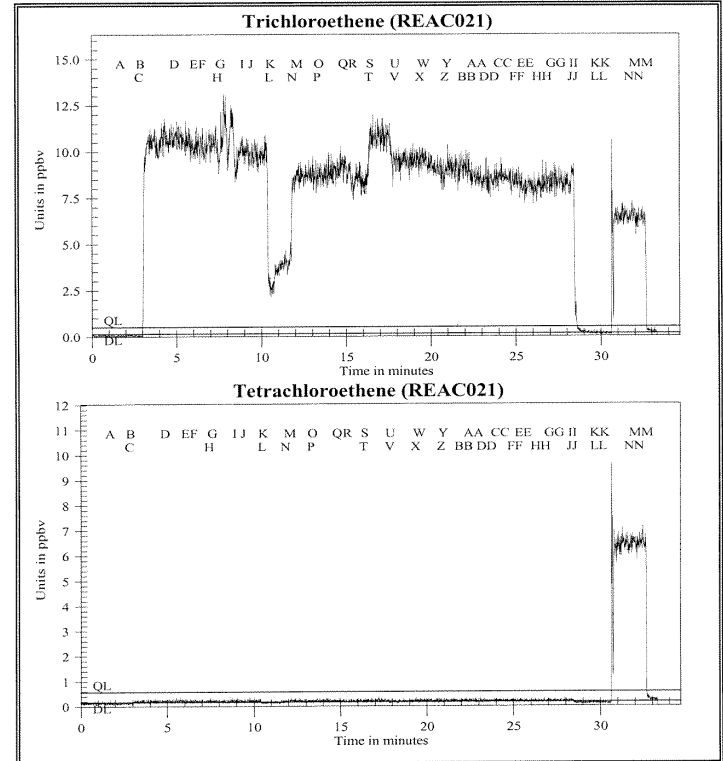


Figure 5c Building 200 Survey for Trichloroethene and Tetrachloroethene

**MONITORING FOR CONTRIBUTIONS FROM
CRAWLSPACE AREAS**

TCE Site

Region 6



TCE Site Region 6

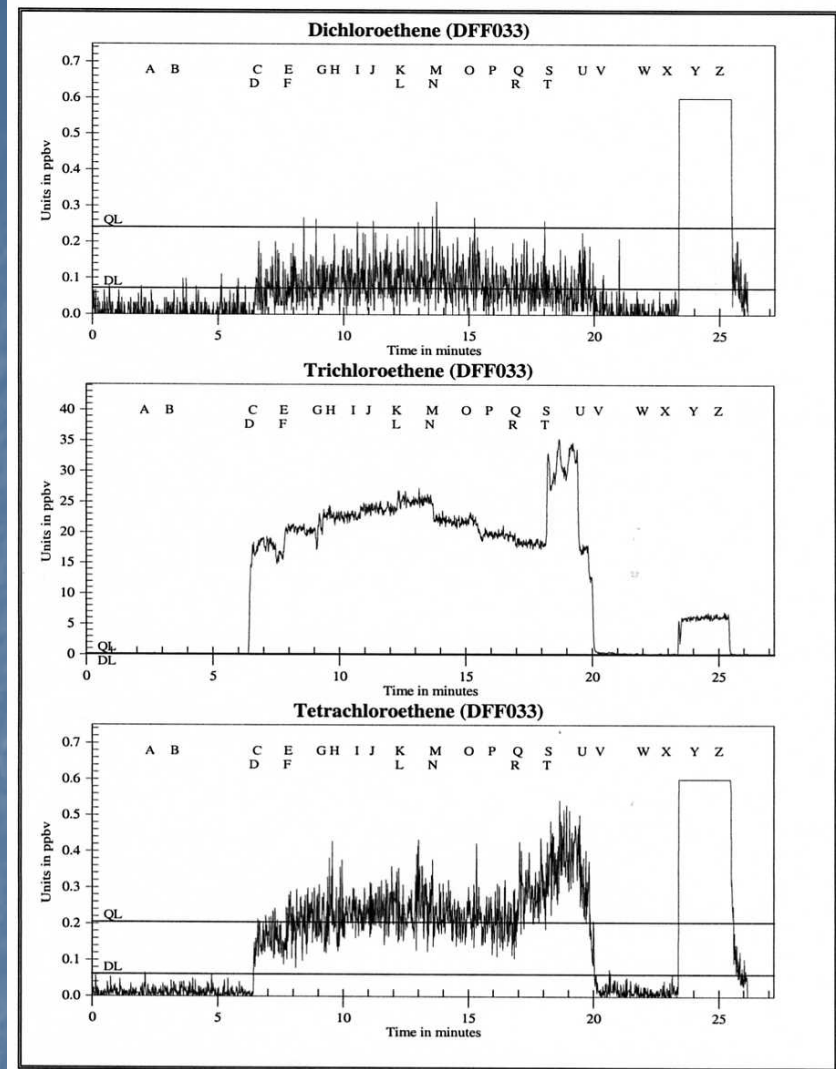
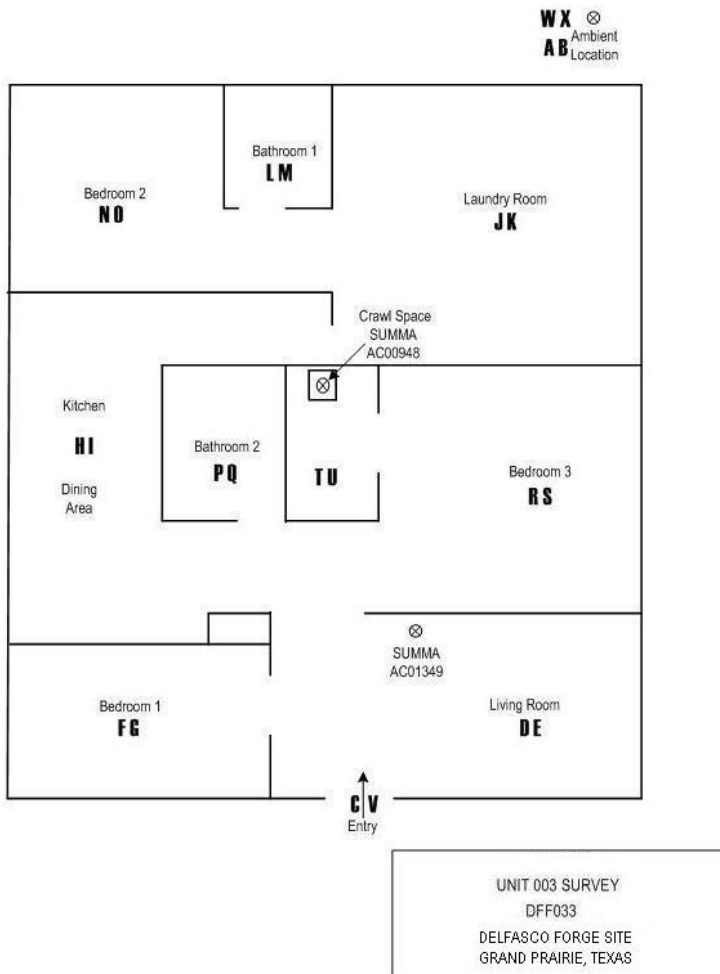


