Vapor Intrusion Forum
Philadelphia, PA

Using the TAGA Mobile Laboratory to Resolve Vapor Intrusion Issues – Interpretation of Multiple Lines of Evidence for Vapor Intrusion

January 2009

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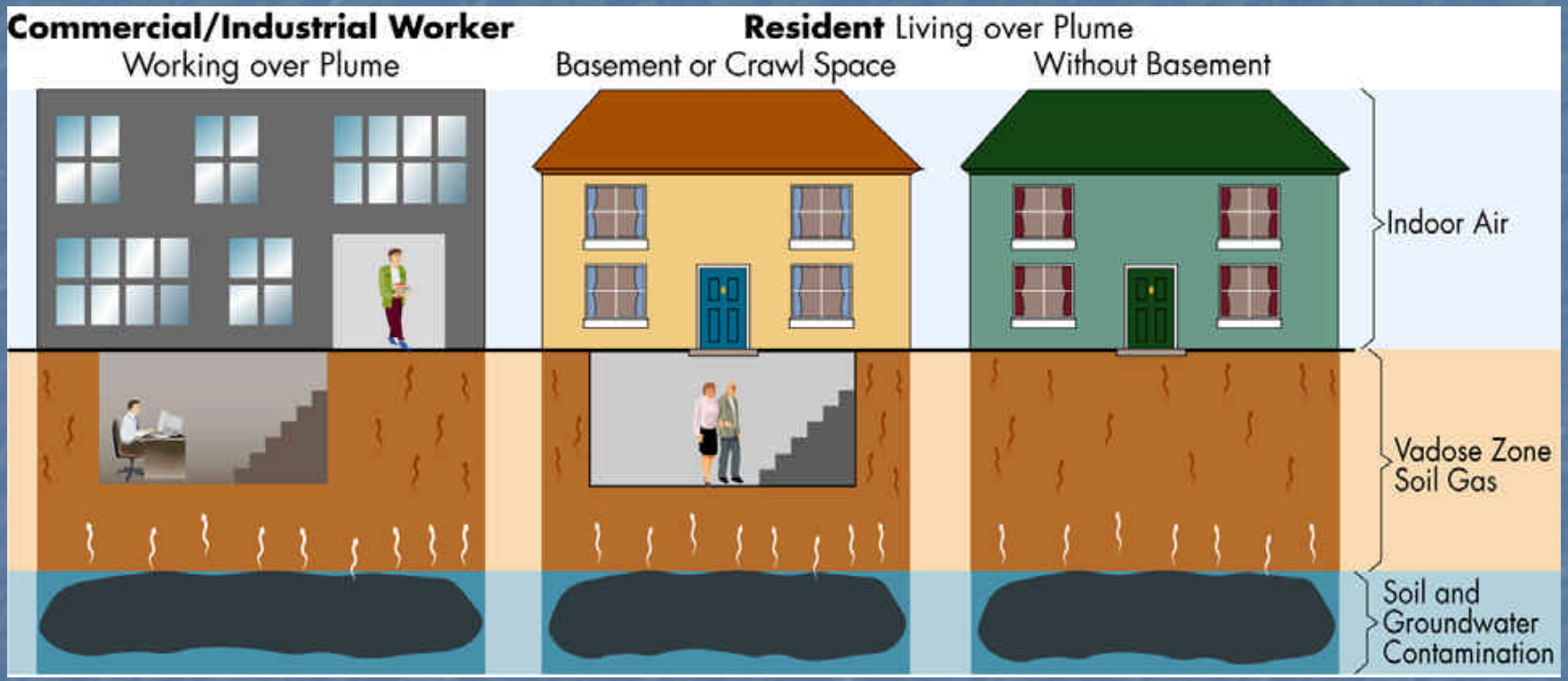
US EPA/ERT

TAGA INDOOR AIR SITES

Love Canal, Love Canal, NY – Region 2
Raymark Site, Stratford, CT – Region 1
Highway 71/72 – Region 6
Grand Traverse Overall Supply Site, Traverse City, MI – Region 5
Hopewell Precision Site, Hopewell Junction, NY – Region 2
Shenandoah Road Site, East Fishkill, NY – Region 2
Armen Cleaners Site, Ann Arbor, MI – Region 5
Grants Site, Grants NM – Region 6
McGaffey and Main Site, Roswell, NM – Region 6
Tranguch Site, Hazleton, PA – Region 3
Valmont Site, Hazleton, PA – Region 3
Chillum Site, Chillum, MD – Region 3
Diaz Site, Holley, NY – Region 2
Glendive Site, Glendive, MT – Region 8
MEW Site, Mountain View, CA – Region 9
Moffett Field, Moffett, CA – Region 9
Berkley Products Site, Akron, PA – Region 3
Perkasie Site, Perkasie, PA – Region 3
Raritan Arsenal, Edison, NJ – Region 2
Corry Site, Corry, PA – Region 3
Pennsylvania Blvd., Hewett, NY – Region 2
Olean Cleaners, Olean, NY – Region 2
Crossley Farm Site, Hereford Township, PA – Region 3
Mitral Site, Harwinton, CT – Region 1
White Swan Site, Wall Township, NJ – Region 2
Marathon Battery Site, Putman City, NY – Region 2
Former Kelly Air Force Base, San Antonio, TX – Region 6
Parker Solvent Site, Little Rock, AR – Region 6
Nebraska Ordnance Plant Site, Mead, NE – Region 7

Higgins Disposal Site, Franklin Township, NJ – Region 2
Lawrence Aviation Site, Port Jefferson, NY – Region 2
Liberty Industrial Finishings Site, Oyster Bay, NY – Region 2
Mackenzie Chemical Works, Suffolk County, NY – Region 2
Little Valley Site, Little Valley, NY – Region 2
Mohonk Site – High Falls, NY – Region 2
Pohatcong Site, Franklin Township, NJ – Region 2
Rockaway Boro Site, Rockaway Township, NJ – Region 2
South Jersey Clothing Site. Buena Borough, NJ – Region 2
Garden State Cleaners Site, Buena Borough, NJ – Region 2
Chemical Leaman Site, Gloucester, NJ – Region 2
Brick Township Landfill, Ocean City, NJ – Region 2
Conell Dublier Site, South Plainfield, NJ – Region 2
Federal Creosote Site, Manville, NJ – Region 2
Radiation Technologies Site, Rockaway, NJ – Region 2
Kaufman and Minteer Site, Jobstown, NJ – Region 2
Scientific Chemical Processing Site, Carlstadt, NJ – Region 2
Lehigh Valley Railroad Derailment Site, LeRoy, NY – Region 2
Port Washington Site, North Hemstead, NY – Region 2
Kentucky Avenue Site, Horseheads, NY – Region 2
Facet Enterprise Site, Elmira Heights, NY – Region 2
Crown Cleaners Site, Carthage, NY – Region 2
Brewster Site, Brewster, NY – Region 2
Mattiace Site, Glen Cove, NY – Region 2
Coldwell Trucking Site, Essex City, NJ – Region 2
Army Corps of Engineers Raritan Center Site, Edison, NJ – Region2
USMC Camp Lejeune, Jacksonville, NC – Region 4
Delforge Site, Grand Prairie, TX – Region 6
Carter Carburator Site, St. Louis, MO – Region 7



Vapor Pathway into Buildings

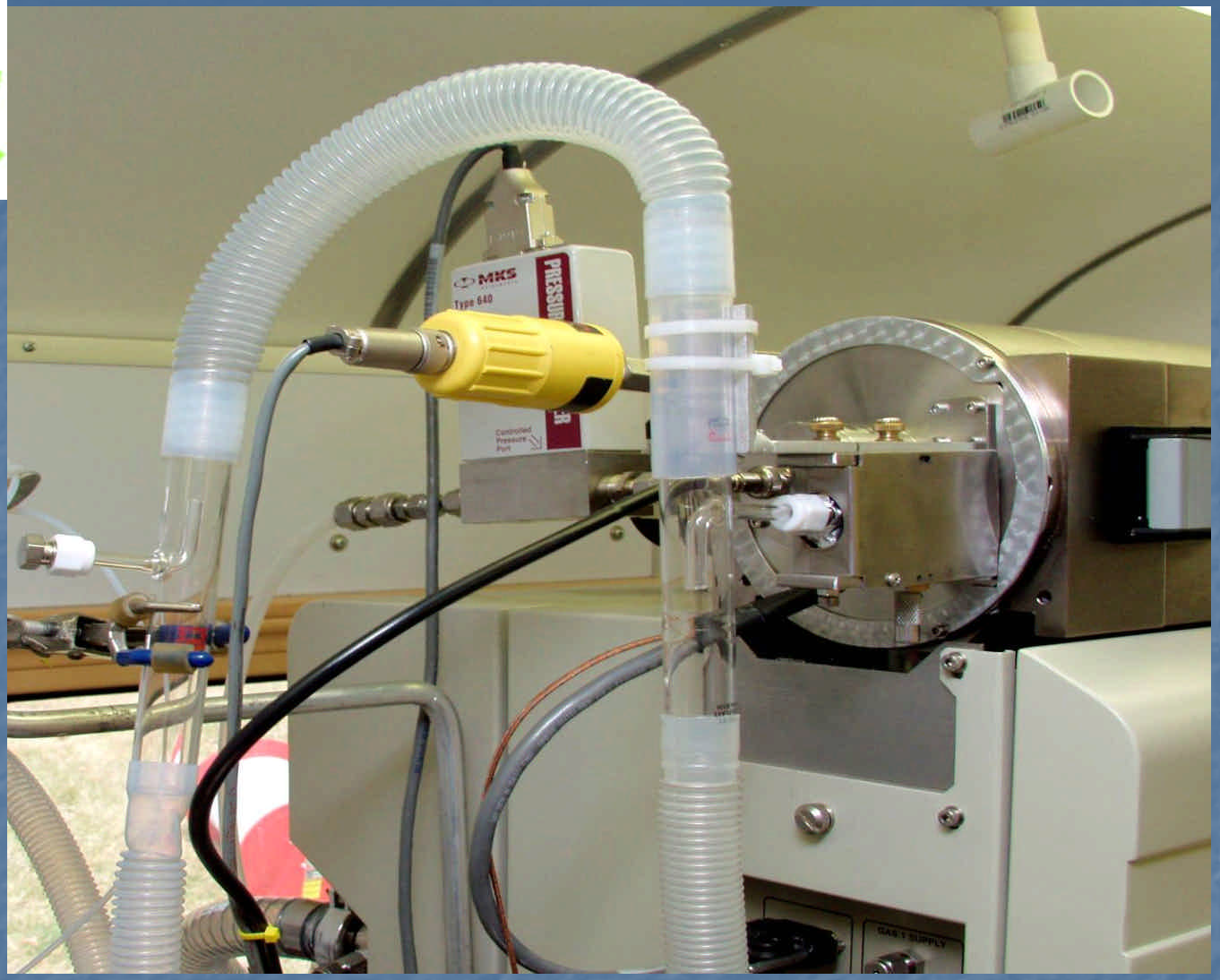
KEY QUESTIONS FOR VAPOR INTRUSION IMPACTS

1. Does Subsurface Gas Contamination Exist?
2. If Subsurface Gas Does Exist, Is it Entering The Residence?
3. If Gas Contamination Exists In The Residence, Is It from the Subsurface or Elsewhere (i.e., Lifestyle, Ambient, etc.)?
4. If Gas Contamination Exists In The Residence and Sources Are Not Due To Subsurface, Have The Sources Been Identified And Is It Of Superfund Regulatory Concern?
5. What Air Analytical Techniques Are Appropriate For The Risk Assessment?

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

Data Acquisition and Reduction Stations

Driver and Passenger Seating with Monitor

INITIAL TAGA MONITORING

TYPICAL INDOOR AIR MONITORING SEQUENCE USING THE TAGA

- Selection Of Target Compounds
- Selection Of Ion Pairs
- Collection Of Ambient Air
- Collection Of Indoor Air
- Collection Of Ambient Air
- Spike Of System With Standard
- Investigation Of Source(s) (If Required)

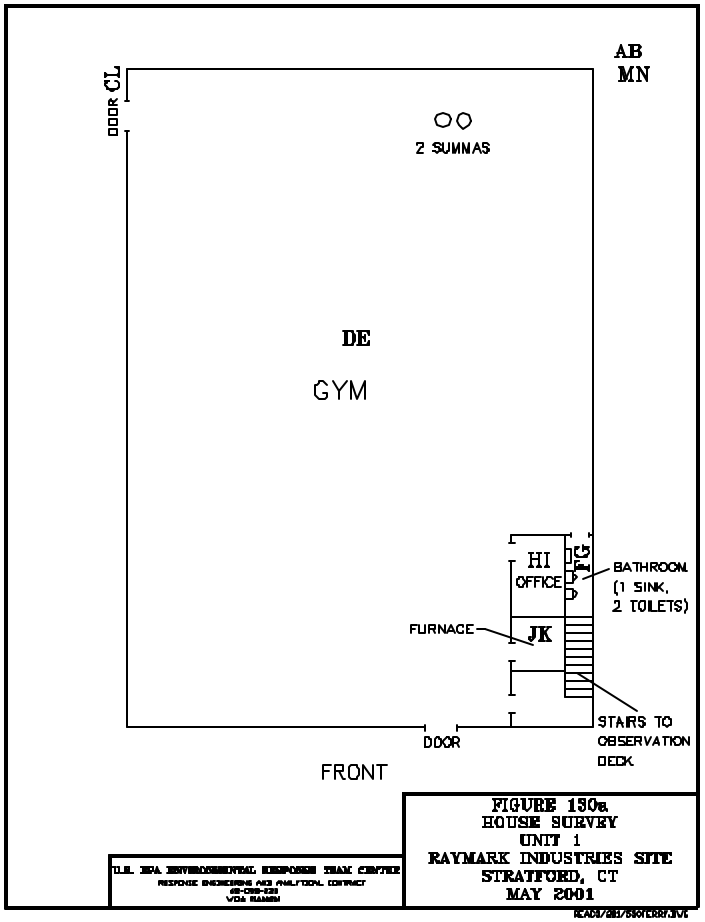
MONITORING FOR SIGNATURE COMPOUNDS TO DETERMINE SUBSURFACE GAS INTRUSION

Chlorinated Solvent Site

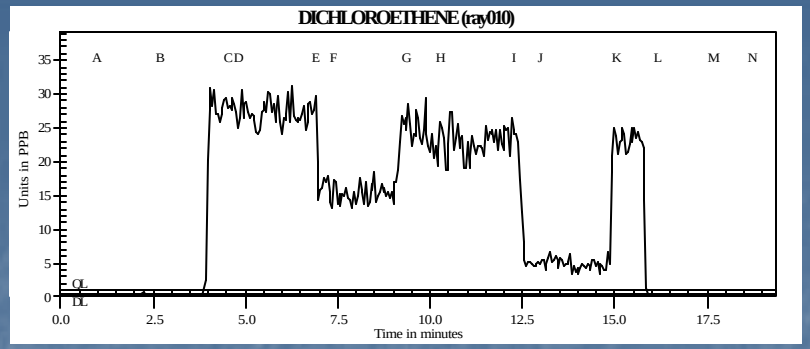
Region 1

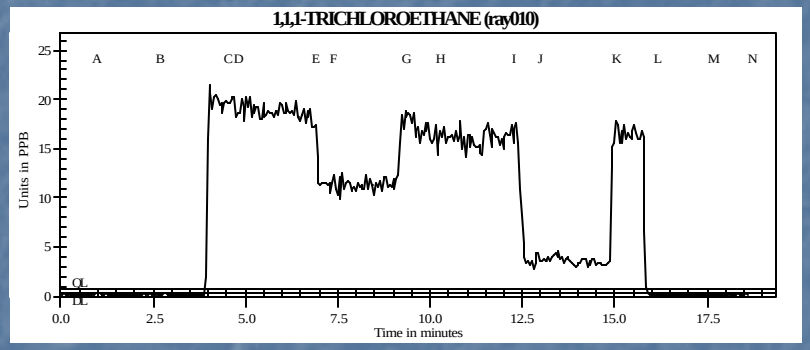
Unit 1

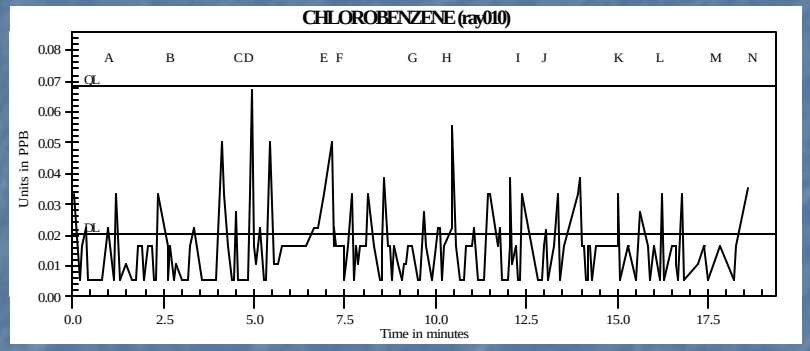
Gymnastic Facility For Children

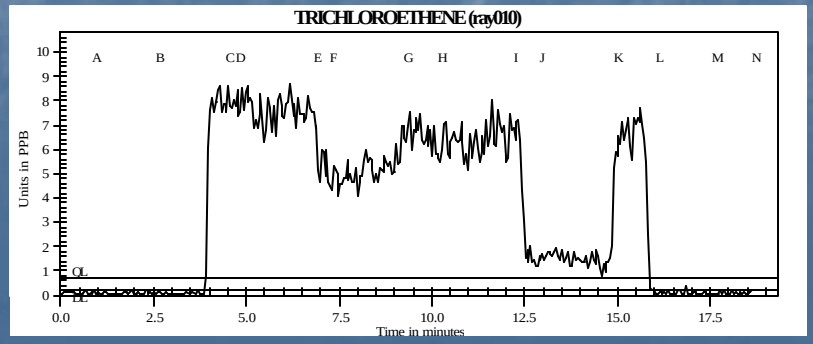


Building Schematic


DICHLOROETHENE (ray010)
A B CD E F G H I J K L M N
Units in PPB
QL
LL
Time in minutes

