

Vapor Intrusion at Former MGP Sites: Do the UST-Based Petroleum Vapor

Intrusion Criteria Apply?

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MUMMMUM

April 2018

MGP SITE BACKGROUND

- Operated from mid 19th to mid 20th century
- Manufactured gas from coal/oil
- Thousands located throughout the country
- Many MGP sites in urban areas
 - Current residential and industrial developments on FMGP sites
 - Desirable future development waterfronts and rehabbed urban industrial area



TT



ASSOCIATED CONTAMINANTS

- Occasionally LNAPL
- Usually DNAPL (tar)
- ► BTEX
- PAHs
- Metals
- Phenols
- Cyanide
- Low solubility, high viscosity often limits groundwater impacts
- Lampblack



COMMON CHARACTERISTICS OF SITE REDEVELOPMENT

- Demolition and redevelopment was often ongoing for 50 to 100 years
- Below-grade structures were left intact
- Structures were backfilled with on-site materials
- Residuals/tar associated with tar wells, holders, pipe joints, etc. often left in place



WHY EVALUATE VI?

- Presence of known or suspected carcinogenic VOCs
- Residential and industrial developments on top of or near known or suspected tar sources
- Regulatory requirements

STUDY APPROACH

- Compile data from multiple site investigations
- Evaluate soil and groundwater data using the ITRC PVI guidance
- Compare results to conclusions obtained via soil gas or groundwater VI evaluations
- Revisit conclusions of previous studies relative to PVI screening approach

PURPOSE OF STUDY

Are there practical screening criteria to focus investigation efforts?

What degree of false positives or false negatives would we see if we evaluated the sites using the ITRC PVI Guidance?

What trends could we observe in the data that may explain the answers to the above questions?



2012 STUDY

PURPOSE OF 2012 STUDY

Compile data from multiple site investigations

- 153 soil gas and subslab data points from 15 sites
- 69 source area samples
- 84 non-source area samples

Are there practical screening criteria to focus investigation efforts?

BENZENE CONCENTRATIONS: SOURCE VS. NON-SOURCE



- Elevated concentrations in near source data
- High variability in near source data

BENZENE CONCENTRATIONS: DISTANCE FROM SOURCE MATERIAL



CONCLUSIONS

Presence and proximity of source material as screening tool

Variable results near source material

Current remedial strategies focusing on source removal likely protective of VI exposures

2016 STUDY

DESCRIPTION OF DATA SET

- VI Investigation at 35 sites
- Removed 11 due to influence of outside (non-MGP) contaminant sources and inconsistent sample collection procedures
- Retained 24 sites in evaluation



RESULTS OF PVI SCREENING

		Does site/building meet		
		Dissolved Phase exclusion		
	Does site/building meet	criterion		
	NAPL exclusion criterion	(i.e., >5 feet vertically from		
	(i.e., >18 feet vertically	Dissolved/Adsorbed Phase		
Site ID	from NAPL?)	Contamination?)	Final Result of PVI Screening	
Α	Yes	No		
A2	No	No		
A3	No	No		
В	Yes	No		
D	Yes	No		
С	Yes	Not Determined	???	
Н	Yes	Not Determined	???	
1	Yes	Not Determined	???	
J	Yes	Not Determined	???	
0	No	Not Determined		
Р	No	Not Determined		
Q	No	Not Determined		
R	No	Not Determined		
U	No	Yes		
V	No	No		
AA	No	No		
BB	Yes	No		
CC	No	No		
DD	No	No		
EE	Yes	No		
FF	No	No		
GG	Yes	Yes	Meets Exclusion Criteria	
HH	No	No		
JJ	No	Yes		

COMPARISON OF PVI SCREENING TO TRADITIONAL VI ASSESSMENT

		Did soil gas or groundwater	Result of Site-Specific Risk
Site ID	Final Result of PVI Screening	exceed VISLs?	Evaluation
Α		no	Acceptable
A2		no	Acceptable
A3		no	Acceptable
В		no	Acceptable
D		no	Acceptable
С	???	no	Acceptable
Н	???	no	Acceptable
l I	???	yes	Acceptable
J	???	no	Acceptable
0		yes	Acceptable
Р		no	Acceptable
Q		no	Acceptable
R		yes	Acceptable
U		no	Acceptable
V		yes	Acceptable
AA		no	
BB		yes	
CC		no	Acceptable
DD		yes	Acceptable
EE		yes	Acceptable
FF		yes	Acceptable
GG	Meets Exclusion Criteria	no	Acceptable
HH		no	Acceptable
JJ		no	Acceptable

CONCLUSIONS

Out of 24 sites, only one site definitively met the PVI exclusion criteria (Likely five sites in total met the criteria)

What does this mean?

- Results skewed heavily toward false positives
- Differences in nature of MGP residual vs. fuel residual may drive differences in risk
- Following PVI screening process is protective for MGP sites likely overly so

2018 STUDY

DESCRIPTION OF DATA SET

- Started with 2016 data set
- Removed sites with incomplete analyte lists
 - Only included sites with BTEXN
 - Attempted to include TPH but insufficient data
- 15 sites retained in data set
 - Various land uses (commercial, residential, and open space)
- Number of data points
 - 56 Soil gas
 - 28 Subslab
 - 77 Soil
 - 39 Groundwater

SAMPLE CO-LOCATION

Closely Co-located Data





Loosely Associated Data

SUMMARY OF DATA

	Benzene in Soil Gas (µg/m³)	Benzene in Soil (mg/kg)	Benzene in Groundwater (mg/L)
Percent Detected	58%	38%	61%
Minimum	0.002	0.0017	0.0005
25 th Percentile	1.8	0.00525	0.001
Median	3.25	0.0062	0.00525
75 th Percentile	6.7	0.08705	0.1375
Maximum	350,000	25.7	6.5

	Naphthalene in Soil Gas (µg/m³)	Naphthalene in Soil (mg/kg)	Naphthalene in Groundwater (mg/L)
Percent Detected	49%	72%	55%
Minimum	0.02	0.034	0.00051
25th Percentile	0.535	0.056	0.00099
Median	2.8	1.3	0.0112
75th Percentile	10	8.1	0.933
Maximum	390,000	820	17

WHAT DOES THIS MEAN FOR PVI SCREENING?

- PVI Screening uses benzene soil and groundwater data
- Almost always are going to fail the dissolved phase screening
- Will rarely identify NAPLs (we had two samples)

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Maximum	25.7	6.5

IS THERE A BETTER NAPL INDICATOR?

Sample Location	Benzene Concentration (mg/kg)	Naphthalene Concentration (mg/kg)	Visual Notes
AA-SB21 (4' to 6' bgs)	0.25 U	628	Tar at 4' to 6' bgs
FF-SP272 (5' to 6' bgs)	0.23 U	0.11	PID > 500 ppm Staining 5' to 6' bgs
A-PH-243 (8' bgs)	0.80	110	Tar at 7' to 8' bgs PID = 111 ppm
HH-SP-642 (8' to 9' bgs)	13	820	Tar saturated 8 to 9 feet

DO THE UST-BASED PVI SCREENING CRITERIA APPLY?

- Following PVI screening process is protective for MGP sites likely overly so
- Technical basis may not directly translate to MGP sites
 - Nature of residual material/NAPL
 - Tar vs. Fuel
 - Ratio of benzene to naphthalene differs
 - NAPL distribution in vadose zone
- Visual indications of NAPL

WHAT'S NEXT?

- MGP-specific VI Guidance?
 - Screening based on naphthalene and benzene
 - Distance criteria specific to MGP sites
 - Redefining "dissolved" phase

GET IN TOUCH WITH US

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