Figure 1b Unit 003 Survey Two for Dichloroethene, Trichloroethene, and Tetrachloroethene

Residence Schematics and Compound Concentrations

**MONITORING FOR CONTRIBUTIONS FROM
ACTIVITIES IN ADJACENT STRUCTURES
Region 5**



Region 5 – PCE Site

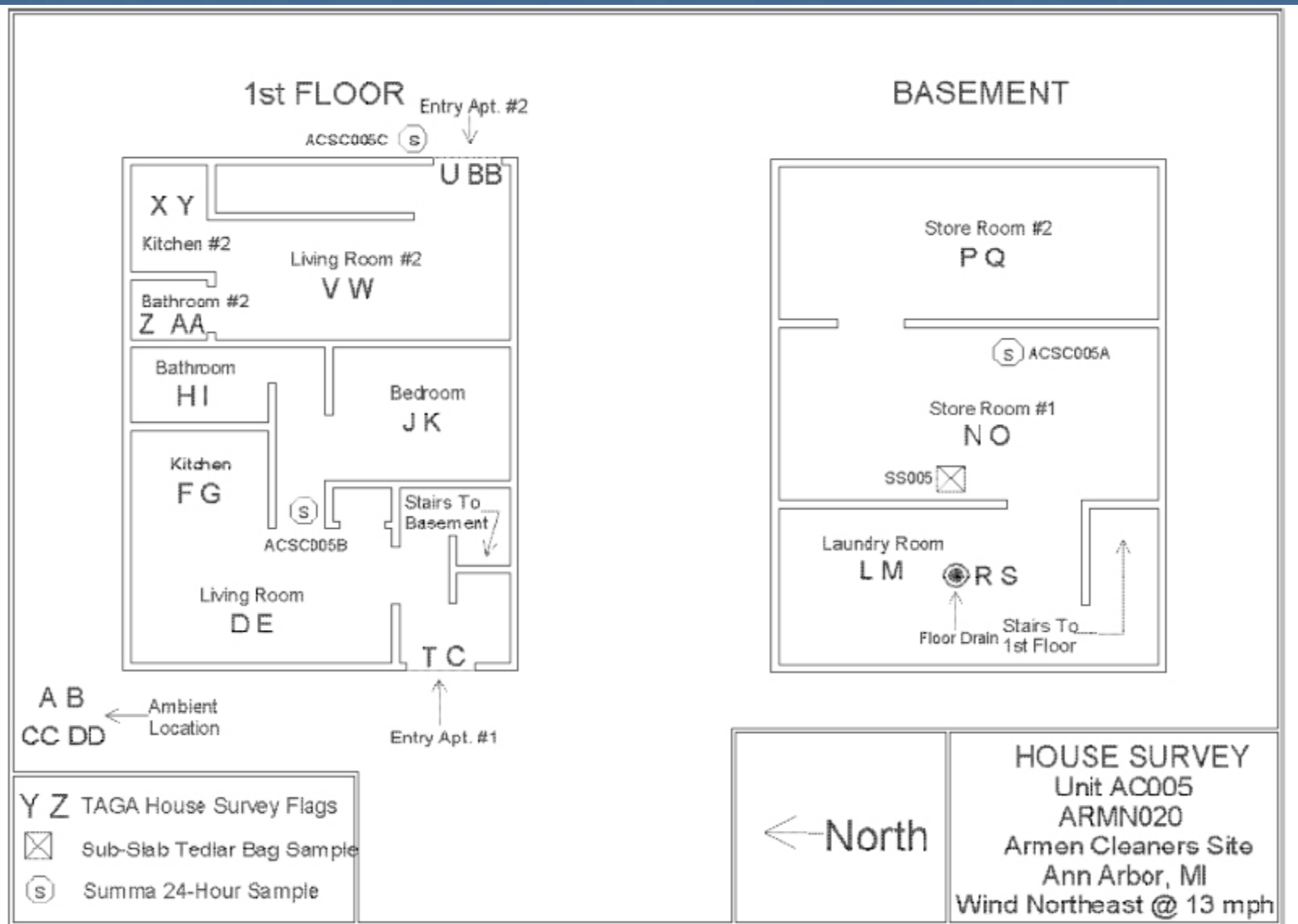
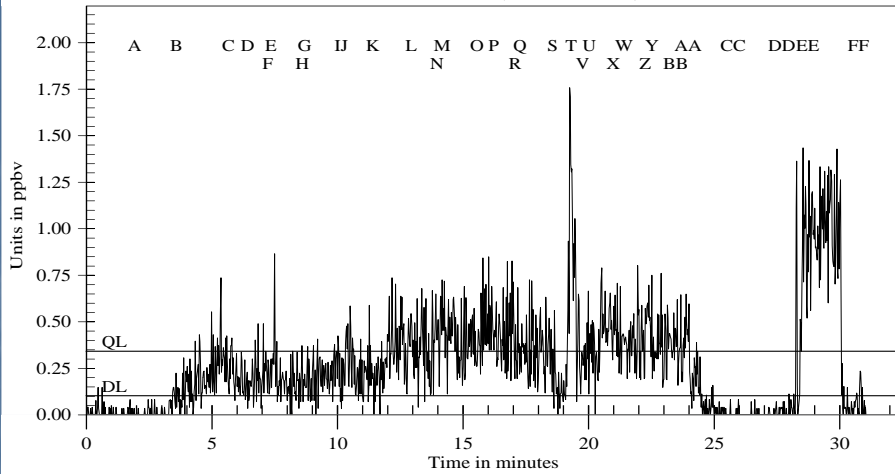