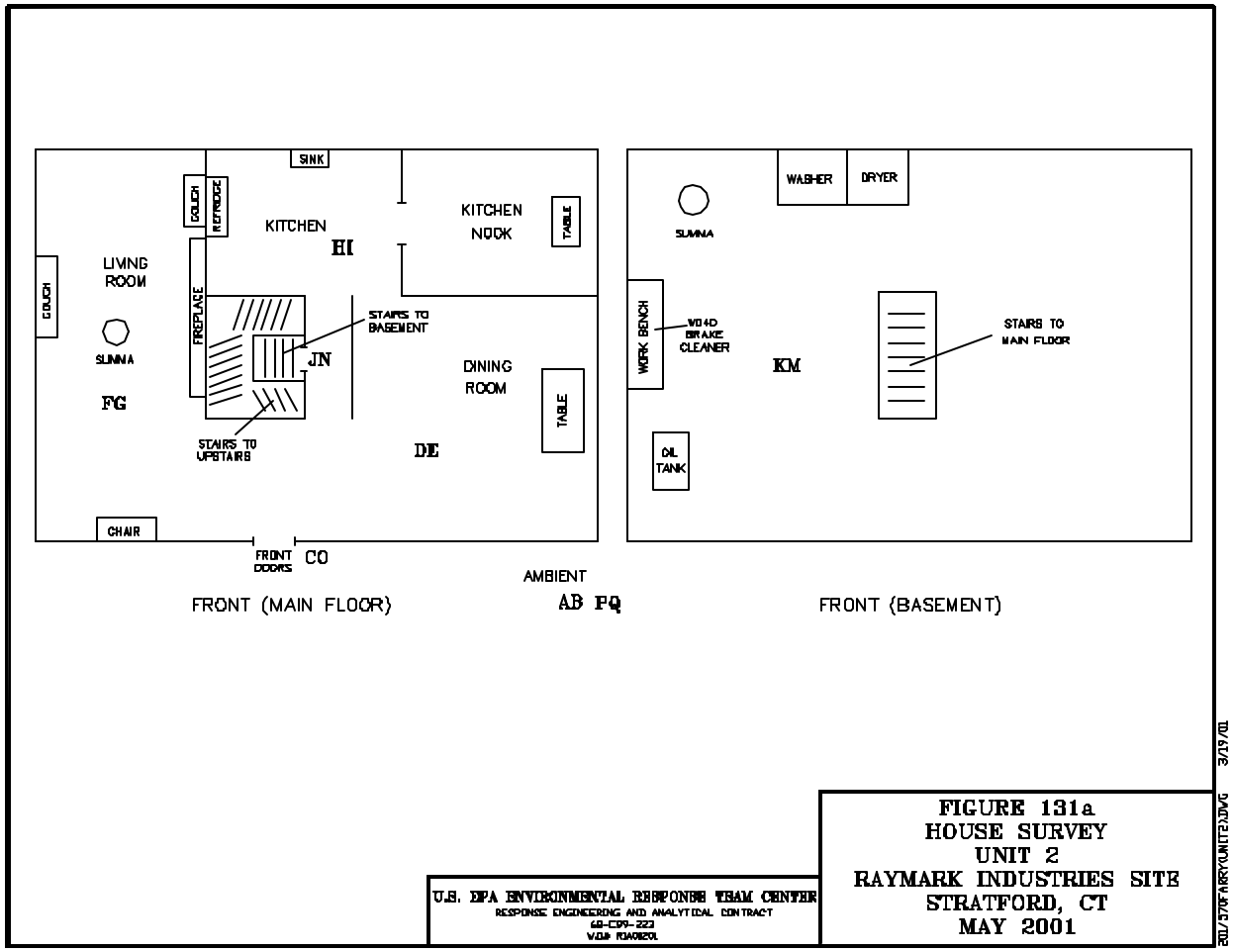

1,1,1-TRICHLOROETHANE (ray010)
A B CD E F G H I J K L M N
Units in PPB
QL
LL
Time in minutes


CHLOROBENZENE (ray010)
A B CD E F G H I J K L M N
Units in PPB
QL
LL
Time in minutes

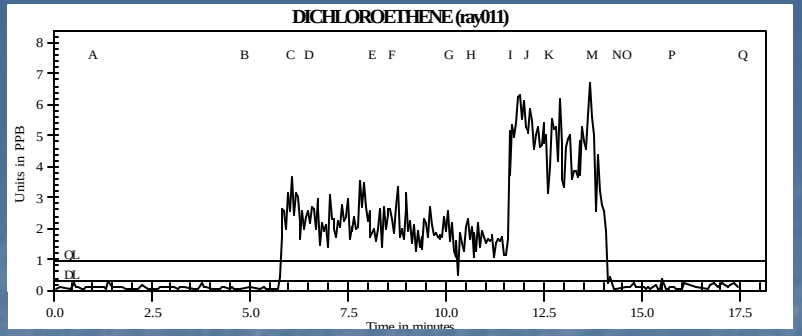

TRICHLOROETHENE (ray010)
A B CD E F G H I J K L M N
Units in PPB
QL
LL
Time in minutes

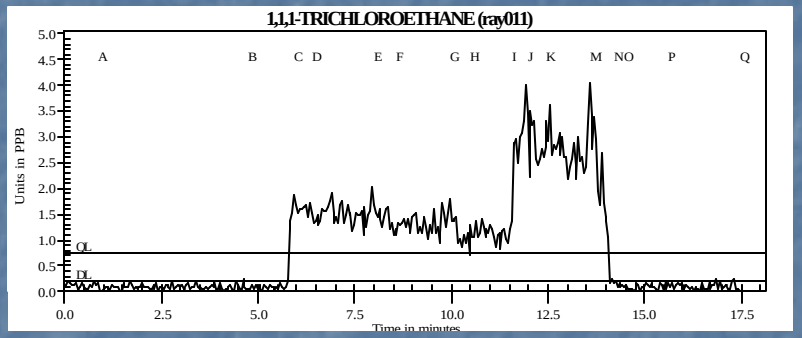
Unit 2

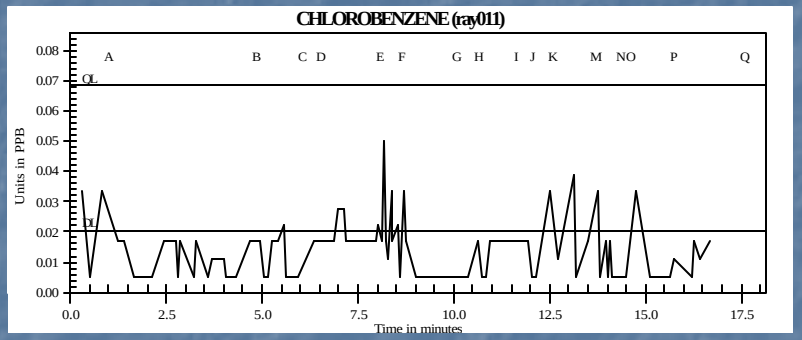
Residence Adjacent to the Gymnastic Facility

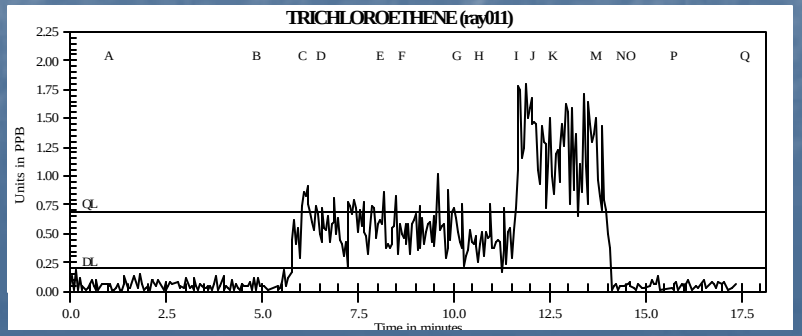


Schematic of the Residence


DICHLOROETHENE (ray011)
Units in PPB
Time in minutes
A B C D E F G H I J K M NO P Q
QL
DL


1,1,1-TRICHLOROETHANE (ray011)
Units in PPB
Time in minutes
A B C D E F G H I J K M NO P Q
QL
DL


CHLOROBENZENE (ray011)
Units in PPB
Time in minutes
A B C D E F G H I J K M NO P Q
QL
DL


TRICHLOROETHENE (ray011)
Units in PPB
Time in minutes
A B C D E F G H I J K M NO P Q
QL
DL

MONITORING FOR CONTRIBUTIONS FROM CRAWLSPACE AREAS

PCE Site

Region 4

TCE Site Region 6

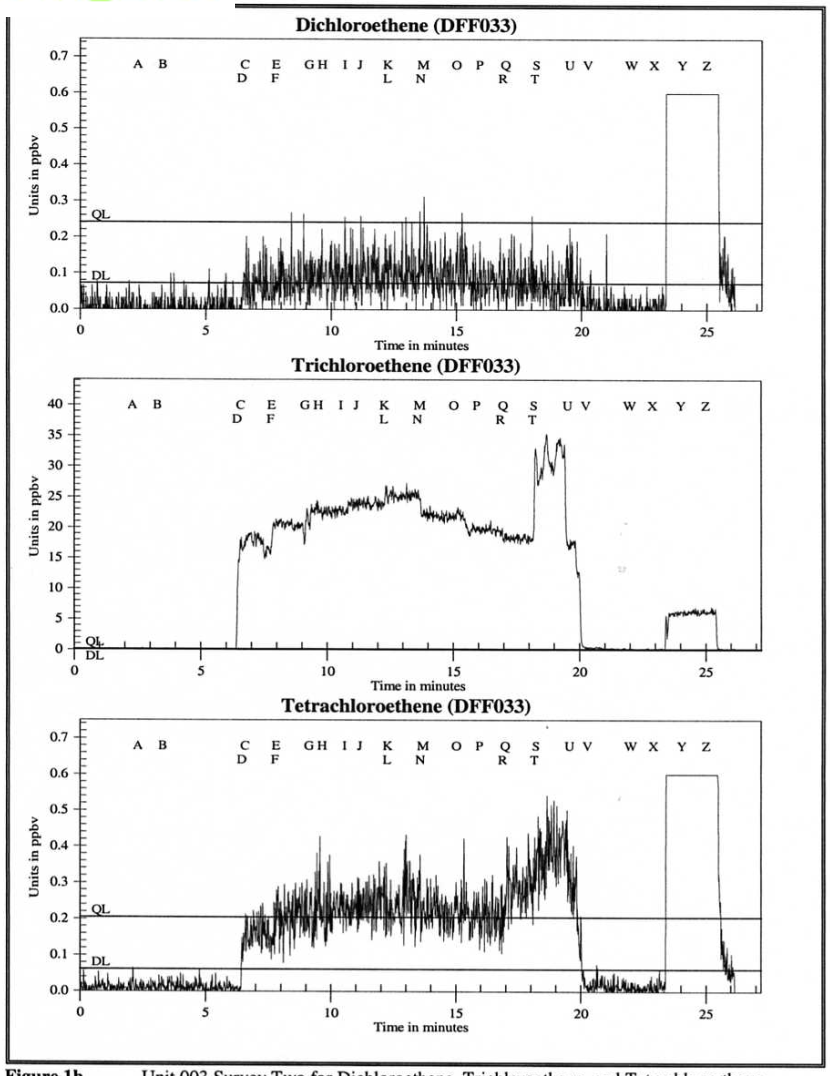


Figure 1b Unit 003 Survey Two for Dichloroethene, Trichloroethene, and Tetrachloroethene

Figure 1b

TAGA File Event Summary
File: DFF033 Acquired on 22 May 2008 at 09:04:20
Title: Unit 003 Survey Two

Flag	Offset Time	Offset Sequence	Description
A	2.1	149	Start of the pre-entry ambient
B	3.1	220	End of the pre-entry ambient
C	6.4	452	Entering the unit
D	6.6	470	Start of the living room
E	7.6	540	End of the living room
F	7.9	560	Start of bedroom one
G	8.9	632	End of bedroom one
H	9.4	669	Start of the kitchen/dining room
I	10.4	740	End of the kitchen/dining room
J	11.0	782	Start of the laundry room
K	12.0	853	End of the laundry room
L	12.4	878	Start of bathroom one
M	13.4	951	End of bathroom one
N	13.8	975	Start of bedroom two
O	14.8	1049	End of bedroom two
P	15.8	1117	Start of bathroom two
Q	16.8	1187	End of bathroom two
R	17.0	1207	Start of bedroom three
S	18.0	1277	End of bedroom three
T	18.3	1295	Start of the crawl space
U	19.3	1368	End of the crawl space
V	20.0	1419	Exiting the unit
W	21.7	1537	Start of the post-exit ambient
X	22.7	1606	End of the post-exit ambient
Y	23.8	1685	Start of the 30 mL/min spike
Z	24.8	1757	End of the 30 mL/min spike

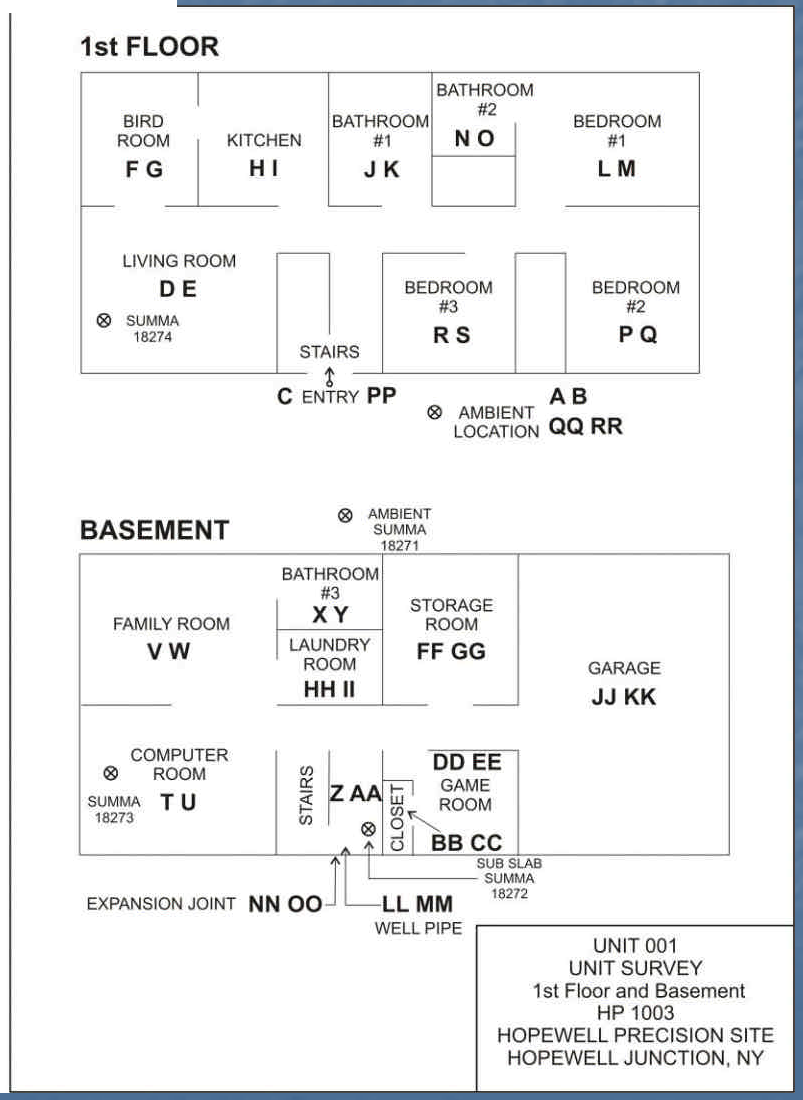
Region 6 TCE Site

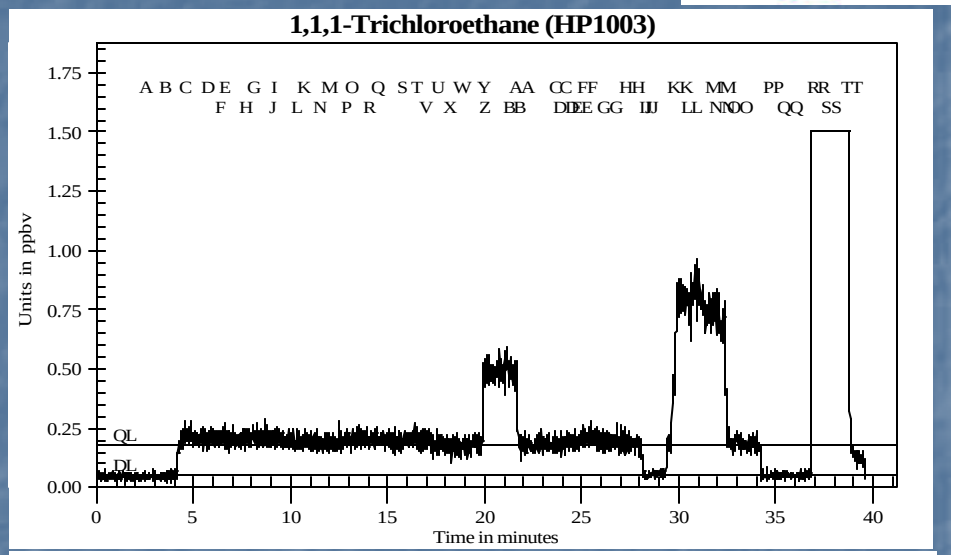
MONITORING FOR SUBSURFACE INTRUSION SOURCE

