



Residential Indoor Air Investigation in Southwestern Pennsylvania Case History

Presented by **Andrew Frishkorn, P.G.**

APRIL 2008

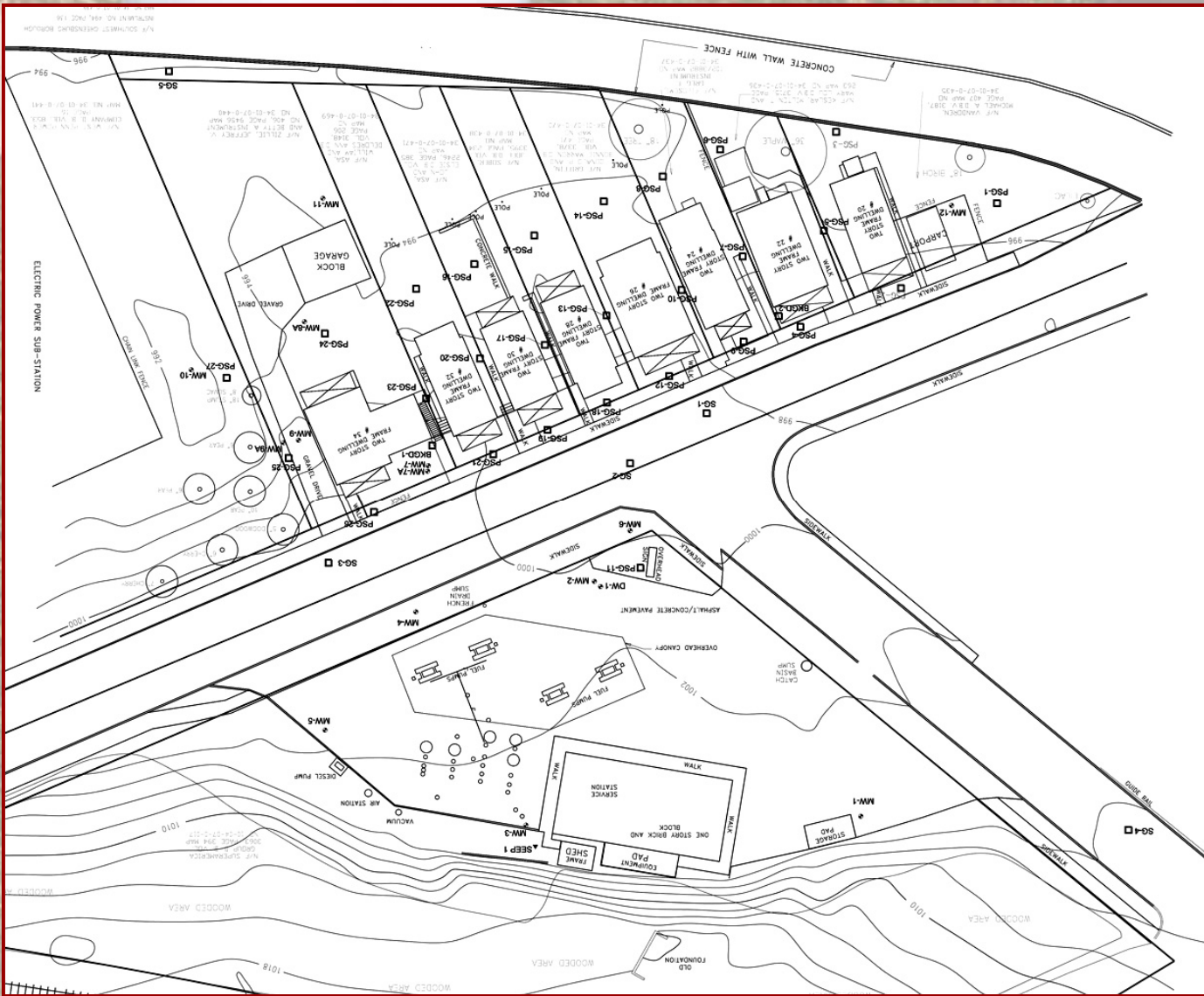
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Project Background

- **Complaints from resident about odors**
- **Gas station located across the street**
- **Seven additional dwellings located across the street from the gas station**
- **Urban setting – southwestern PA**
- **Local land uses: mixed residential, commercial and light industrial**



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A background image showing a person's hands in white gloves working on a lawn. There is a hole in the grass, and a person's arm is visible on the right side. The text is overlaid on this image.

Project Background *continued*

- **Historical release of gasoline to sewers, soils and groundwater**
- **Owner of gas station conducted groundwater monitoring**
- **Purchased one home**
- **Groundwater remediation (MNA and pump and treat)**
- **Replaced sewers/installed sewer traps (2 homes)**



Project Background *continued*

- **Various investigations conducted**
- **Active soil gas survey conducted by gas station, one home, detected no BTEX but PCE**
- **PCE was not detected in indoor air by gas station's consultant**
- **Several other compounds detected in indoor air grab sample (e.g., methylene chloride, hexachlorobutadiene, xylene, ethylbenzene, toluene.....)**

The background of the slide is a photograph showing a person's hands wearing white nitrile gloves, working in a grassy field. There are several pink circular markers on the ground. The image is semi-transparent, allowing the text to be overlaid.