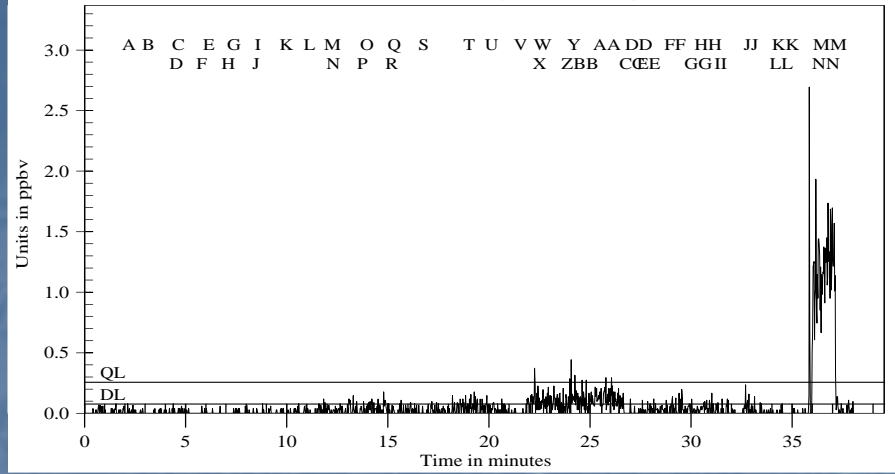
Figure 7a House Survey in Unit AC-005, ARMN020

Schematic of the Residence

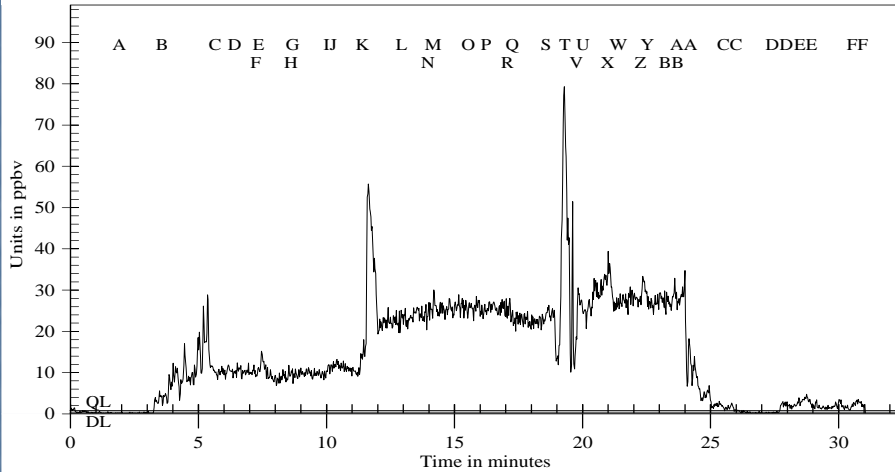
Trichloroethene (ARMN020)



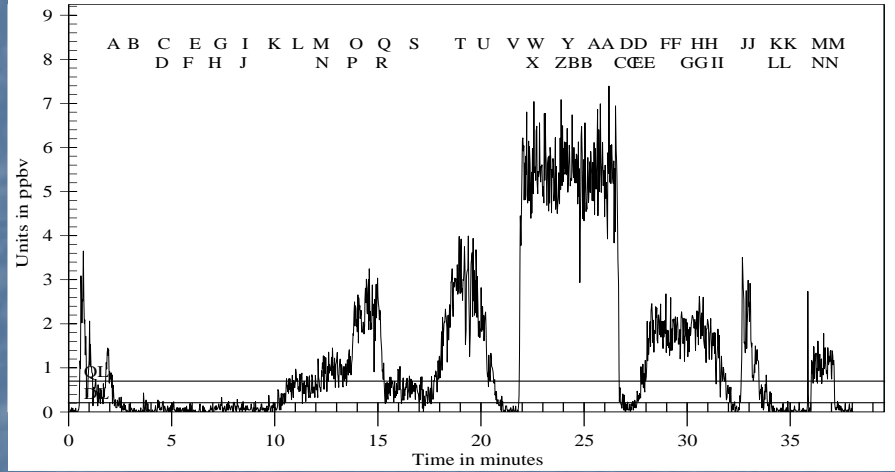
Trichloroethene (ARMN048)



Tetrachloroethene (ARMN020)



Tetrachloroethene (ARMN048)