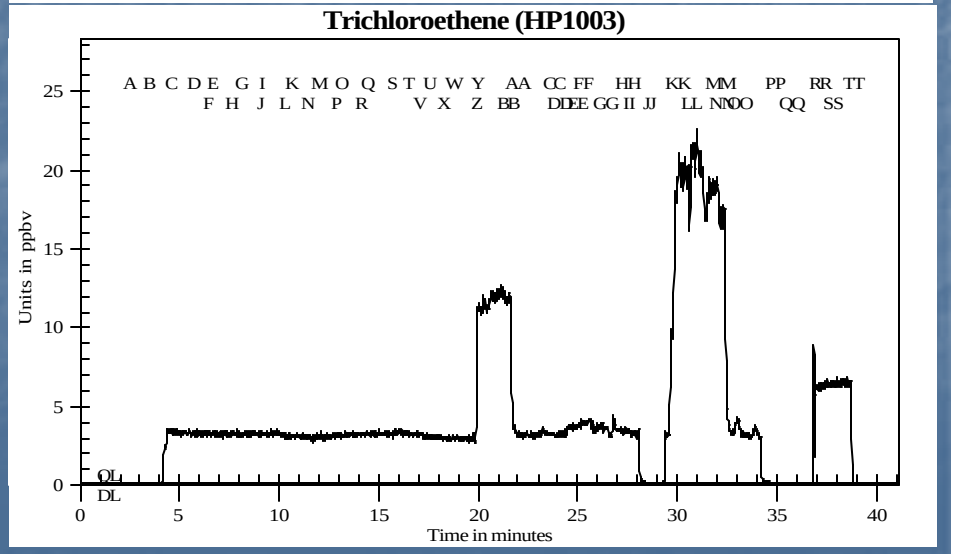
TCE Site

Region 2

Region 2 - TCE Site

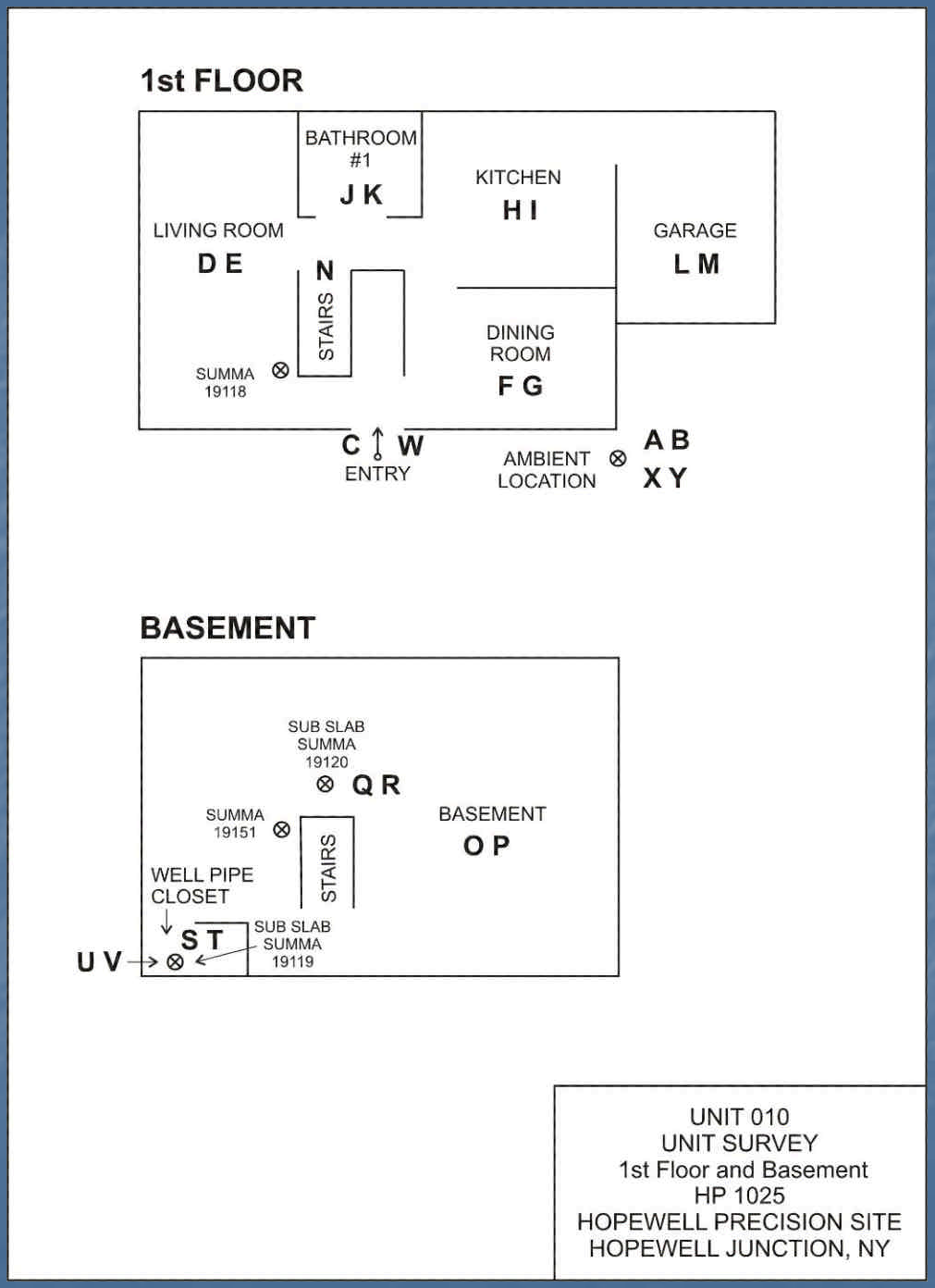

1st FLOOR
BIRD ROOM
F G
KITCHEN
H I
BATHROOM #1
J K
BATHROOM #2
N O
BEDROOM #1
L M
LIVING ROOM
D E
SUMMA 18274
STAIRS
BEDROOM #3
R S
BEDROOM #2
P Q
C ENTRY PP
AMBIENT LOCATION
A B
QQ RR
BASEMENT
AMBIENT SUMMA 18271
FAMILY ROOM
V W
BATHROOM #3
X Y
LAUNDRY ROOM
HH II
STORAGE ROOM
FF GG
GARAGE
JJ KK
COMPUTER ROOM
SUMMA 18273
T U
STAIRS
Z AA
CLOSET
DD EE
GAME ROOM
BB CC
SUB SLAB SUMMA 18272
EXPANSION JOINT NN OO
LL MM
WELL PIPE
UNIT 001
UNIT SURVEY
1st Floor and Basement
HP 1003
HOPEWELL PRECISION SITE
HOPEWELL JUNCTION, NY


1,1,1-Trichloroethane (HP1003)
A B C D E G I K M O Q S T U W Y AA CC FF HH KK MM PP RR TT
F H J L N P R V X Z BB DD EE GG II JJ LL NN OO QQ SS
Units in ppbv
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
QL
DL
0
5
10
15
20
25
30
35
40
Time in minutes


Trichloroethene (HP1003)
A B C D E G I K M O Q S T U W Y AA CC FF HH KK MM PP RR TT
F H J L N P R V X Z BB DD EE GG II JJ LL NN OO QQ SS
Units in ppbv
25
20
15
10
5
0
QL
DL
0
5
10
15
20
25
30
35
40
Time in minutes

MONITORING FOR LIFESTYLE SOURCES
TCE Site
Region 2

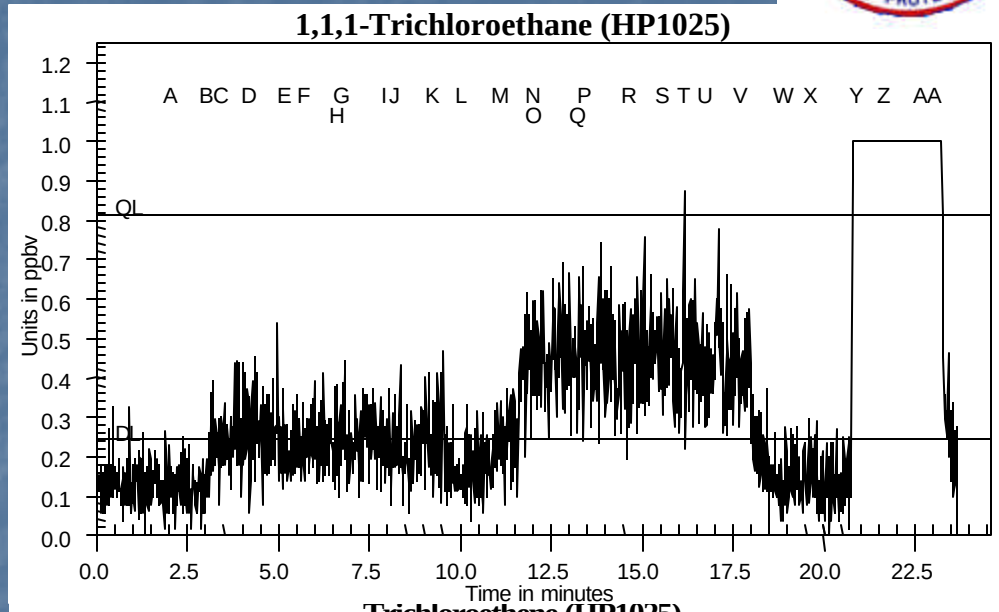
Region 2 - TCE Site

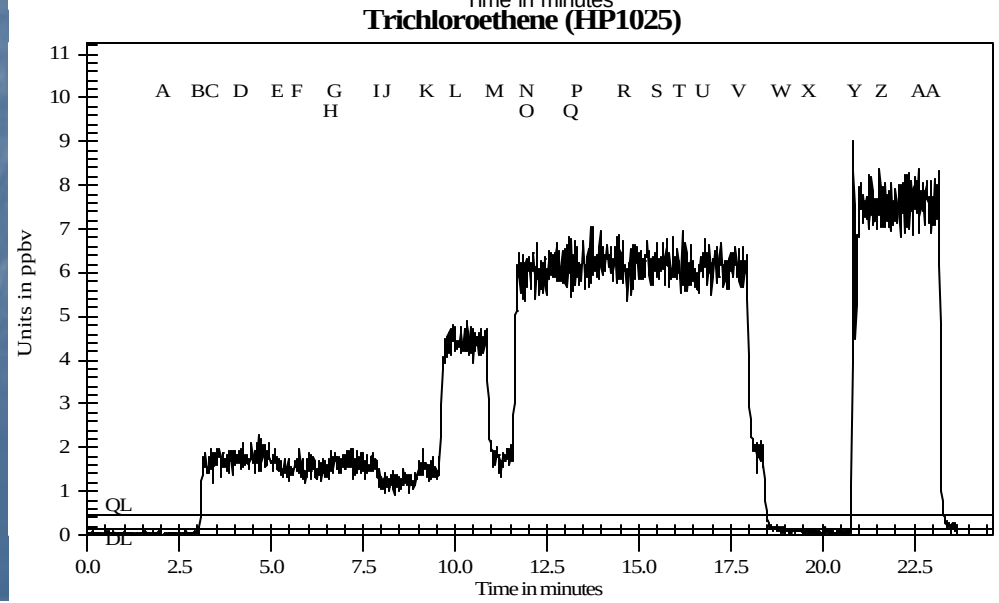


Schematic of the Residence

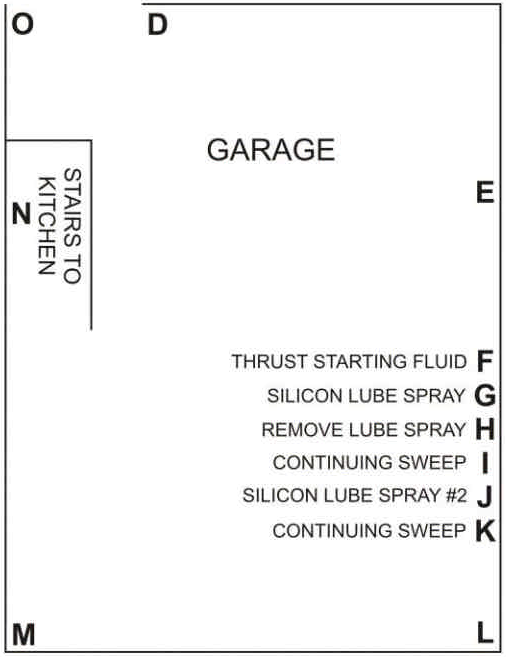
TAGA File Event Summary
File: HP1025 Acquired on 01/27/04 At: 15:41:14
Title: Unit 010 Survey

Flag	Time	Offset Sequence	Description
A	1.3	148	Start of the pre-entry ambient
B	2.3	229	End of the pre-entry ambient
C	2.7	262	Entering the unit
D	3.5	324	Start of the living room
E	4.5	405	End of the living room
F	5.0	449	Start of the dining room
G	6.0	529	End of the dining room
H	6.3	556	Start of the kitchen
I	7.3	634	End of the kitchen
J	7.5	653	Start of the bathroom
K	8.5	735	End of the bathroom
L	9.3	801	Start of the garage
M	10.3	882	End of the garage
N	11.2	957	Entering the basement
O	11.7	992	Start of the basement
P	12.7	1072	End of the basement
Q	12.9	1090	Start of the sub-slab sampling port
R	13.9	1171	End of the sub-slab sampling port
S	14.8	1247	Start of the sub-slab closet
T	15.4	1298	End of the sub-slab closet
U	16.0	1343	Start of the sub-slab sampling port 2
V	17.0	1424	End of the sub-slab sampling port 2
W	18.1	1511	Exiting the unit
X	18.9	1580	Start of the post-exit ambient
Y	20.1	1680	End of the post-exit ambient
Z	20.9	1743	Start of the post-exit 30 mL/min spike
AA	21.9	1824	End of the post-exit 30 mL/min spike





INVESTIGATION



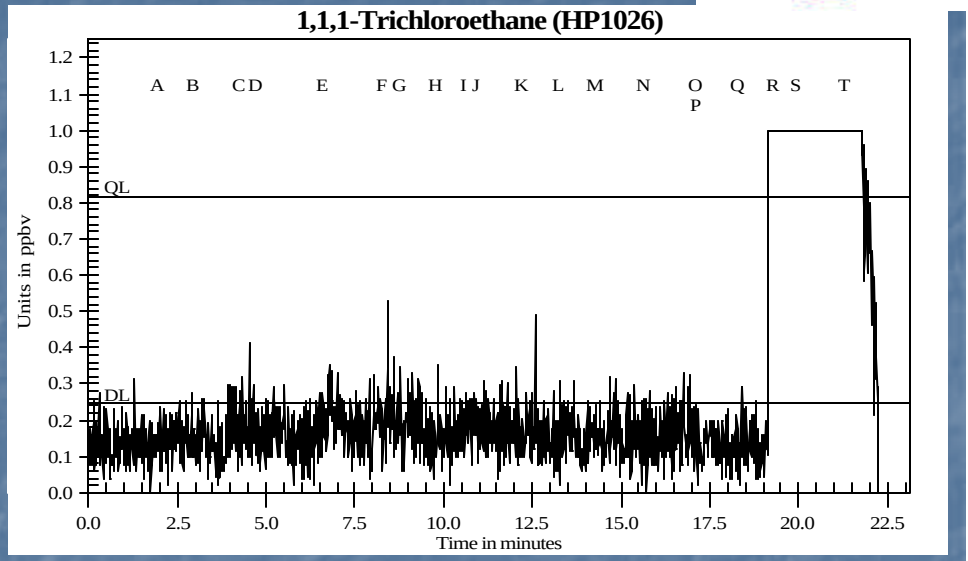
Q R
A B - AMBIENT

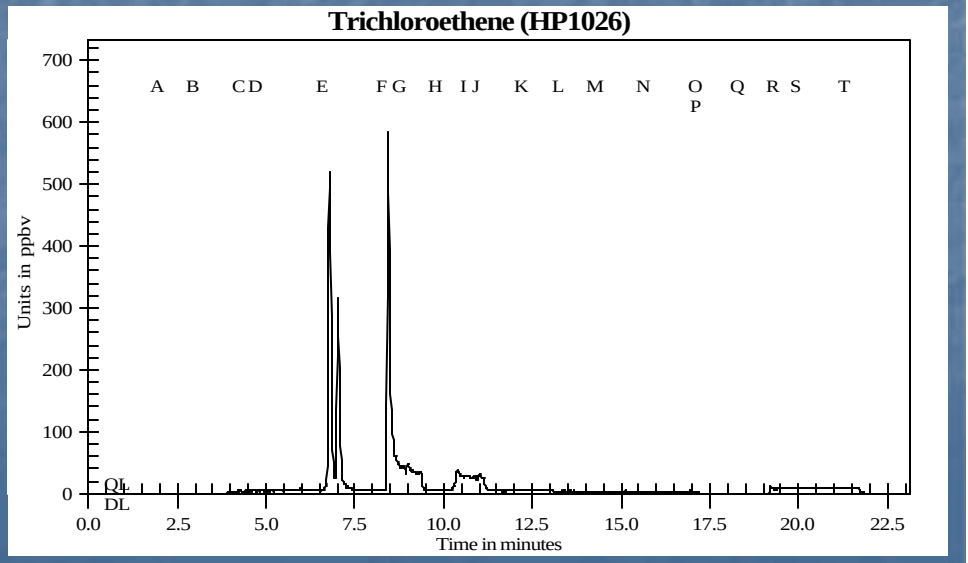
C - ENTER

P - EXIT

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

TAGA File Event Summary File: HP1026 Acquired on 01/27/04 At: 16:06:20 Title: Unit 010 Investigation			
Flag	Time	Offset Sequence	Description
A	1.2	141	Start of the pre-entry ambient
B	2.2	223	End of the pre-entry ambient
C	3.5	328	Entering the garage
D	4.0	366	Starting clockwise sweep
E	5.9	523	Sweeping at the shelf of household products
F	7.6	659	At the rust quick starting fluid
G	8.0	694	At the silicon lube spray
H	9.0	777	Leaving the can of spray
I	9.9	851	Continuing sweep
J	10.3	878	At the second can of silicon lube spray
K	11.5	977	Continuing sweep
L	12.5	1061	At the garage door
M	13.5	1138	Sweeping the common wall between garage and house
N	14.9	1256	At the area beneath the stairs
O	16.4	1374	At the light switch in the wall
P	16.7	1403	Exiting garage
Q	17.5	1468	Start of the post-exit ambient
R	18.5	1550	End of the post-exit ambient
S	19.3	1608	Start of the post-exit 30 mL/min spike
T	20.6	1716	End of the post-exit 30 mL/min spike





MONITORING FOR METEOROLOGICAL EFFECTS

TCE Site

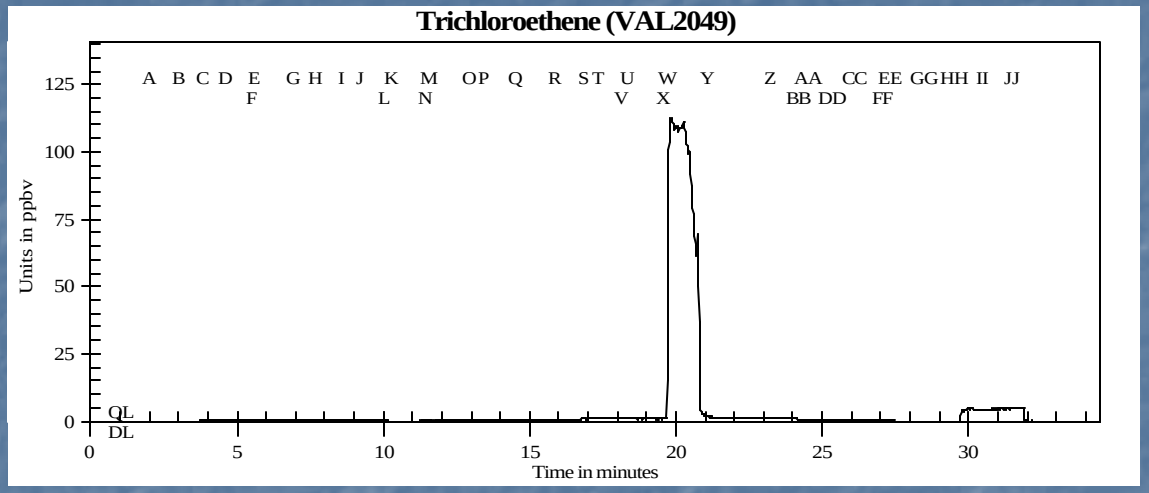
Region 3

Region 3 - TCE Site

1ST

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

Wet Sumps

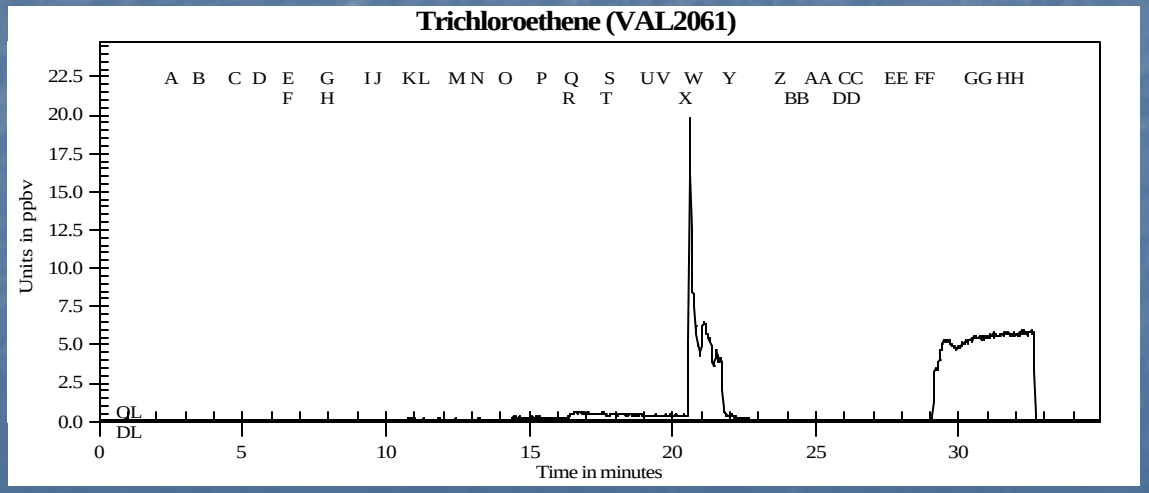


~ 120 PPBV

2ND

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

Dry Sumps



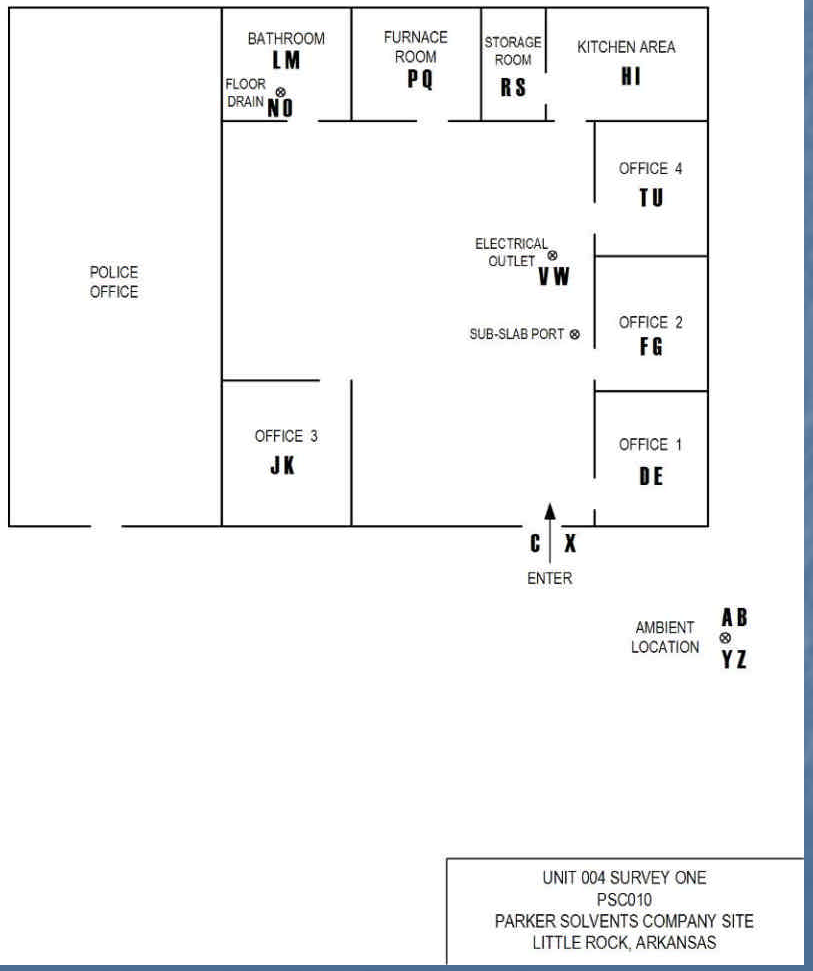
~21 PPBV

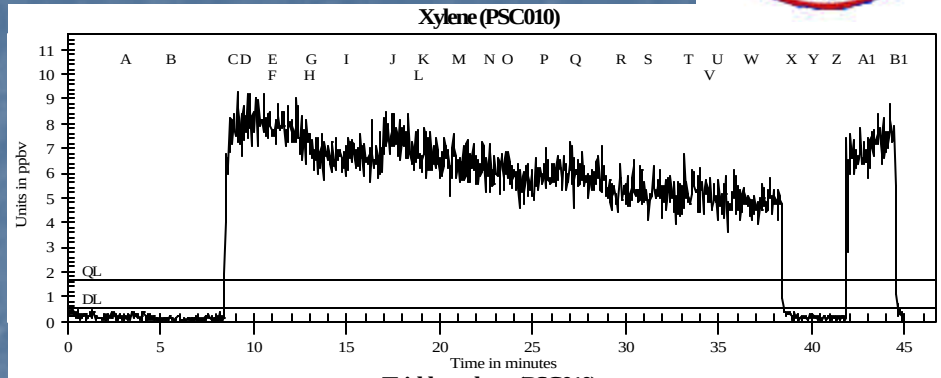
TRICHLOROETHENE CONCENTRATIONS

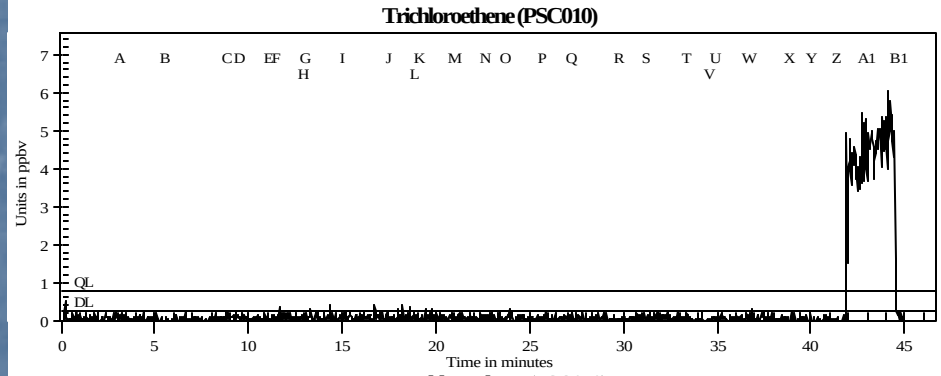
MONITORING FOR CONTRIBUTIONS FROM ATTACHED FACILITIES