Northeast – 13 mph

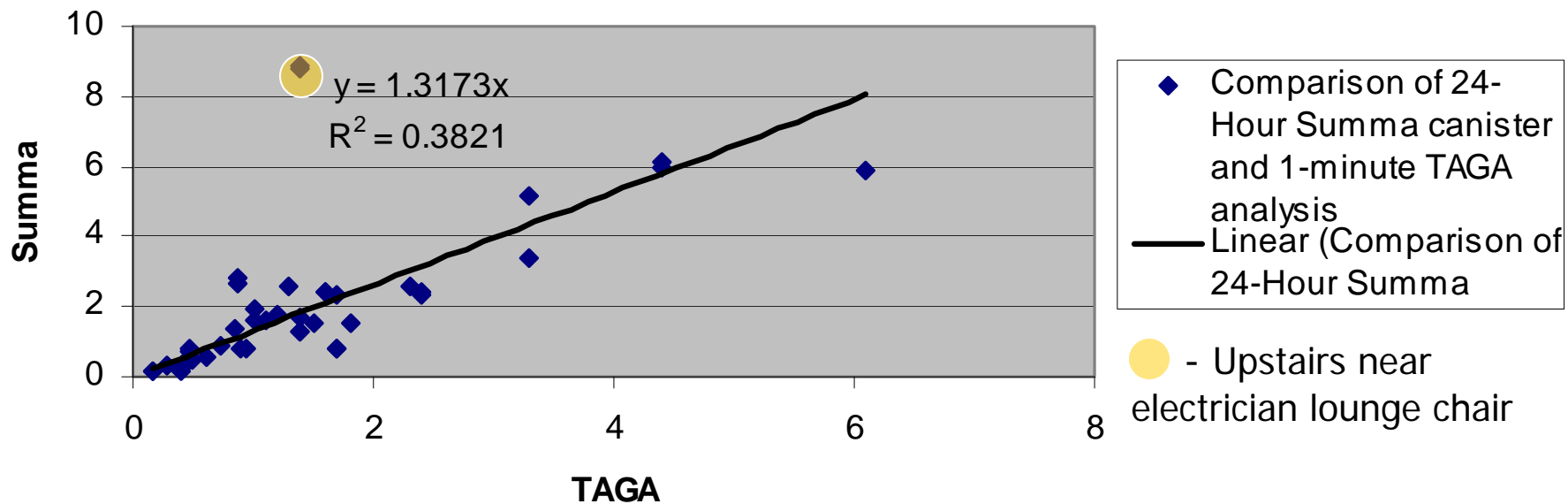
North – 12 mph

Indoor Air Compound Concentrations At the Same Residence On Two Different Days When The Wind Directions Varied

INDOOR ANALYSIS

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

TCE Summa Canister and TAGA Results



Hopewell Junction Site – Hopewell, NY

42 INDOOR LOCATIONS

May 14, 2008

24-HOUR SUMMA SAMPLES TO 1-MINUTE TAGA RESULTS

DATA POINTS: 152

RANGE OF DELTA (SUMMA – TAGA): -0.93 – 1.92 ppbv

RANGE OF % DIFFERENCE (SUMMA – TAGA)/SUMMA
-48.3 to +84.2%

NOT DETECTED: 110

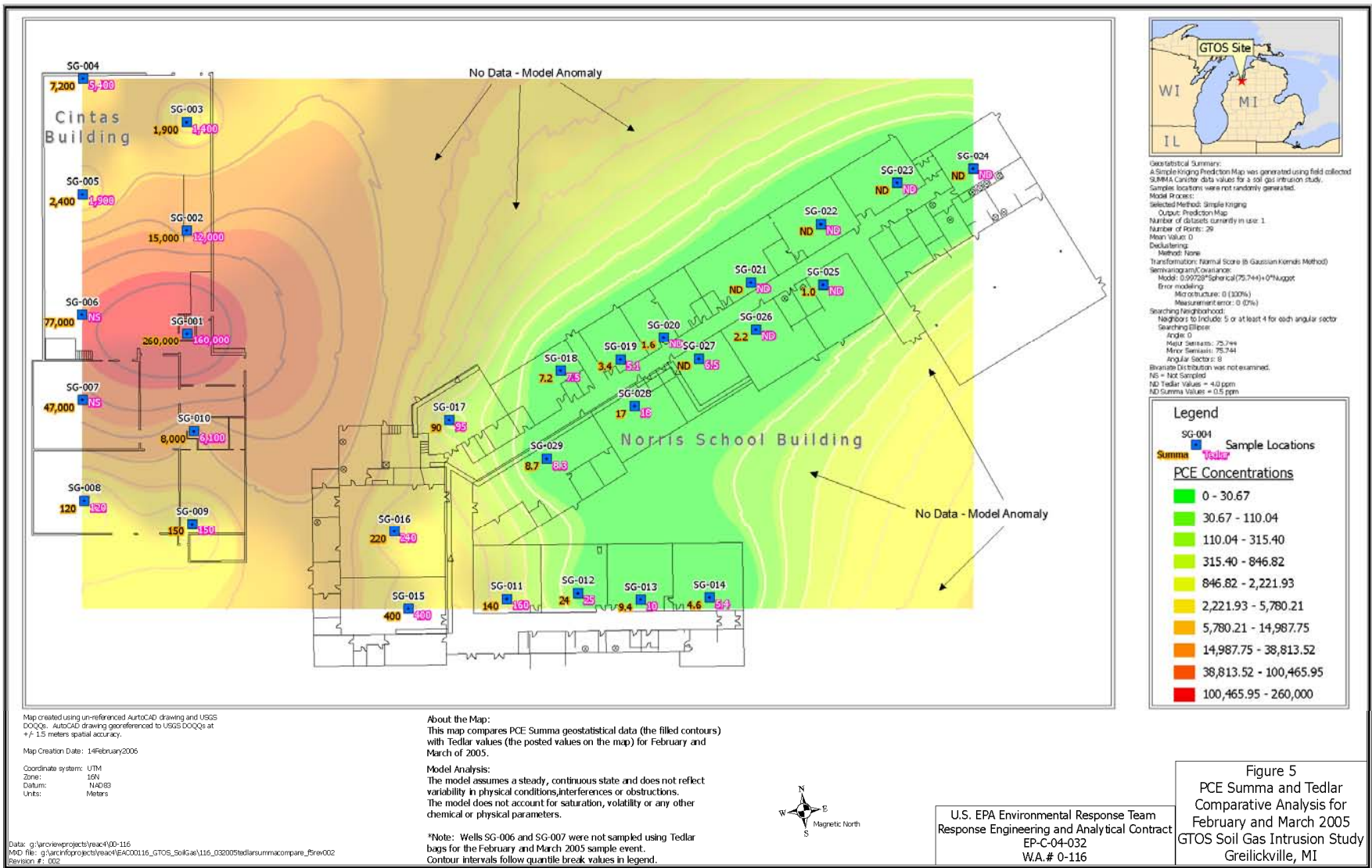
100% AGREEMENT BETWEEN SUMMA AND TAGA

GRAND TRAVERSE OVERALL SITE

TEDLAR BAG GRAB SAMPLES ANALYZED ON SITE (using a sample concentrator – **45 minute run time** – 1 ppbv detection limit) vs SUMMA CANISTER 24-HOUR SAMPLES ANALYZED OFF SITE

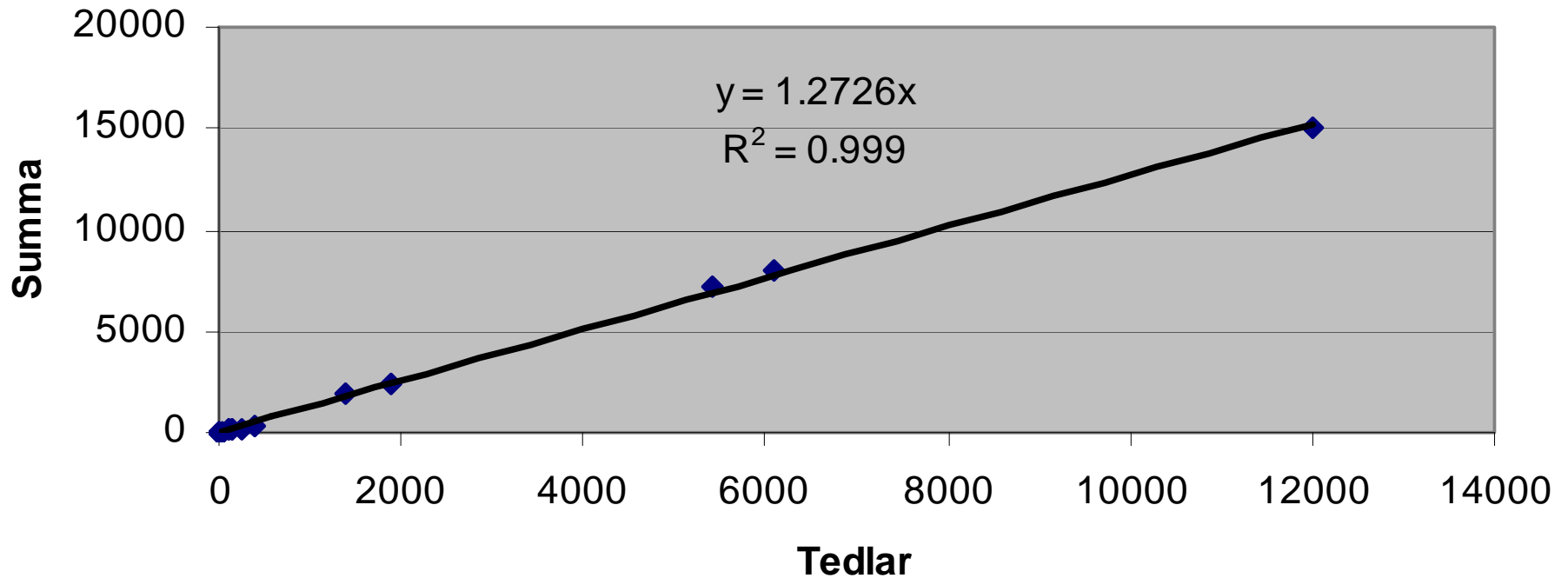
30 SUBSLAB LOCATIONS

MARCH 2005



GTOS Facility and Norris Elementary School February & March 2005 Comparison Summa and Tedlar Bag Sampling