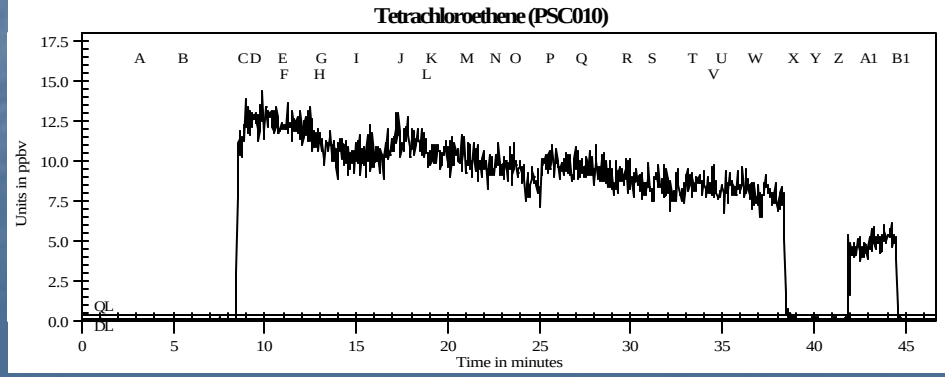
Solvent Site

Region 6

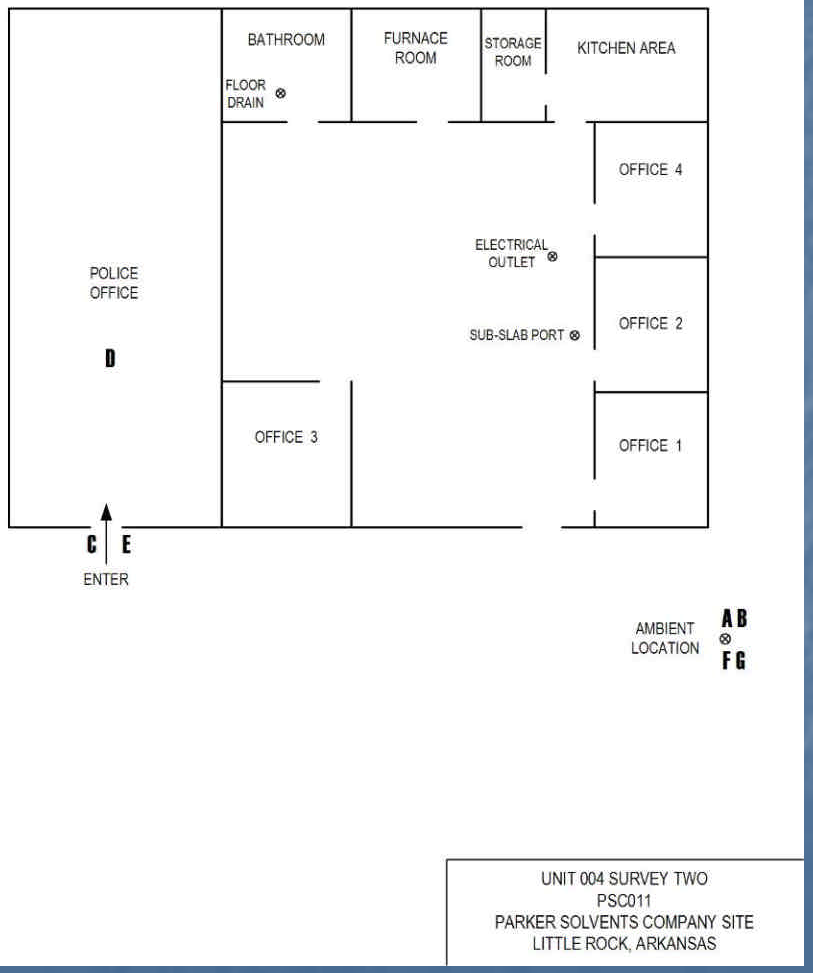


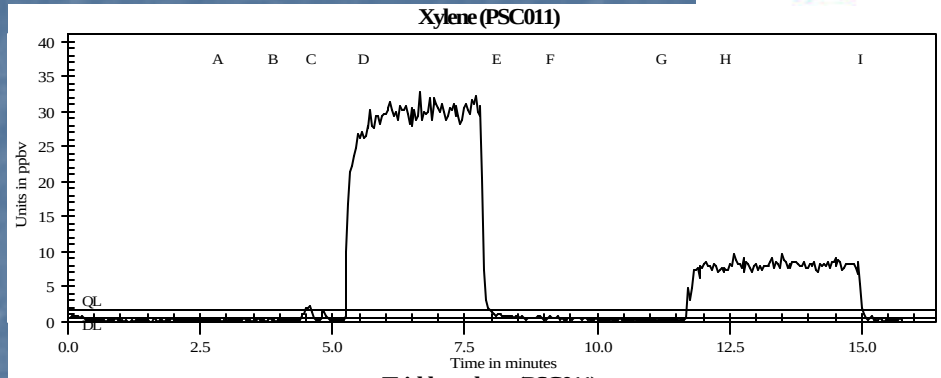


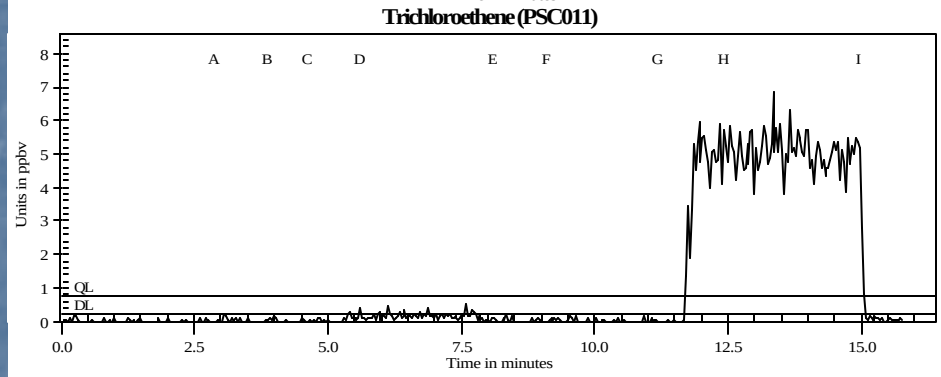


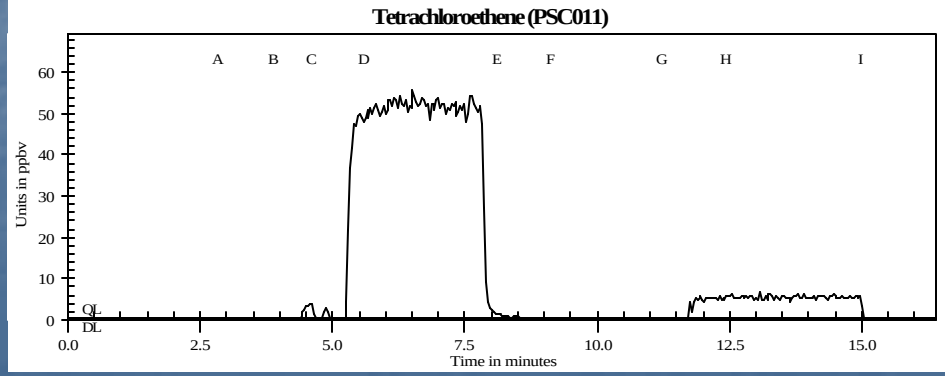


Region 6 Solvent Site







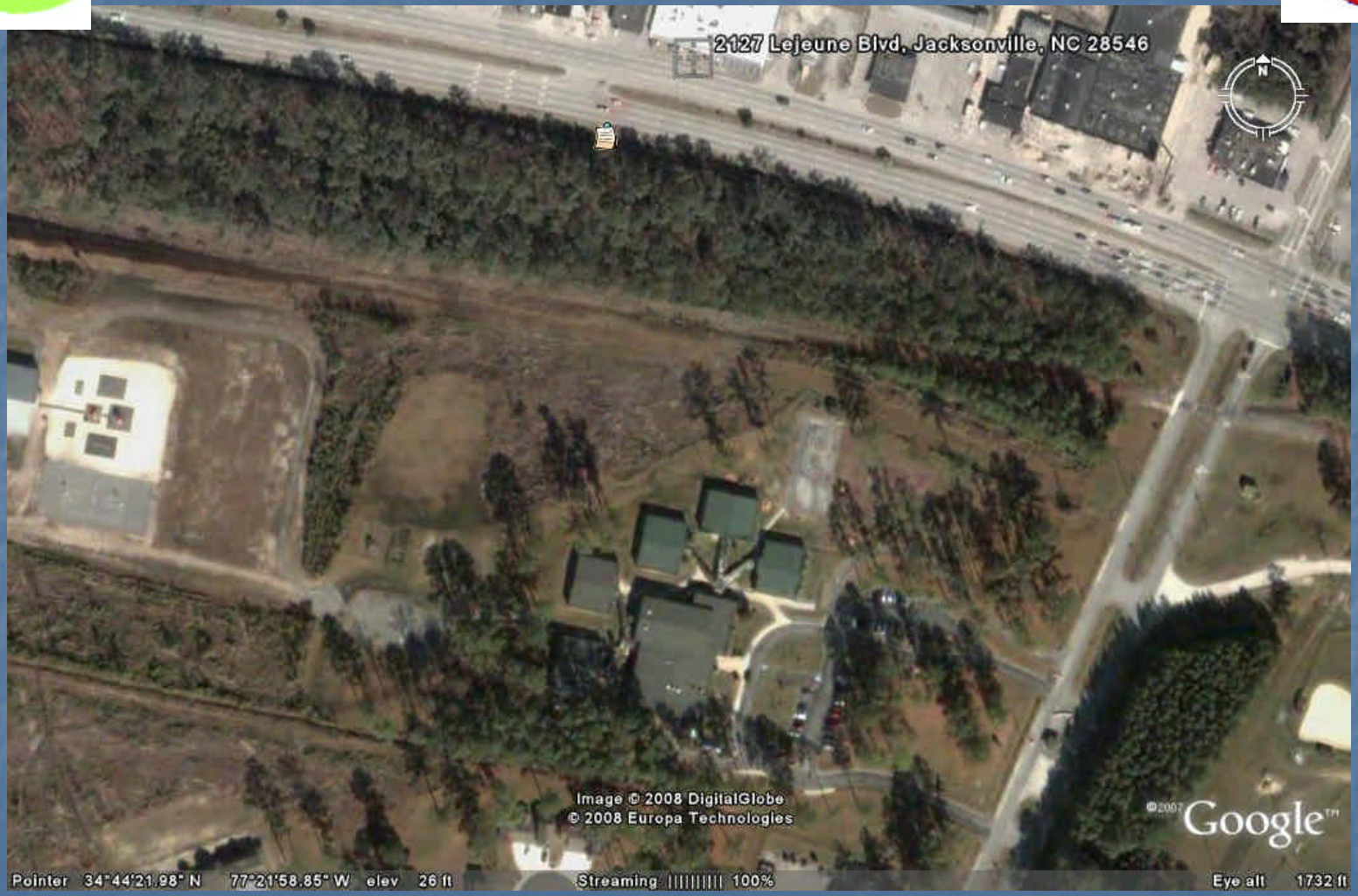


Region 6 Solvent Site

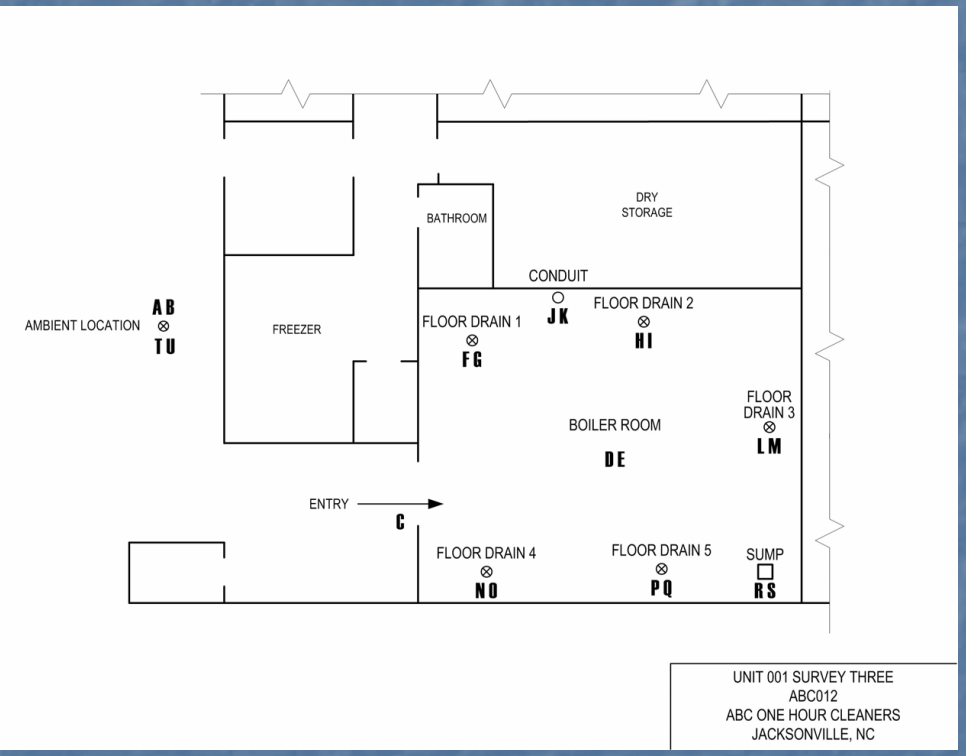
MONITORING FOR CONTRIBUTIONS FROM SELF-POLLUTING OPERATIONS

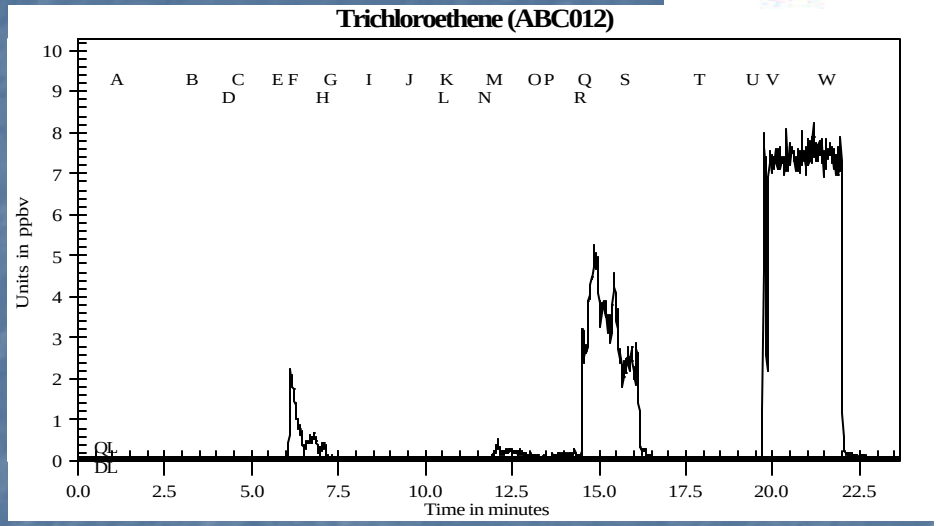
PCE Site

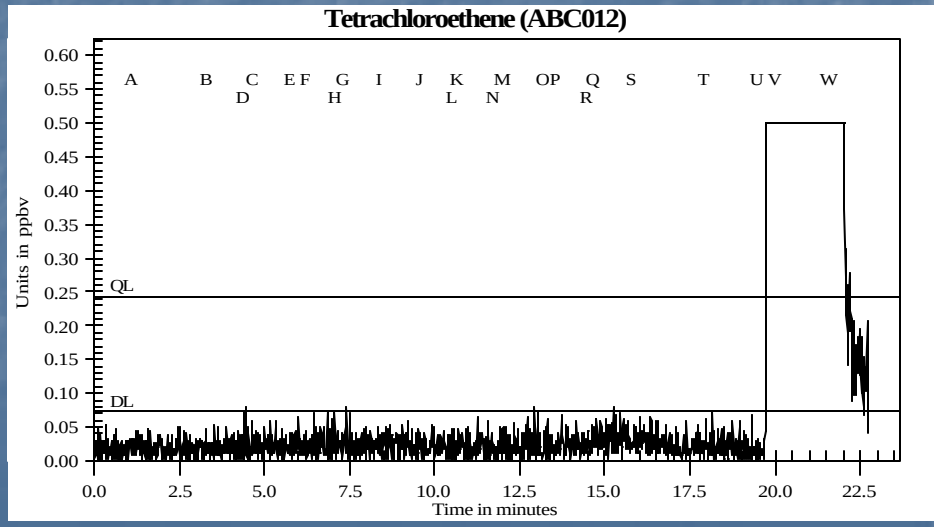
Region 4



Tarawa Terrace Primary School







Region 4 PCE Site

MONITORING FOR CONTRIBUTIONS FROM ACTIVITIES IN ADJACENT STRUCTURES

Region 5

Region 5 – PCE Site

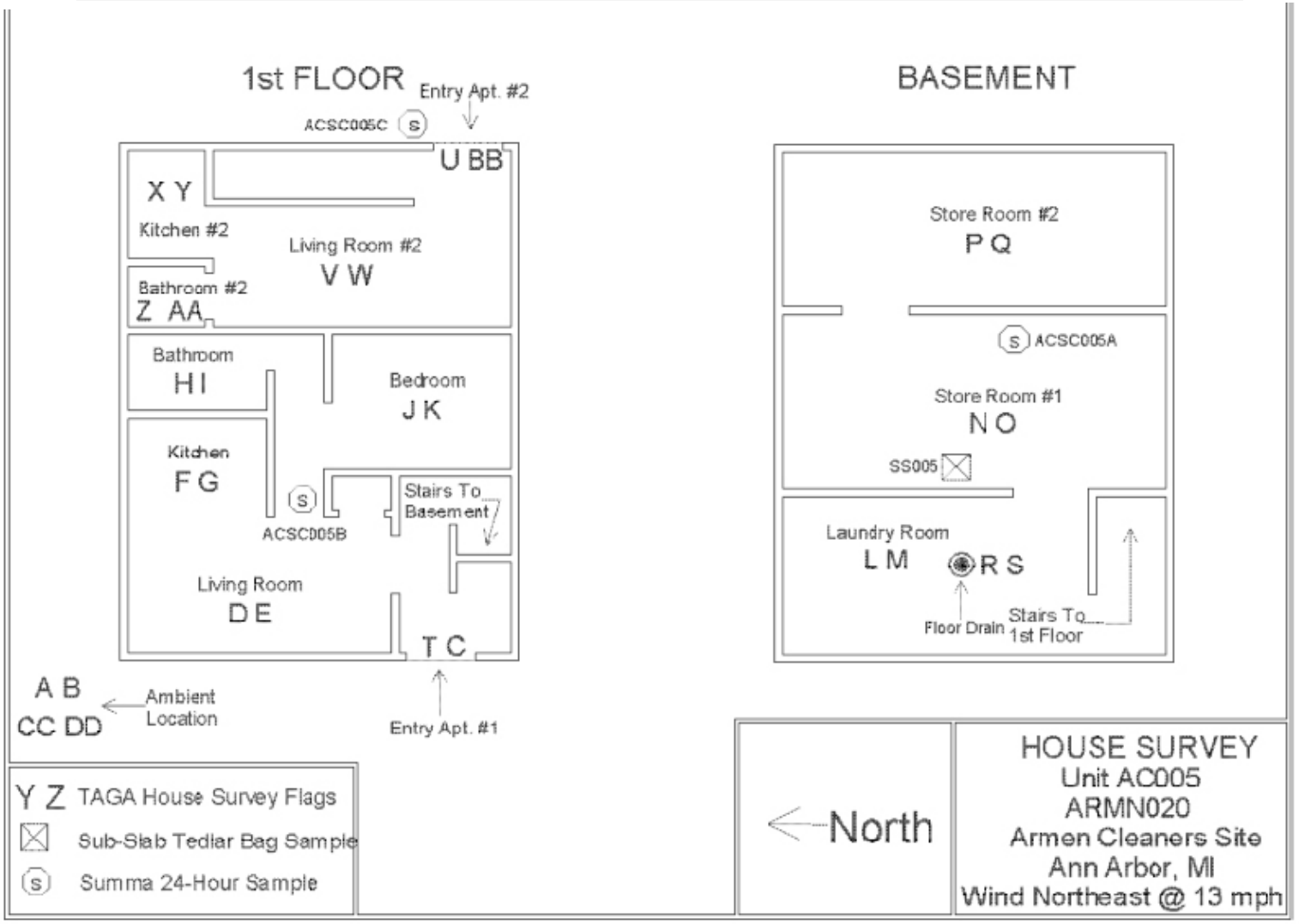
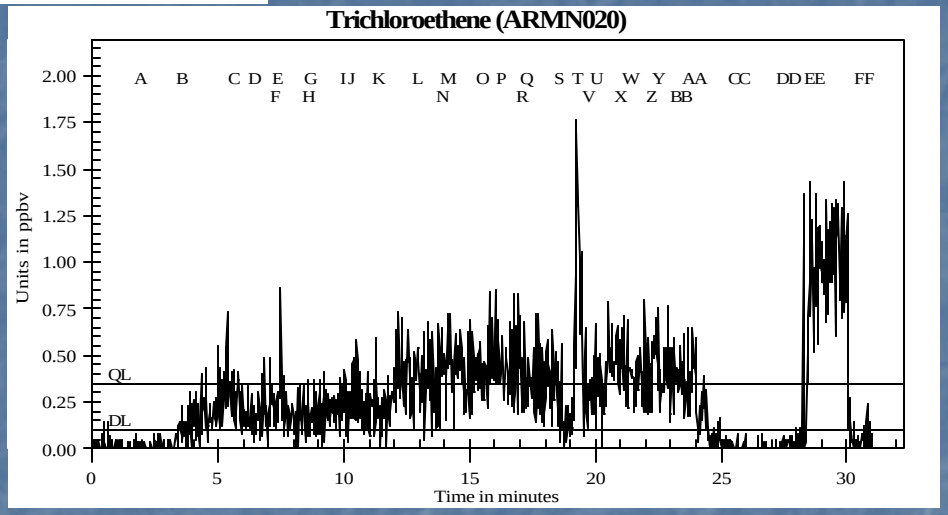
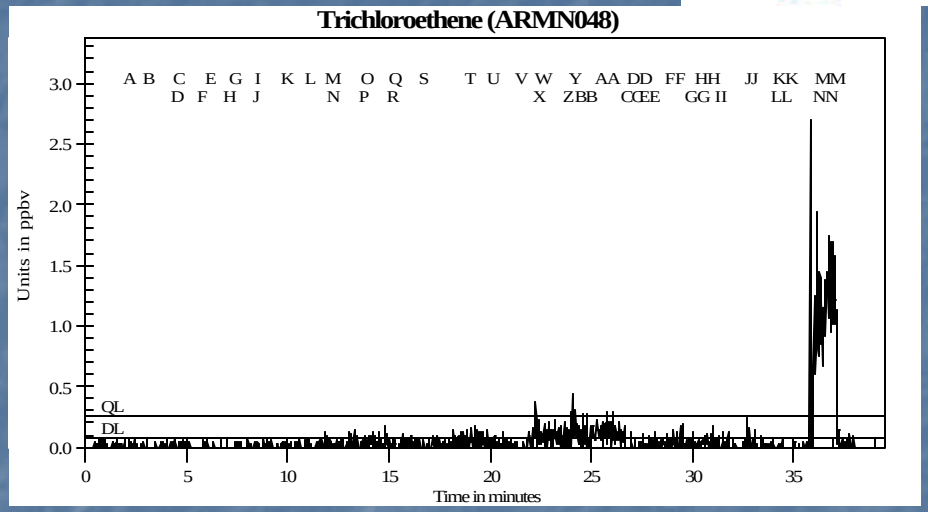
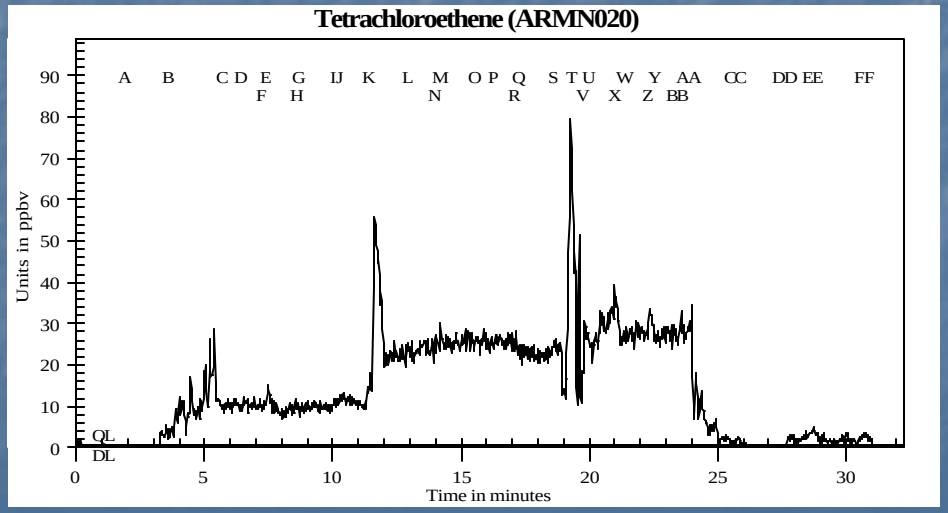


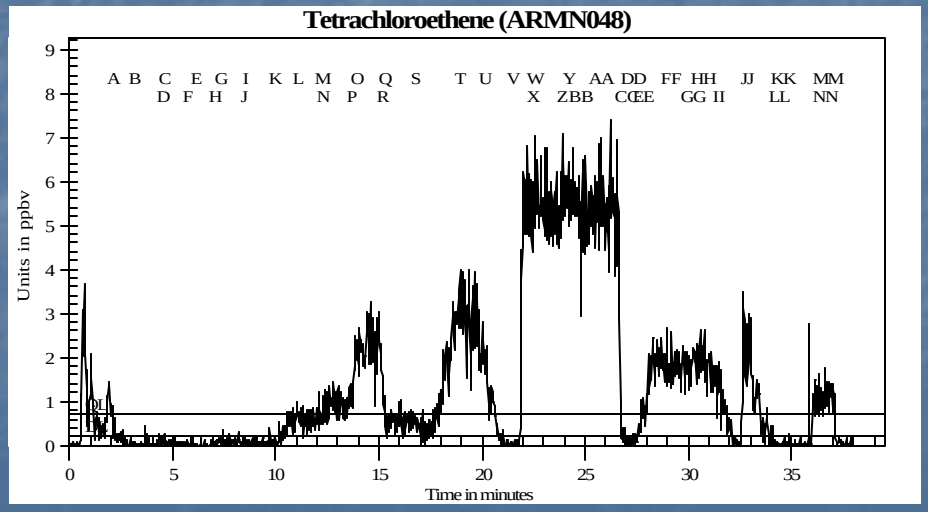
Figure 7a House Survey in Unit AC-005, ARMN020