PCE Concentrations in Tedlar Bags vs Summa Canisters



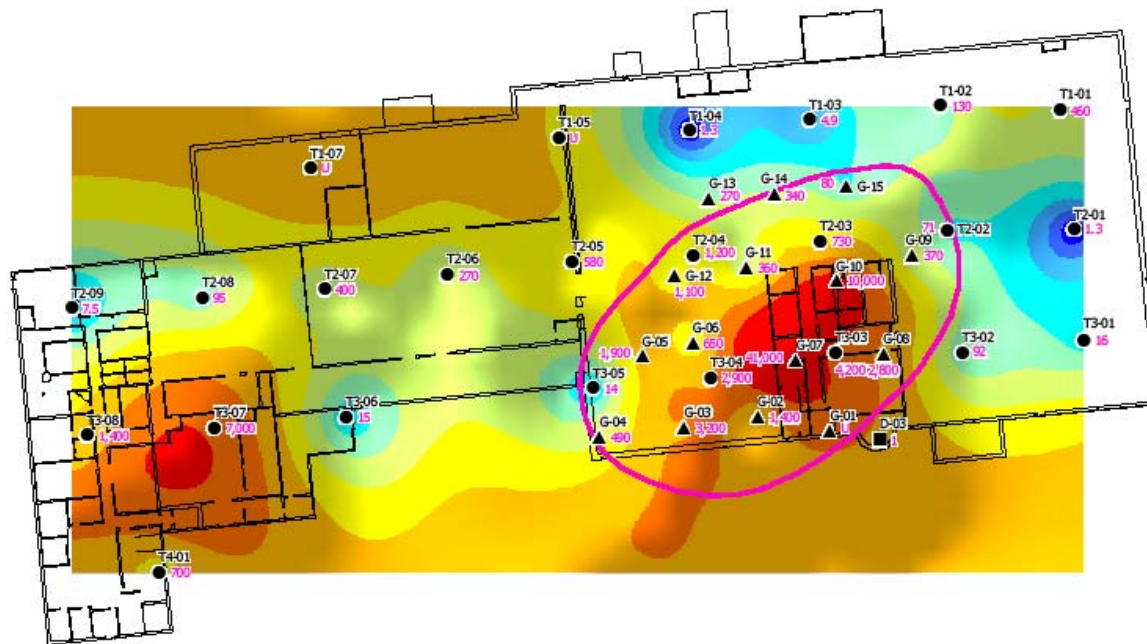
Grand Traverse Overall Supply Site – Traverse City, MI

30 SUBSLAB LOCATIONS

MARCH 2005

Loop Injection Method

TEDLAR BAG GRAB SAMPLES ANALYZED ON SITE (using a loop injection – **6 minute run time** – 1 ppbv detection limit) vs SUMMA CANISTER 24-HOUR SAMPLES ANALYZED OFF SITE



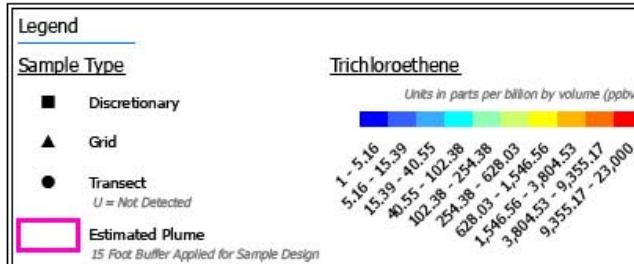
Geostatistical Summary	
Input datasets:	Trichloroethene
Method	Kriging
Type	Simple
Output type	Prediction
Output ID	1
Trend type	None
Transformation	Normal Score Transformation
Approximation	Linear
Date decalending	Cell
Cell size	73.99615520626717
Anisotropy	1
Angle	0
Shift	12
Searching neighborhood	Standard
Neighbors to include	5
Include all neighbors	3
Sector type	Four and 45 degree
Angle	0
Major semiaxis	58.7905950813055
Minor semiaxis	58.7905950813055
Variogram Covariance	
Number of lags	12
Lag dist.	10.018
Measurement error	0
Model type	Spherical
Range	58.7905950813055
Anisotropy	No
Partial sill	0.284602759429019

Map created using randomly generated sample locations and site-provided AutoCAD building floor plan. Samples produced using Visual Sample Plan (VSP) for plume area, and a random number generator for transect locations.

Map Creation Date: 25May2007

Coordinate system: New York State Plane East
 FIPS: 3102
 Datum: NAD83
 Units: Feet

Date: g:\arcview\projects\year4\90-198
 MOD File: g:\arcview\projects\year4\90-198\vestal\198_postsummatoc\Brow003
 Revision Number: 003

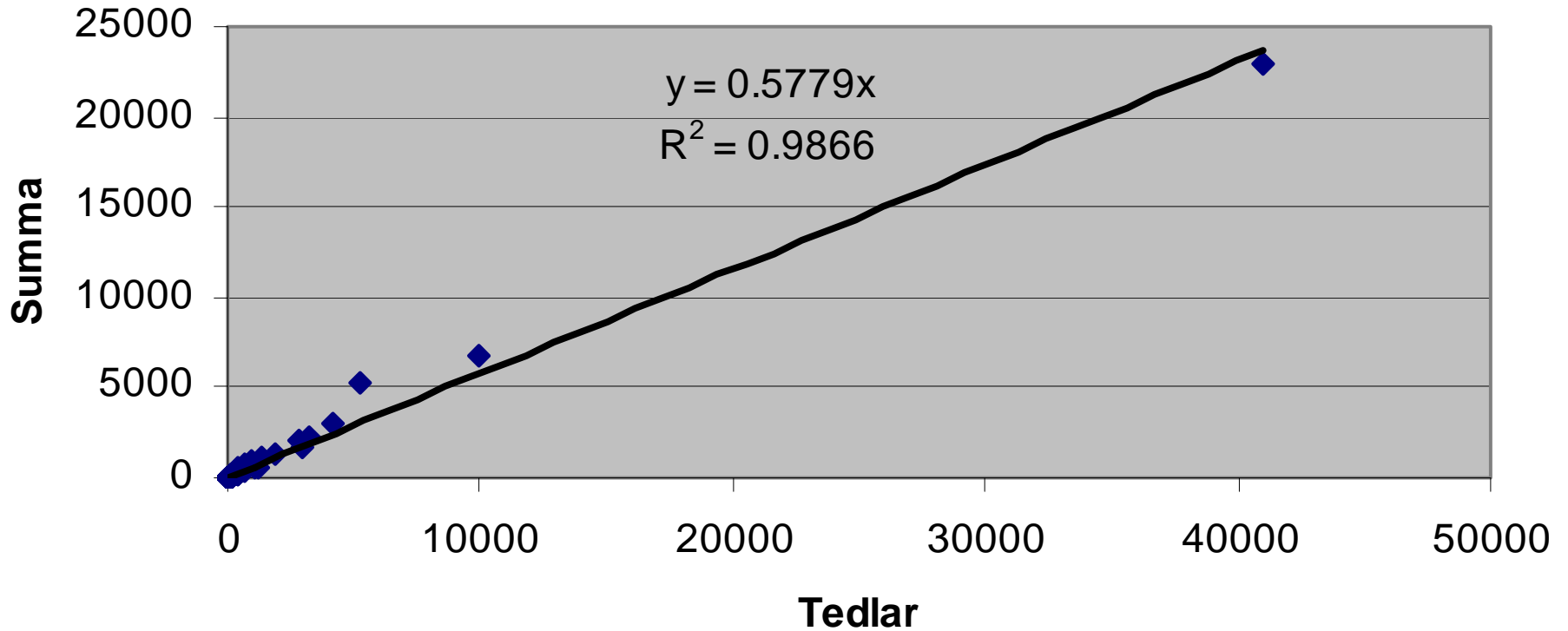


U.S. EPA Environmental Response Team
 Response Engineering and Analytical Contract
 EP-C-04-032
 W.A.# 0-198

Figure 8c
 Post-Summa Tedlar Bag Results
 Trichloroethene
 Vestal Chlorinated Hydrocarbon Site
 Vestal, NY
 April 11, 2007