Schematic of the Residence



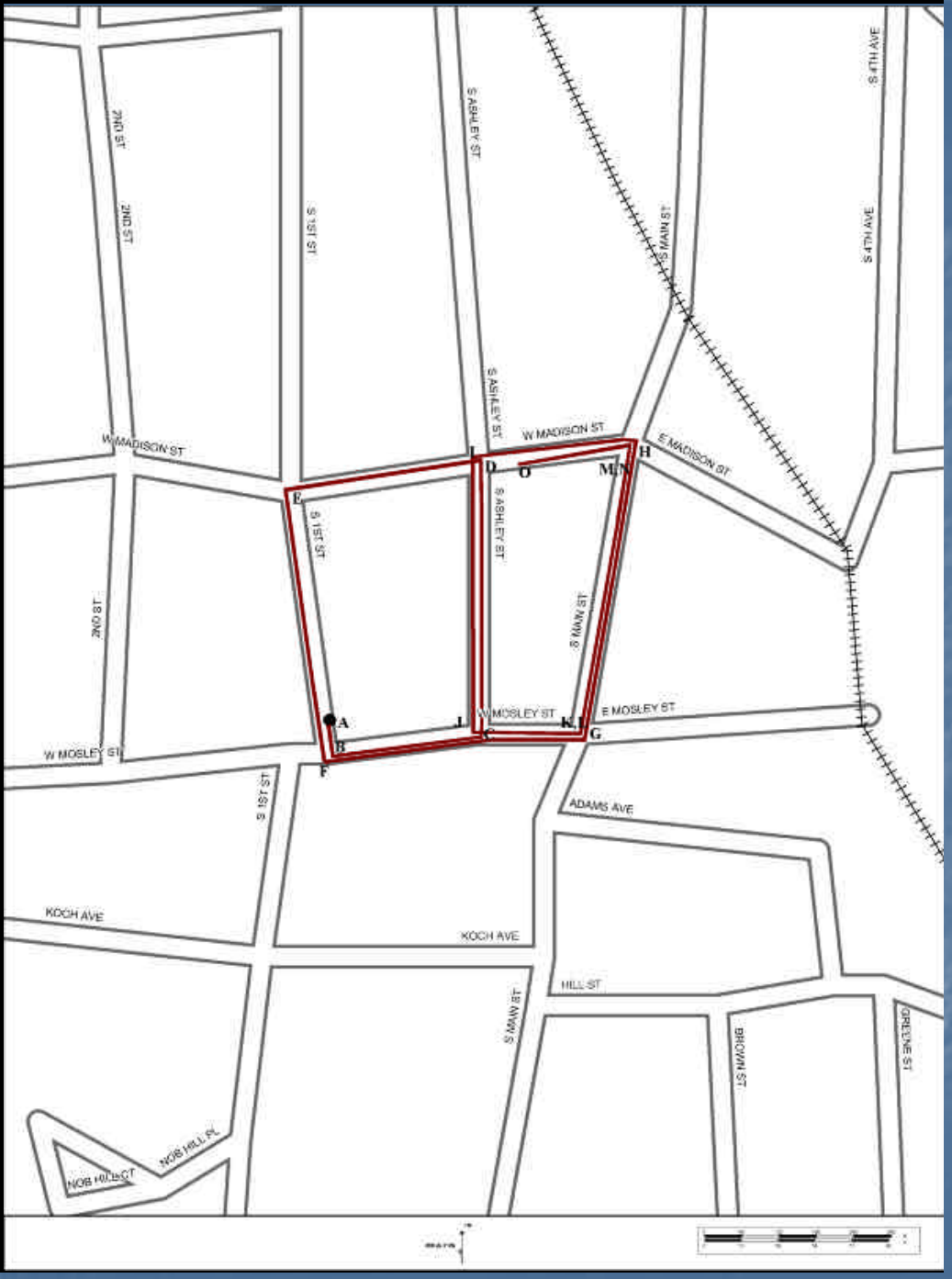


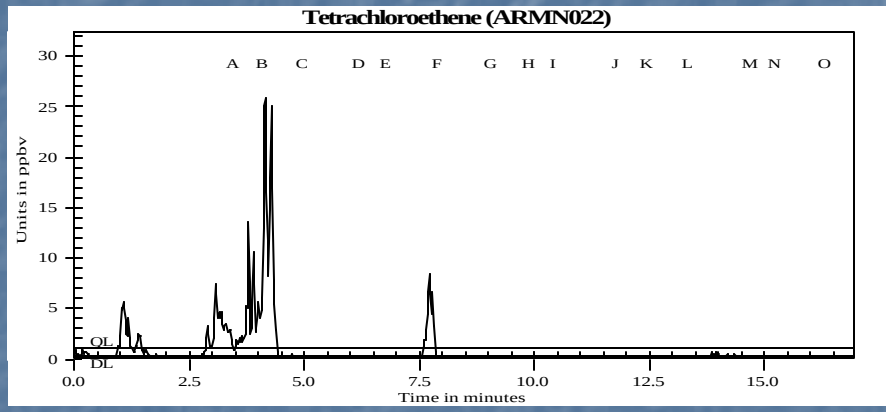




Northeast – 13 mph

North – 12 mph





Wind: 10 mph/050°

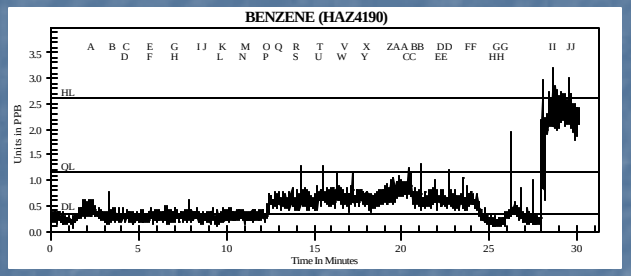
Figure 18a Mobile Monitoring Path Two, ARMN022

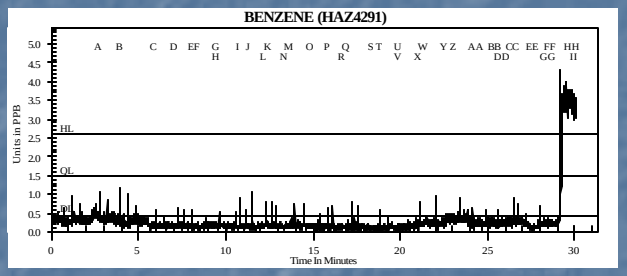
MONITORING FOR ACCIDENTAL OR INTENTIONAL RELEASES