Region 2 – TCE Site

TCE Concentrations in Tedlar Bags vs Summa Canisters

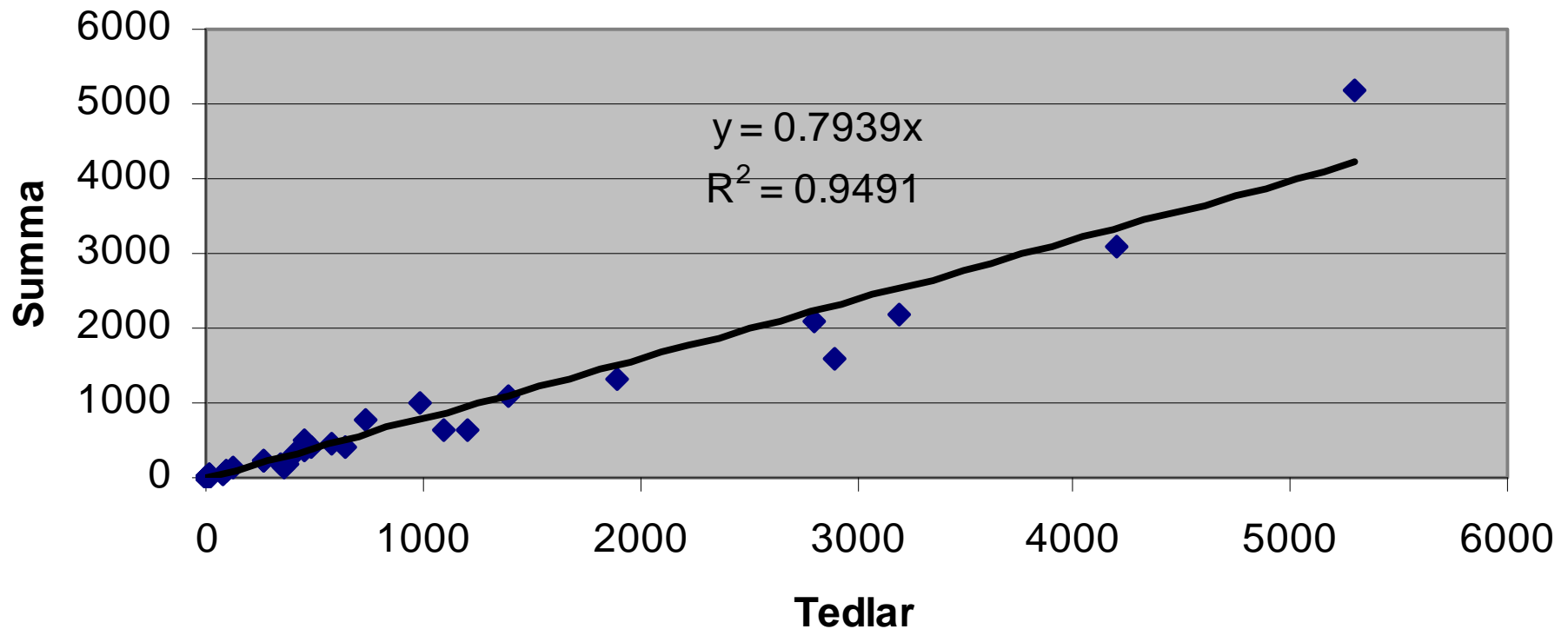


Vestal Chlorinated Hydrocarbon Site – Vestal, NY

42 SUBSLAB LOCATIONS

APRIL 2007

TCE Concentrations in Tedlar Bags vs Summa Canisters

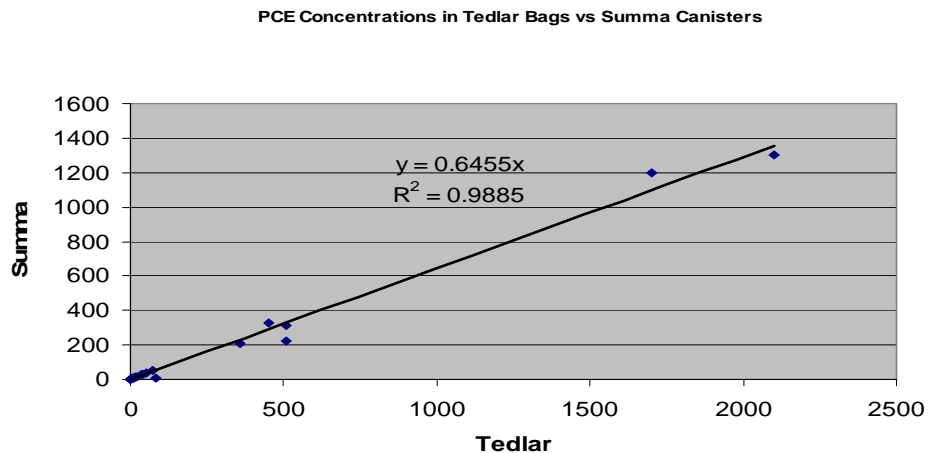


Vestal Chlorinated Hydrocarbon Site – Vestal, NY

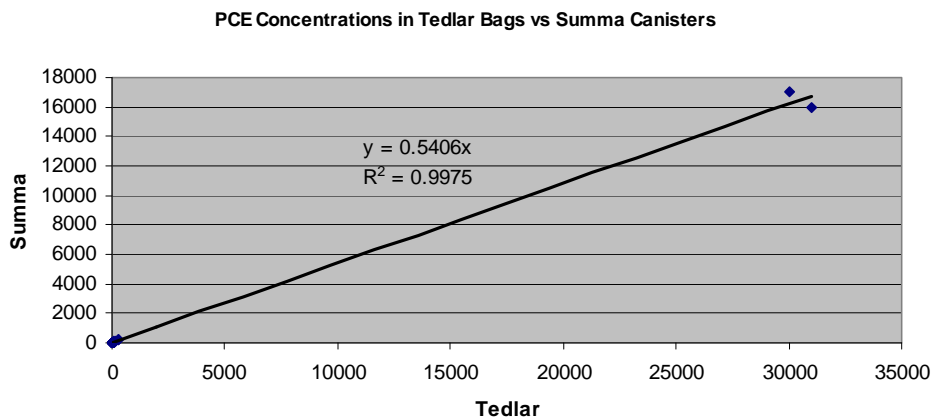
42 SUBSLAB LOCATIONS – (less the two high points)

APRIL 2007

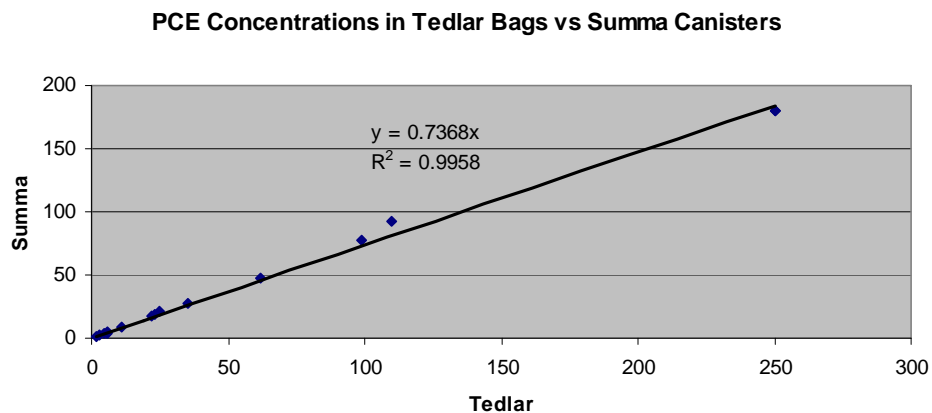
White Swan Site – Sea Girt, NJ
 18 SUBSLAB LOCATIONS
 January 8, 2008



White Swan Site – Sea Girt, NJ
 17 SUBSLAB LOCATIONS
 January 11, 2008



White Swan Site – Sea Girt, NJ
 17 SUBSLAB LOCATIONS
 (less the two high points)
 January 11, 2008



TAKE-AWAY POINTS

- UTILIZATION OF THE TAGA TRIPLE QUADRUPOLE MASS SPECTROMETER REAL-TIME MONITORING TO RESOLVE VARIOUS VAPOR INTRUSION ISSUES –**
Demonstrated that this technology can provide quantitative and qualitative information to isolate confounding factors involved in vapor intrusion studies. The interfering sources may be related to lifestyle products/operations, ambient air impacts, accidental/intentional releases, geological anomalies, etc. The TAGA is by far the best technology to resolve the problems associated with the vapor intrusion matrices.
- INDOOR AIR ANALYSIS ON SITE (using the Trace Atmospheric Gas Analyzer [TAGA]) –**
Demonstrated that a one-minute monitoring within each room of a structure gave similar results as 24-hour time-weighted-averaged Summa canister samples – however, the disruption to the residents is limited to a single entry with the TAGA as compared to two entries with 24-hour time-weighted-averaged Summa canister samples. This provides information in the field for decision making and again, further reduces overall expenses.
- TOXICOLOGY OR POLICY –** These groups set the action limits for vapor intrusion.

TAKE-AWAY POINTS (Cont'd)

- SUBSLAB AIR ANALYSIS ON SITE (using the GC/MS analysis with the Concentrator) – Demonstrated that a one-minute grab Tedlar bag sample gave similar results as 24-hour time-weighted-averaged Summa canister samples – limited the disruption to the residents is limited to a single entry with the Tedlar bag sampling as compared to two entries with 24-hour time-weighted-averaged Summa canister samples. The analysis required 45 minutes per sample. This provides information in the field for decision making and again, further reduces overall expenses.

- SUBSLAB AIR ANALYSIS ON SITE (using the GC/MS analysis with the Loop Injector) – Demonstrated that a one-minute grab Tedlar bag sample gave similar results as 24-hour time-weighted-averaged Summa canister samples – limited the disruption to the residents is limited to a single entry with the Tedlar bag sampling as compared to two entries with 24-hour time-weighted-averaged Summa canister samples. The analysis required 6 minutes per sample. This provides information in the field for decision making and again, further reduces overall expenses.



Hey, did you want all of the sources removed???

What does your data tell you???



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

David Mickunas

US EPA/ERT-Research Triangle Park, NC

Telephone - (919) 541 4191

E-mail - Mickunas.Dave@epa.gov.