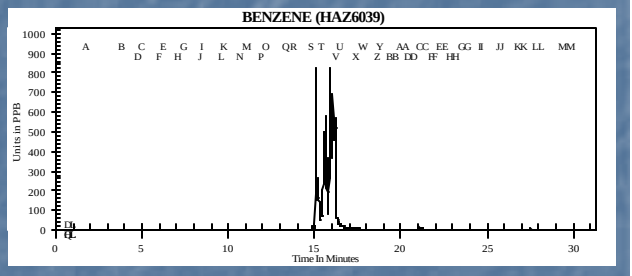
Gasoline Spill Site

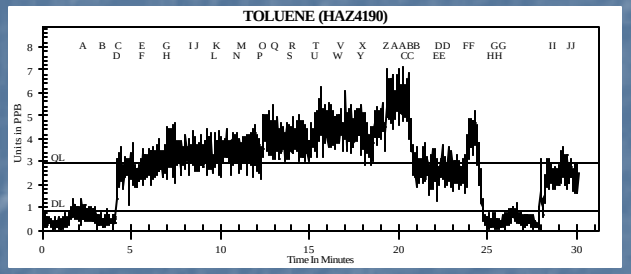
Region 3

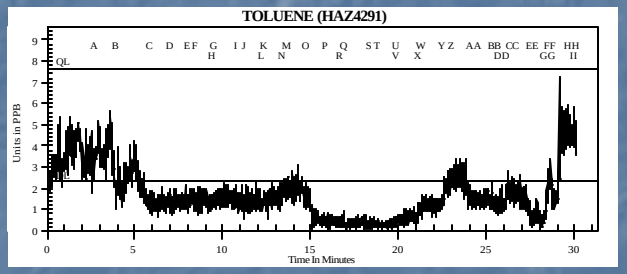
1st 2nd 3rd

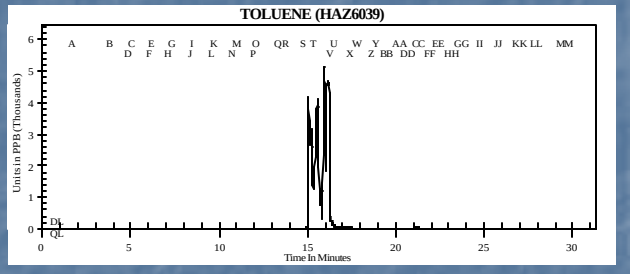


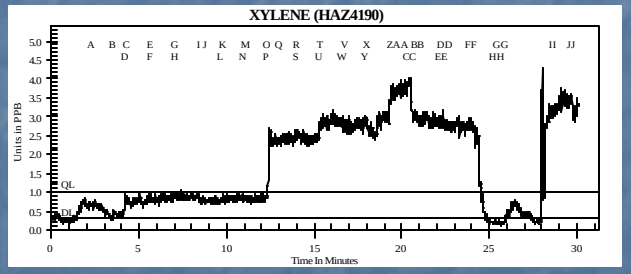


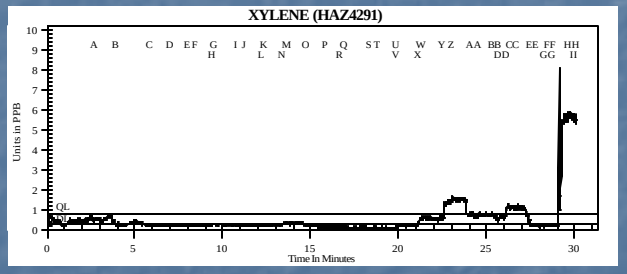


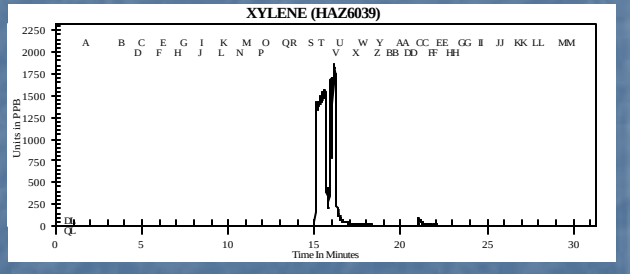












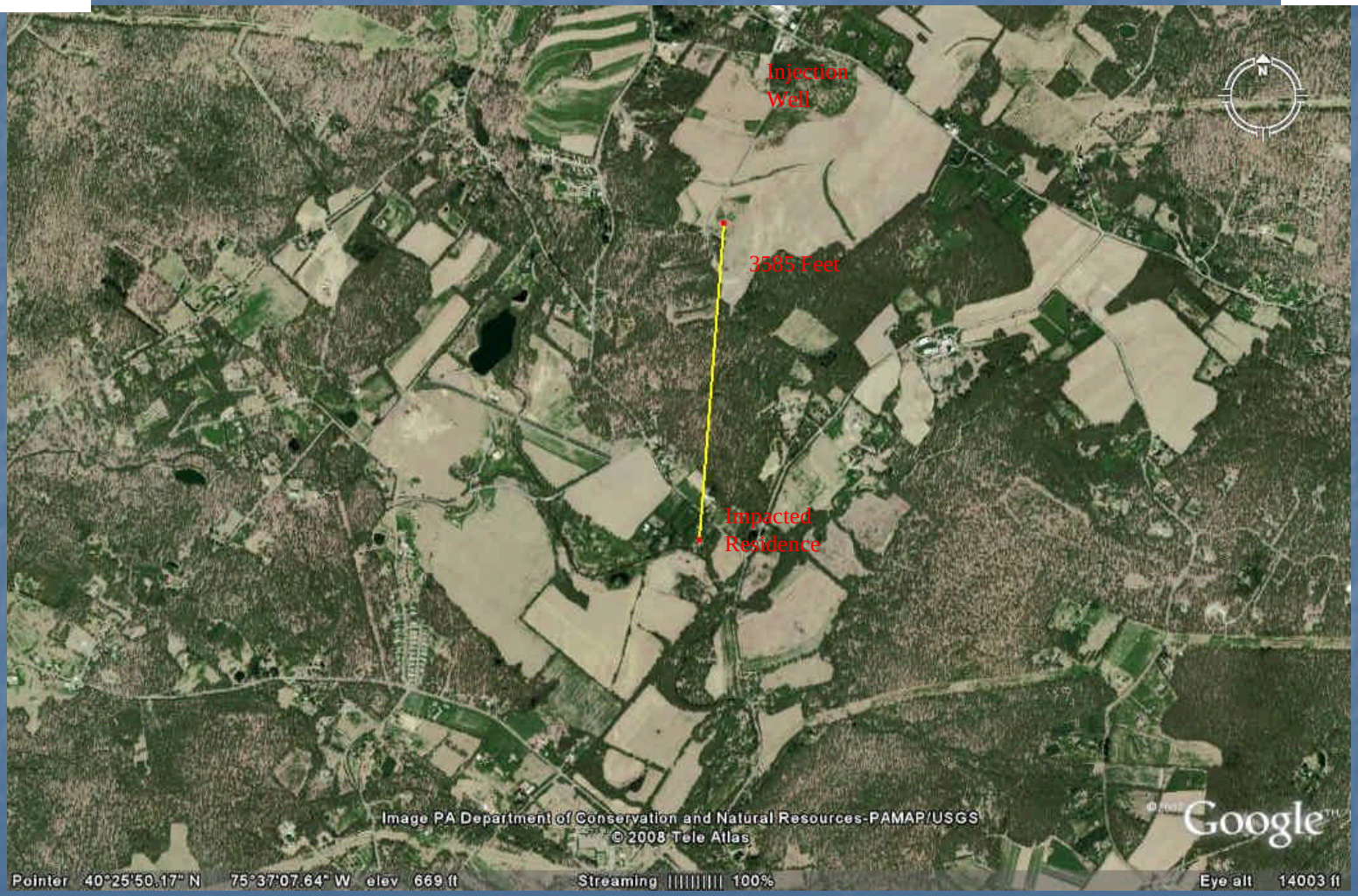
< 1.0 PPBV < 1.0 PPBV > 900 PPBV

BENZENE CONCENTRATIONS

MONITORING FOR FRACTURED BEDROCK CONTRIBUTIONS

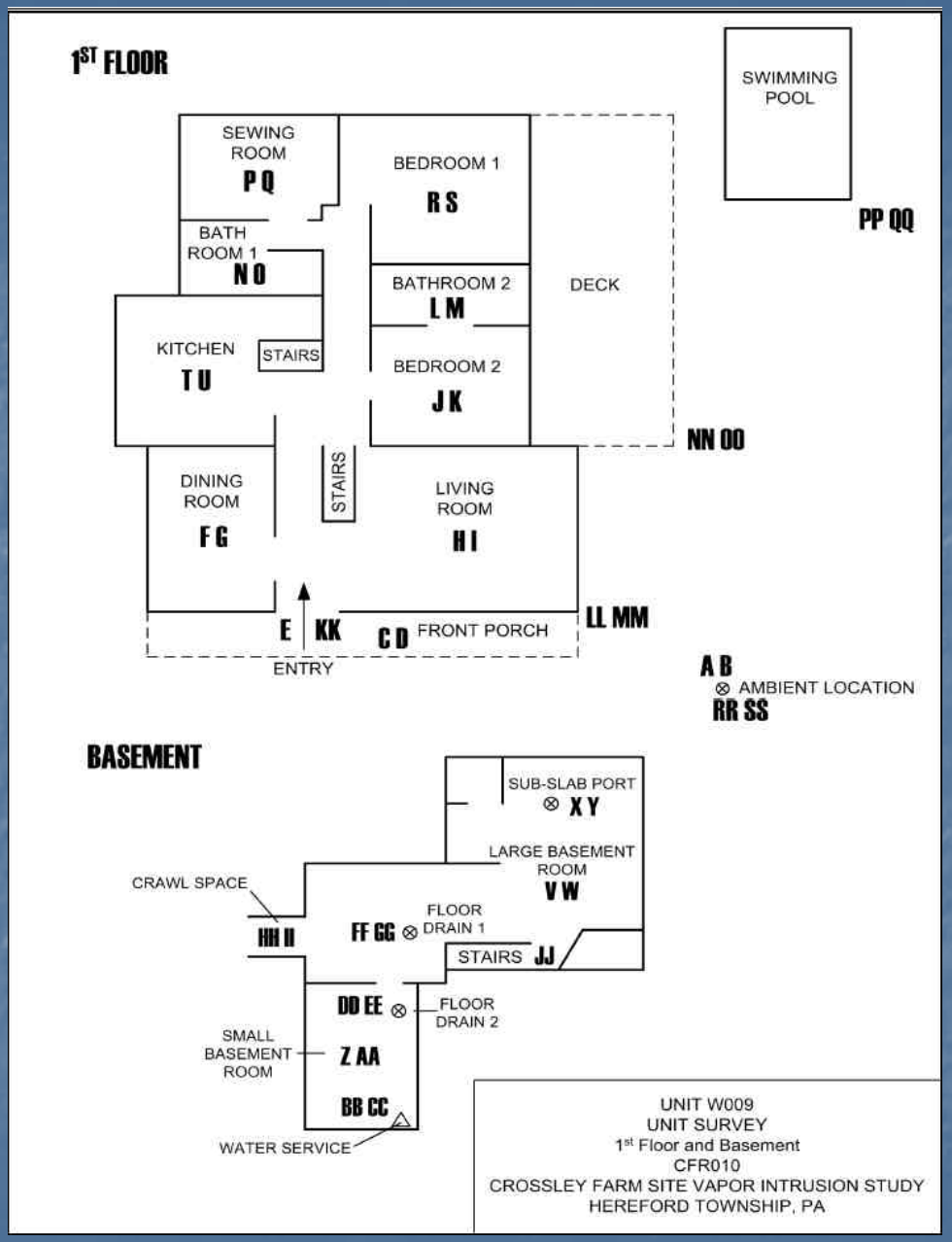
TCE Site

Region 3

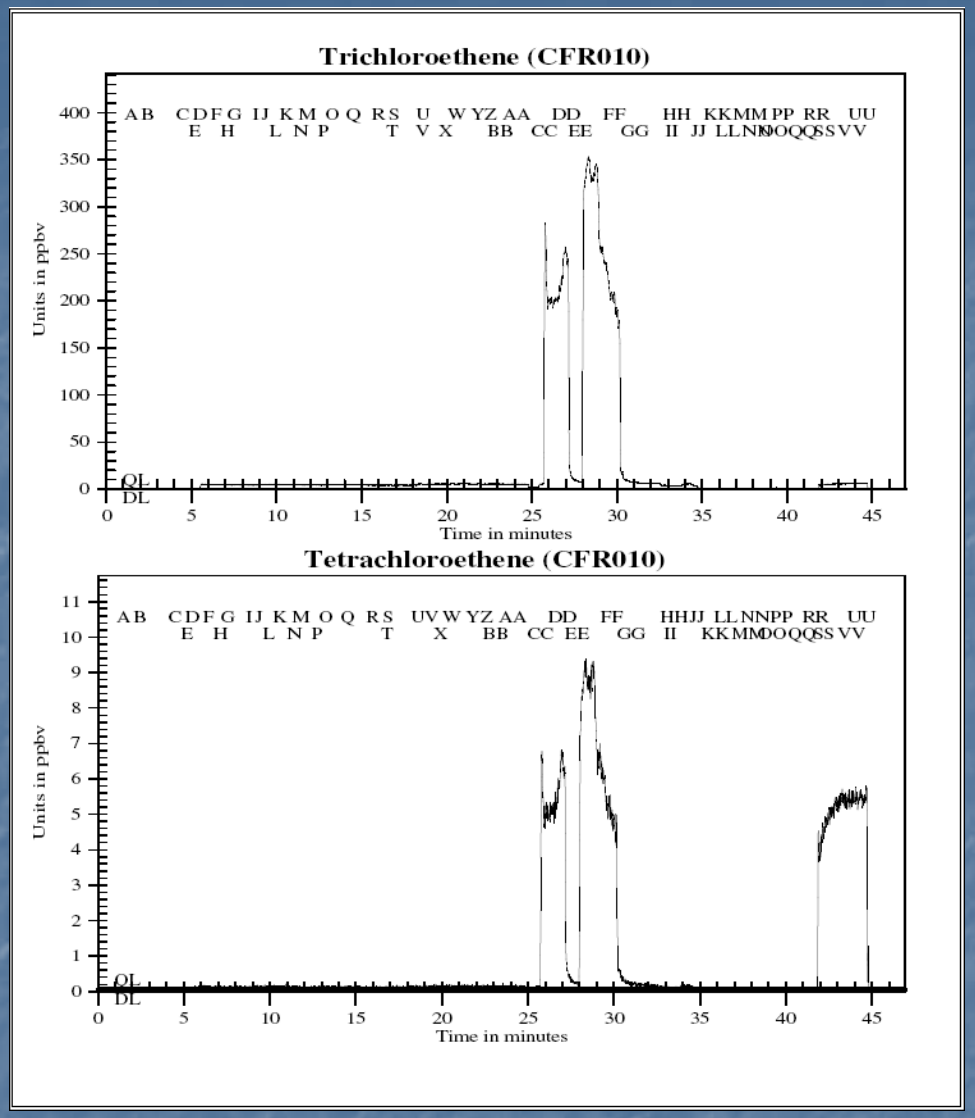


Crossley Farm Site Satellite Overview

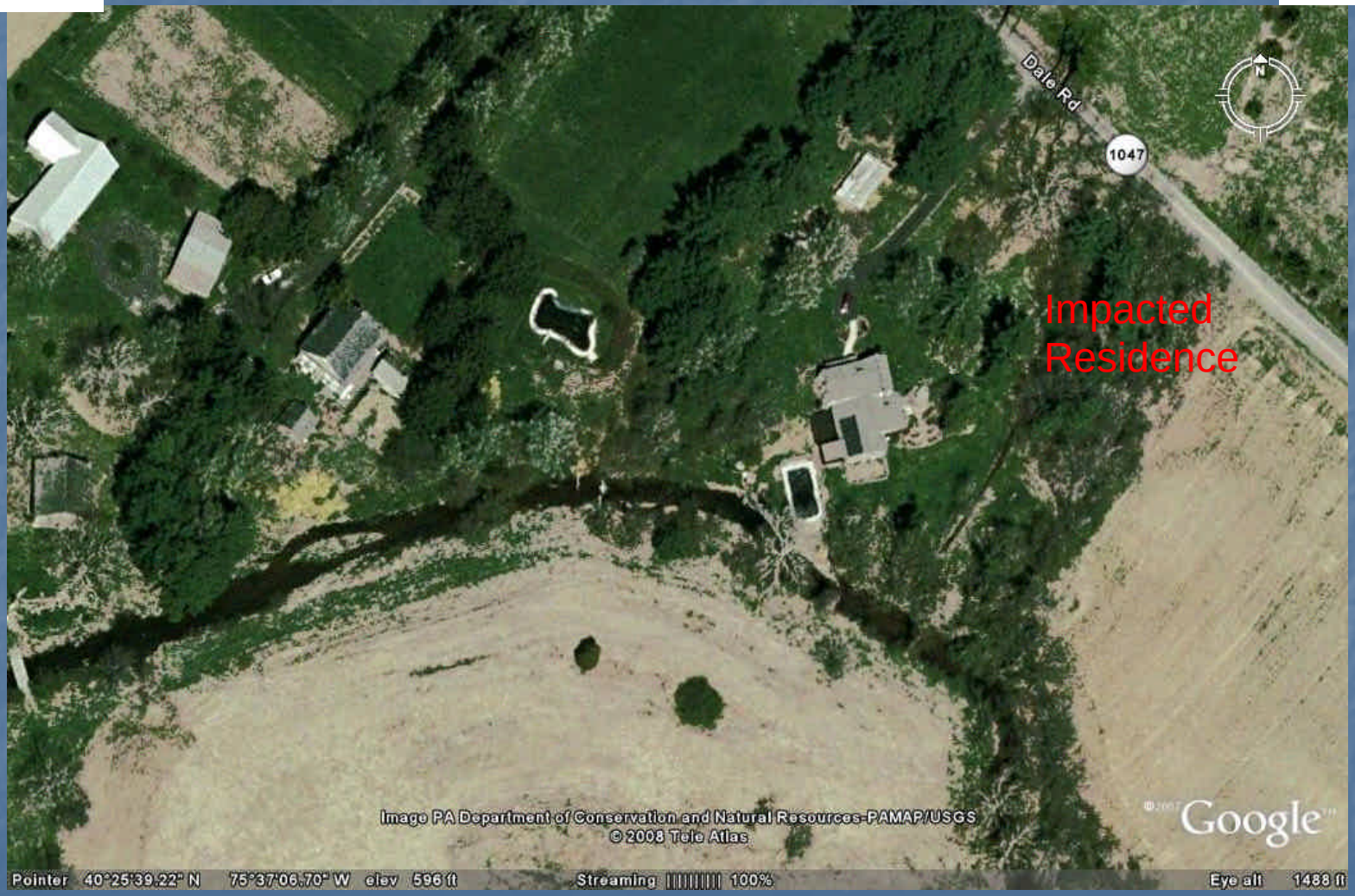
Region 3 - Trichloroethene Site



Schematic of the Residence

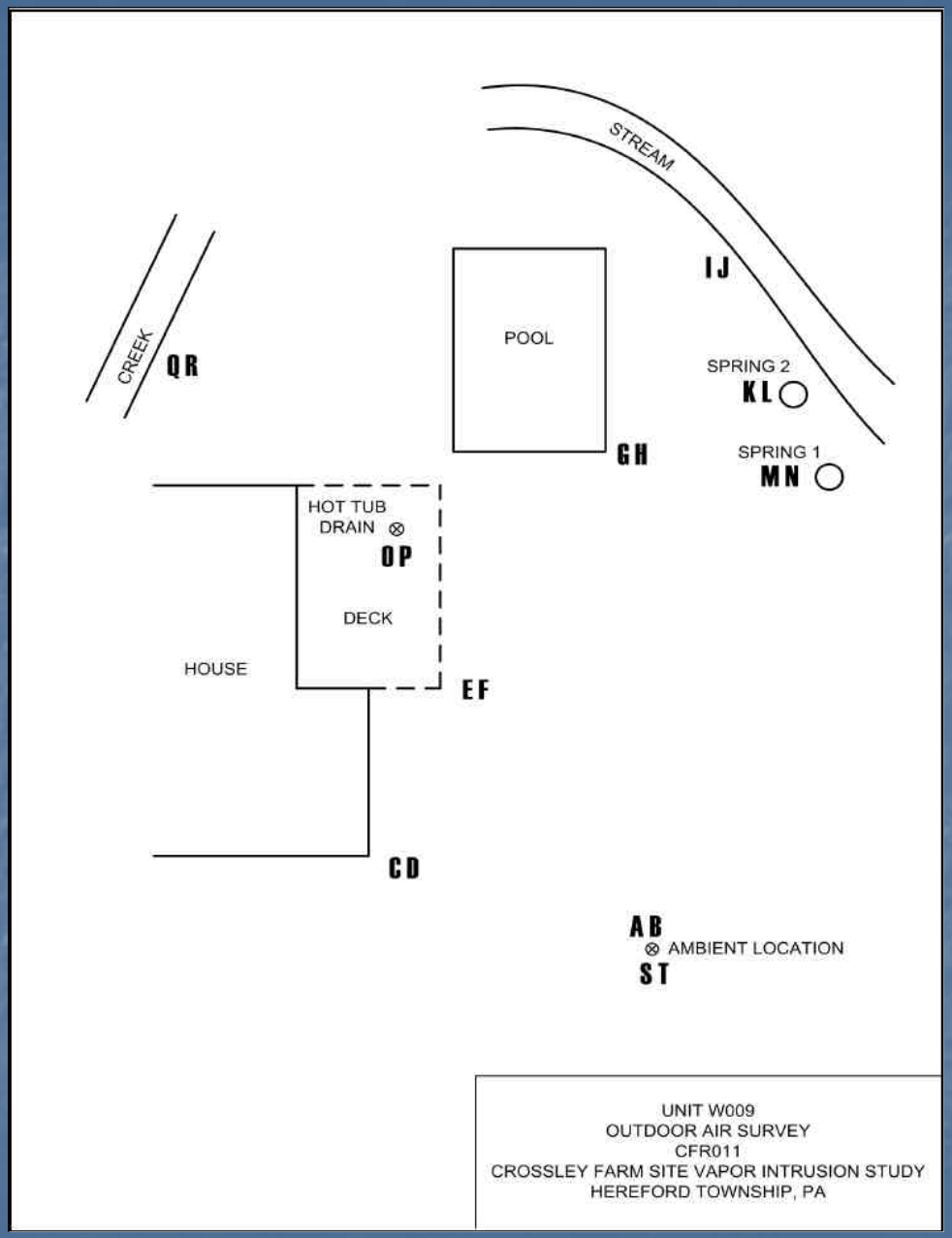


Ion Profiles of Trichloroethene and Tetrachloroethene

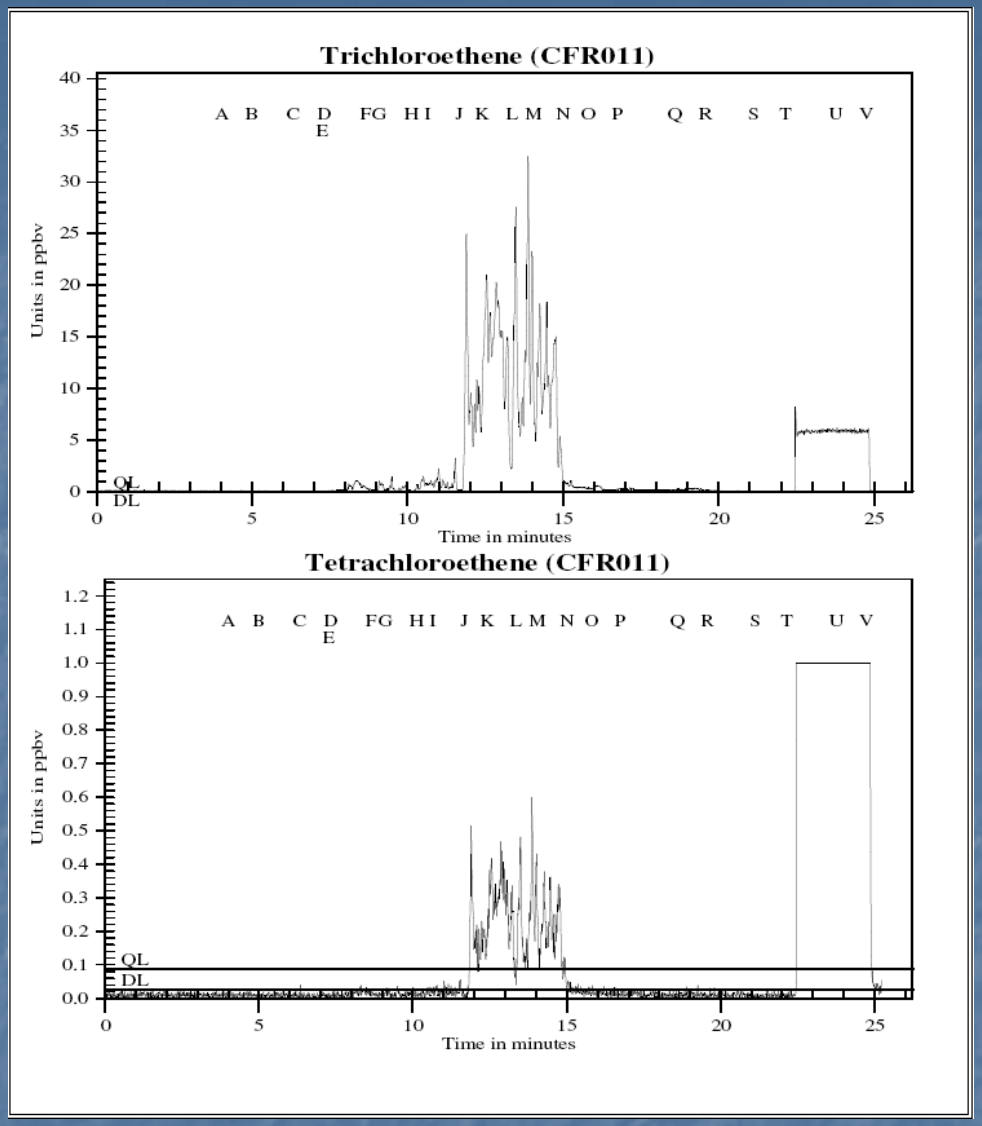


Crossley Site Residence Satellite Overview

Region 3 - Trichloroethene Site



Schematic of the Area Adjacent to the Residence

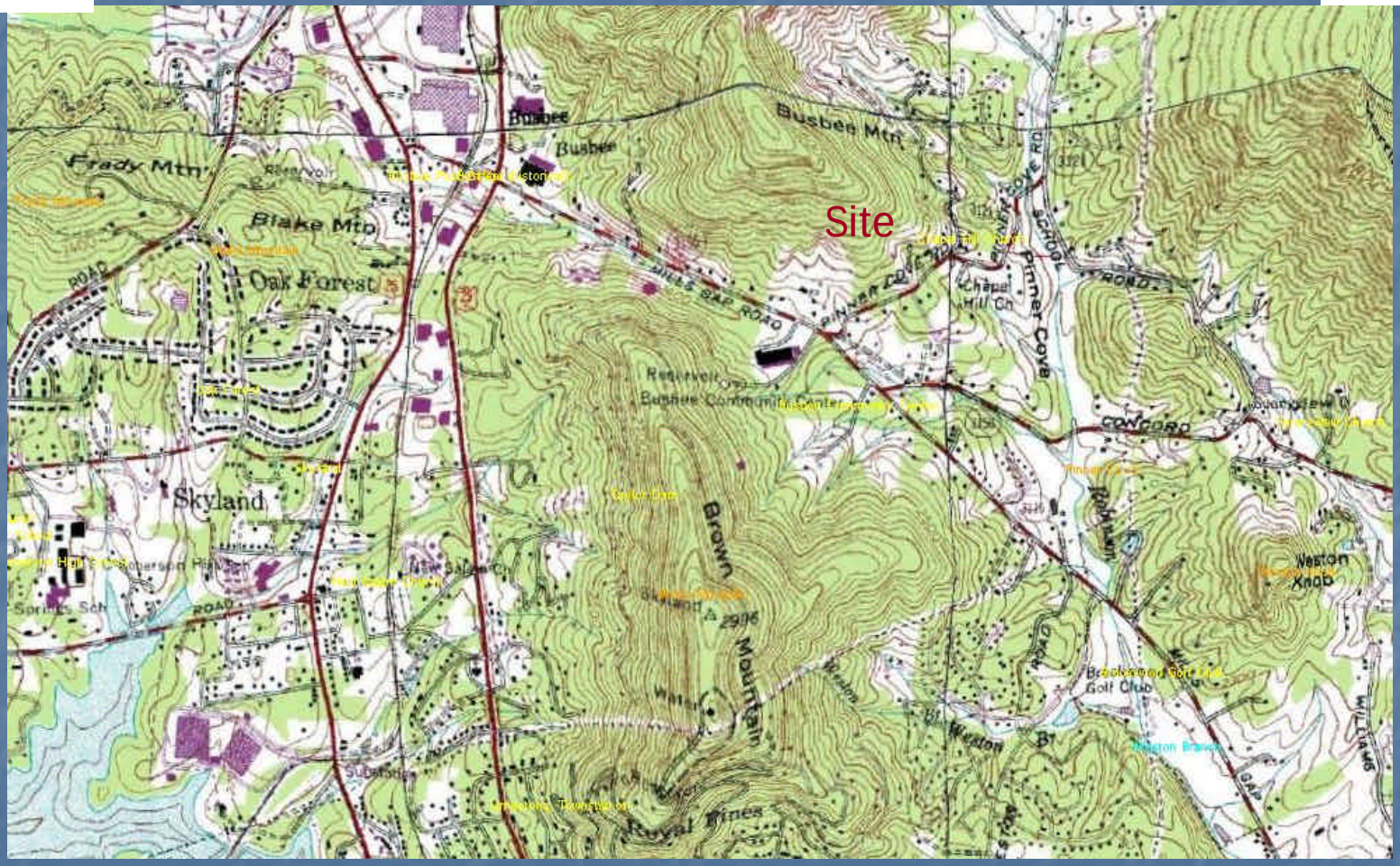


Ion Profiles of Trichloroethene and Tetrachloroethene

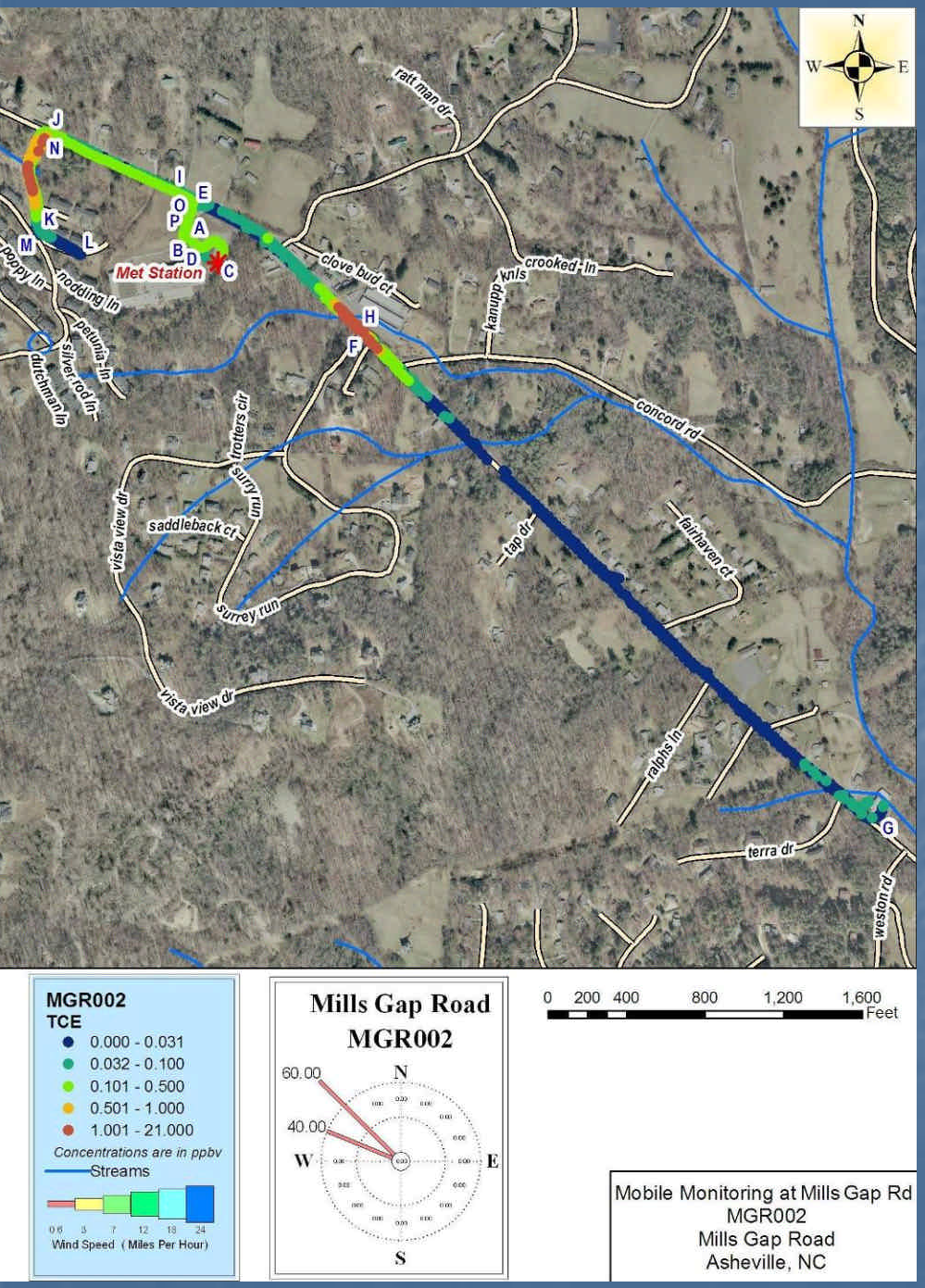
MONITORING FOR FRACTURED BEDROCK CONTRIBUTIONS

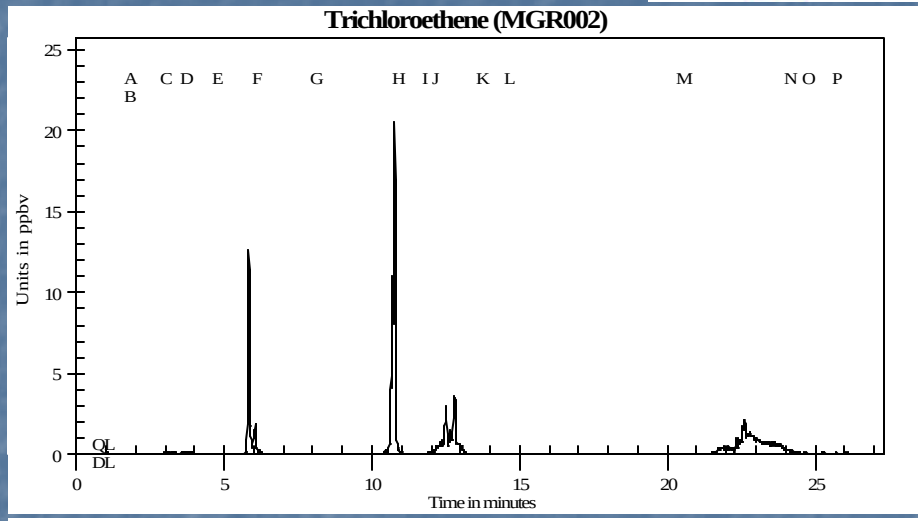
TCE Site

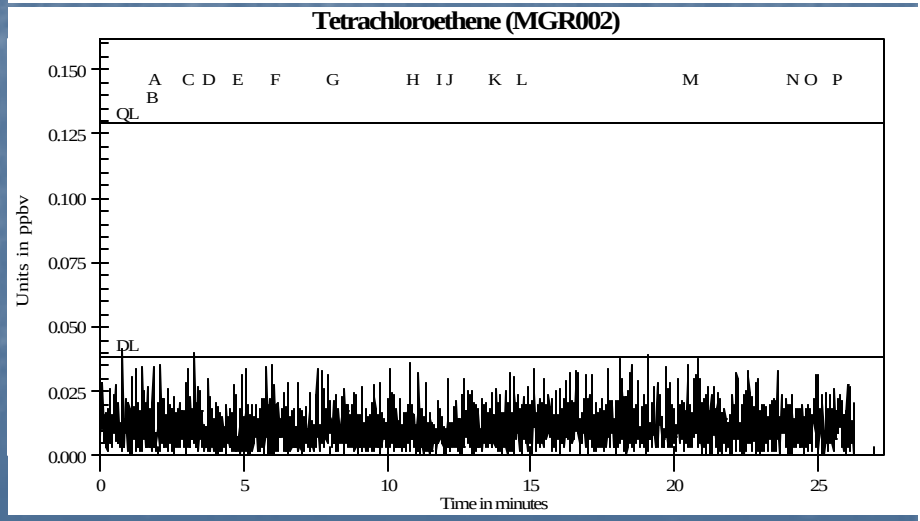
Region 4



Mills Gap Road Site Topographical Map



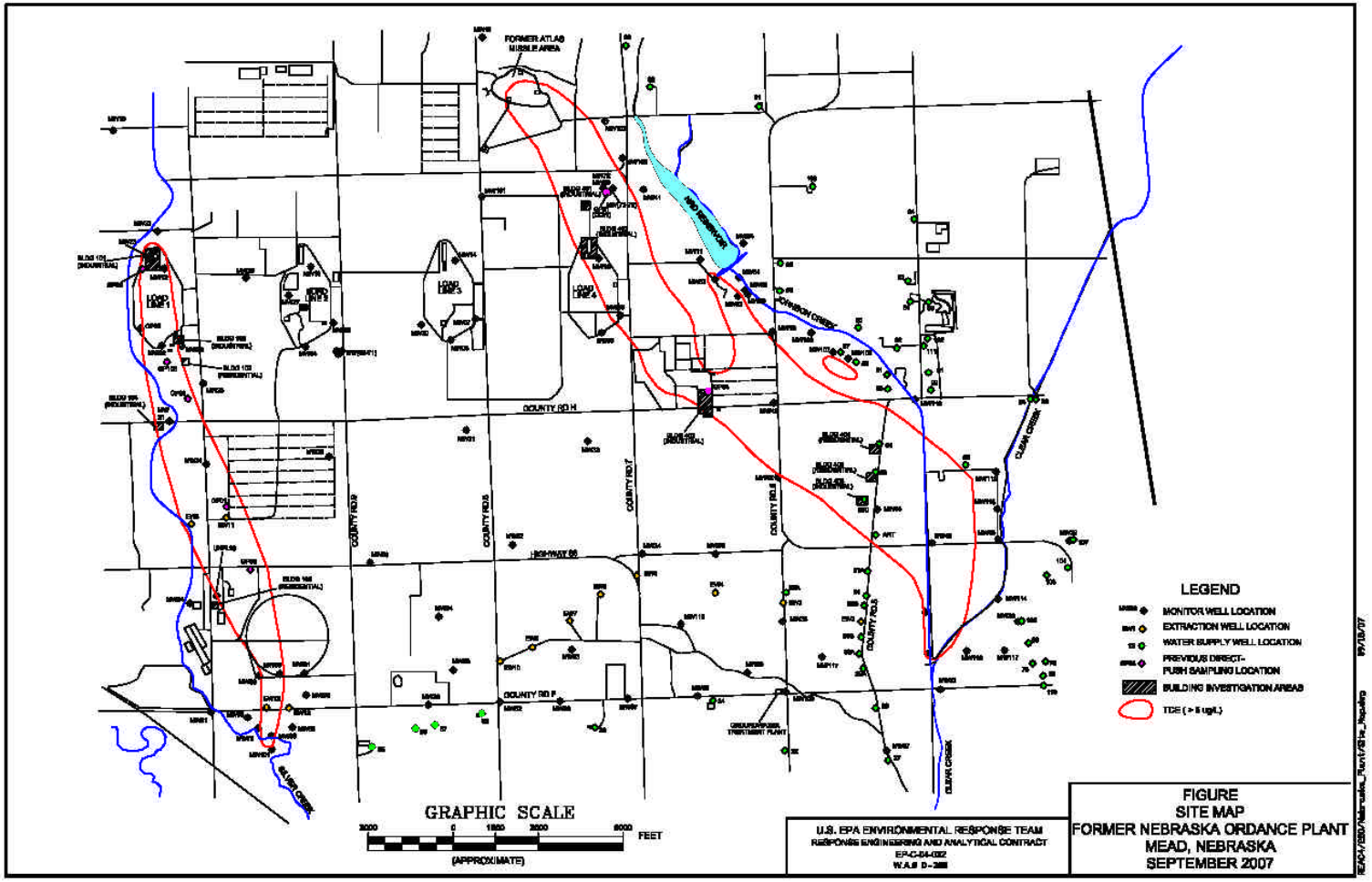




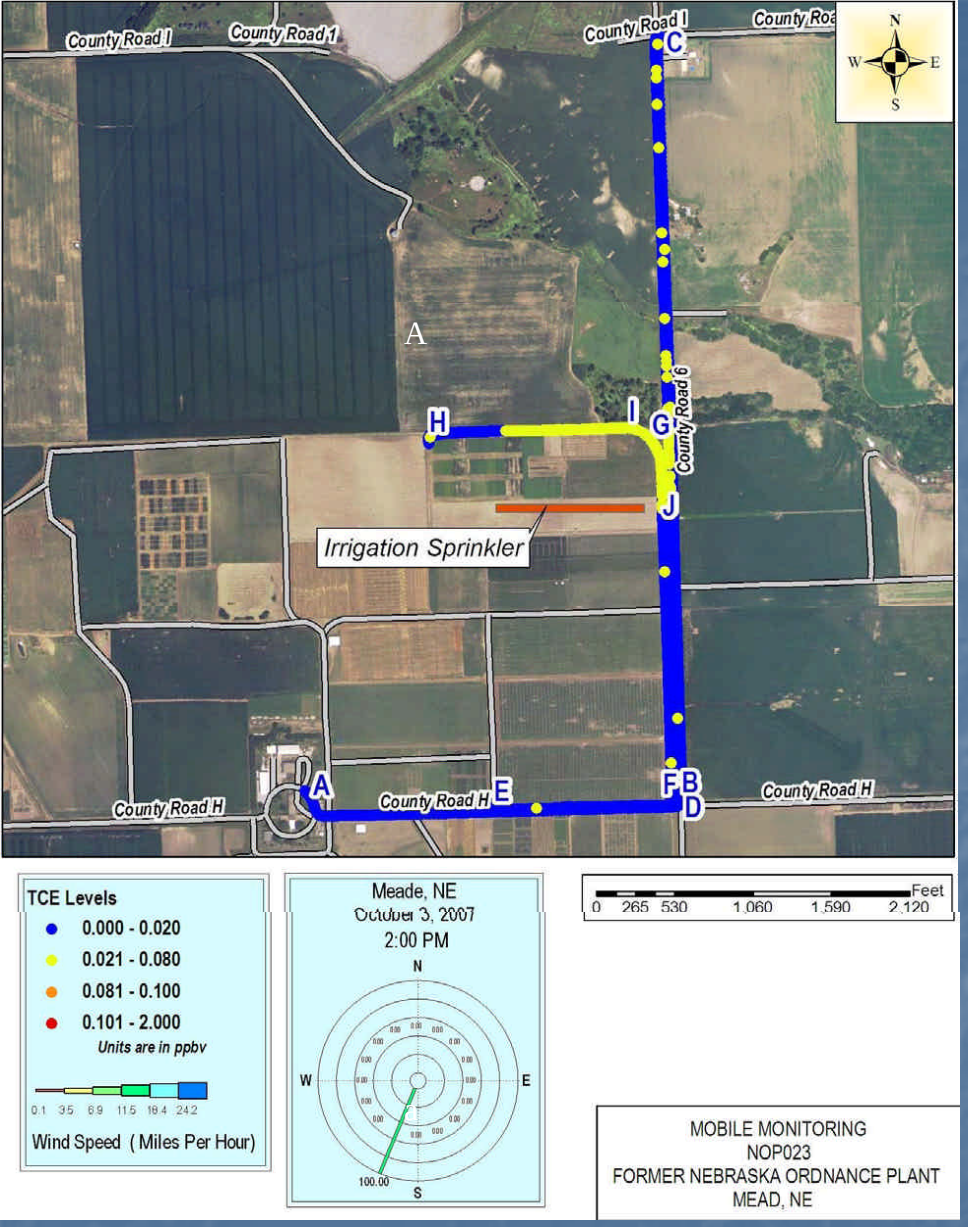
Mobile Monitoring Route
10 December 2007

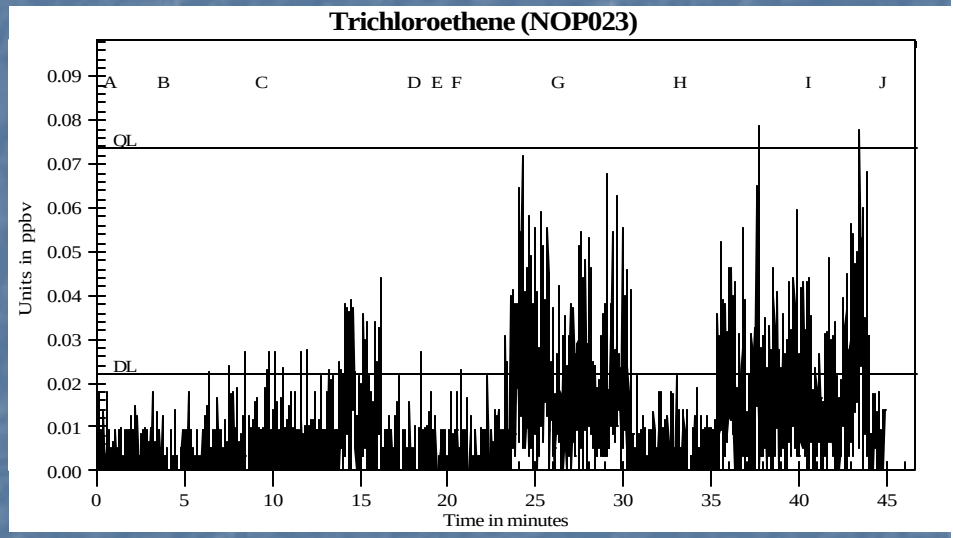
MONITORING FOR CONTRIBUTIONS FROM ACTIVITIES UTILIZING CONTAMINATED GROUNDWATER

Region 7



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

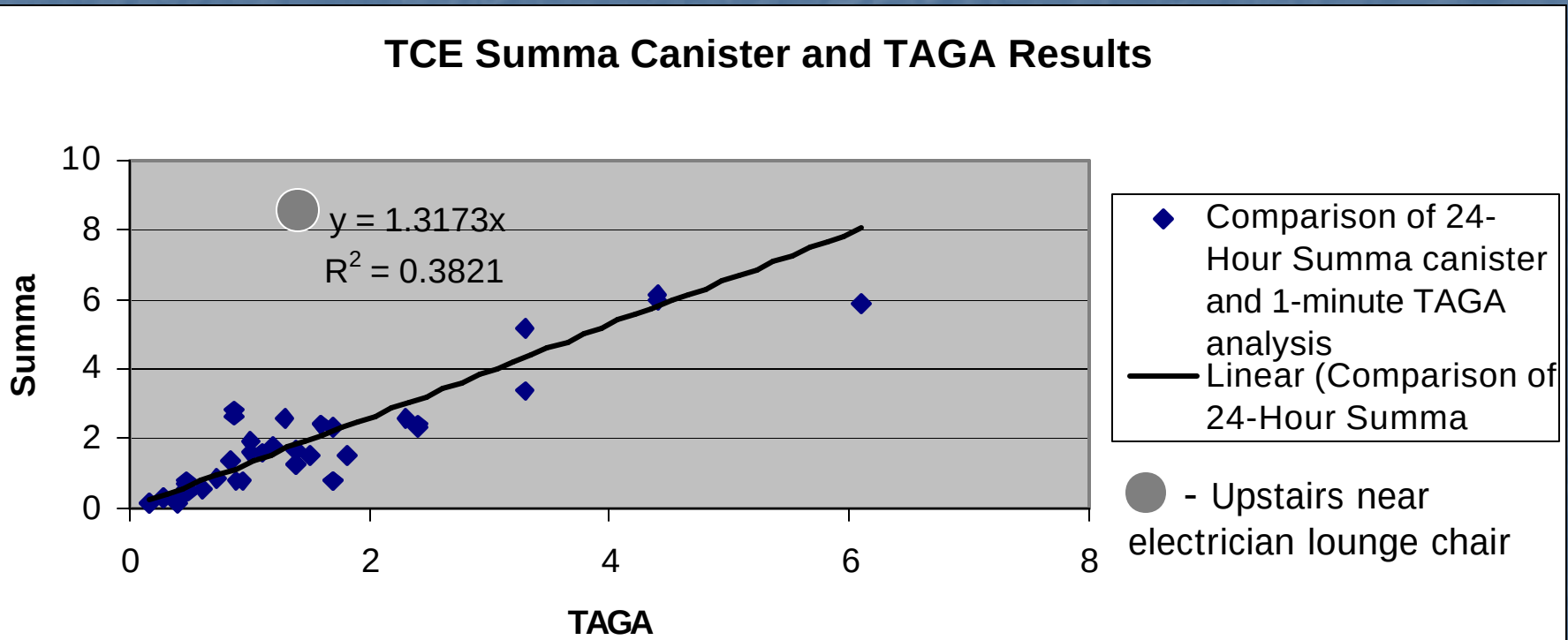




Mobile Monitoring Adjacent to an Active Irrigation Sprayer Region 7 – TCE Site

INDOOR ANALYSIS

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



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

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.

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

What does your data tell you???

For additional information concerning the capabilities and applications of the TAGA, call or e-mail me at 919 541 4191 or Mickunas.Dave@epa.gov.