Objective

- **Health Department and PADEP Recommendations**
 - Determine if plume from gasoline station causing vapors
 - Characterize PCE plume (if present)
 - Better characterize indoor air quality (i.e., 24 hr composite)



Scope of Work

- **Modified Phase I ESA**
- **Geophysical survey to locate underground utilities**
- **Passive soil gas survey**
- **Groundwater and seep sampling**
- **Indoor air sampling**



Site Geology

- **Fill (0 to 3 feet)**
- **Sandy to silty clay underlain by limestone bedrock**
- **The uppermost aquifer is 1 to 7 feet bgs**
- **$K = \text{about } 9 \times 10^{-4} \text{ ft/min}$**



EMFLUX[®] Passive System

- 27 soil locations, 5 sewer locations, 2 ambient outdoor air
- 1.5-inch hole – 12-inches deep – copper pipe
- ½ -inch hole – 30-inches deep
- Sampler lowered into hole
- Foil plug, soil cover, pin flag
- In ground for 10 days



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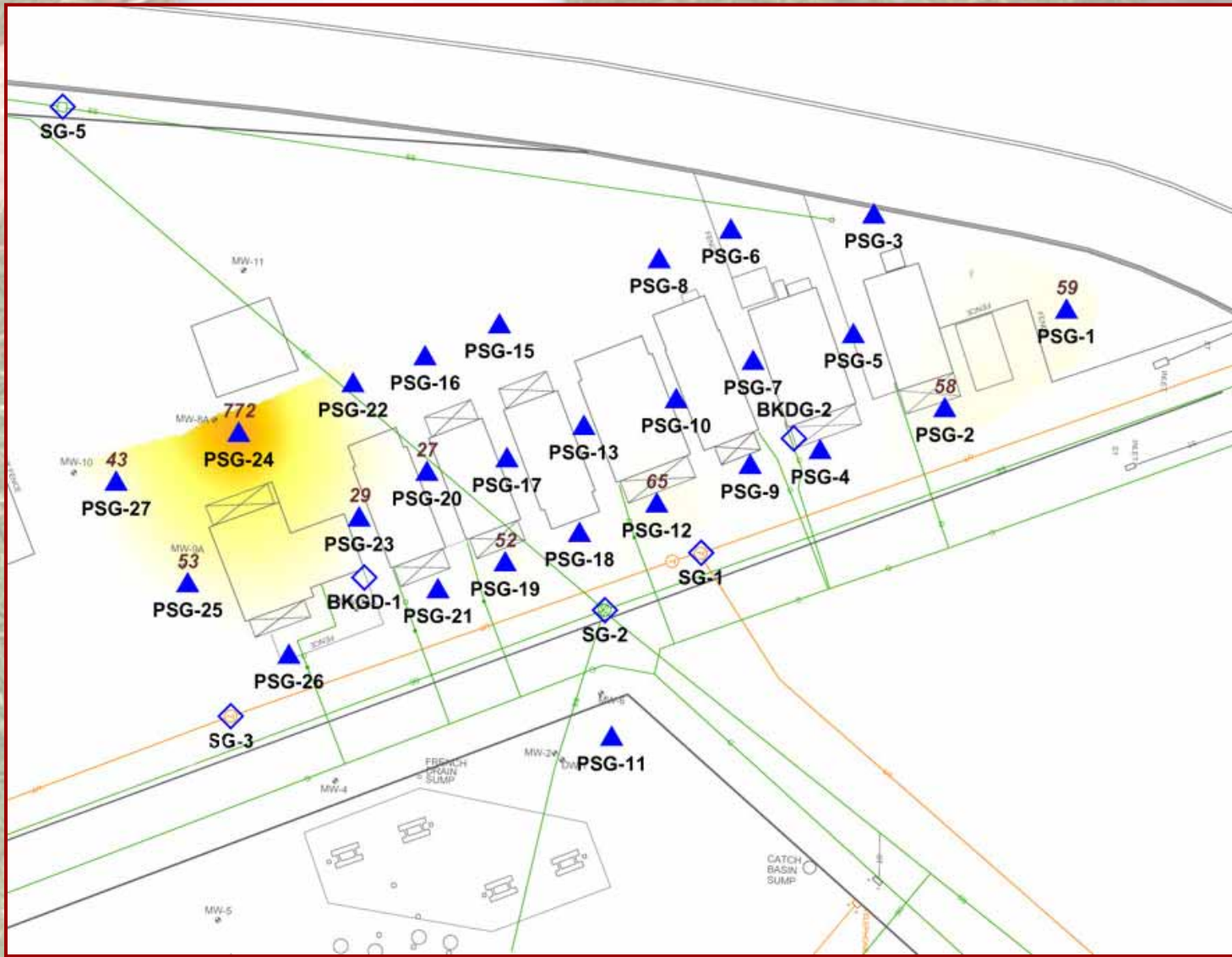
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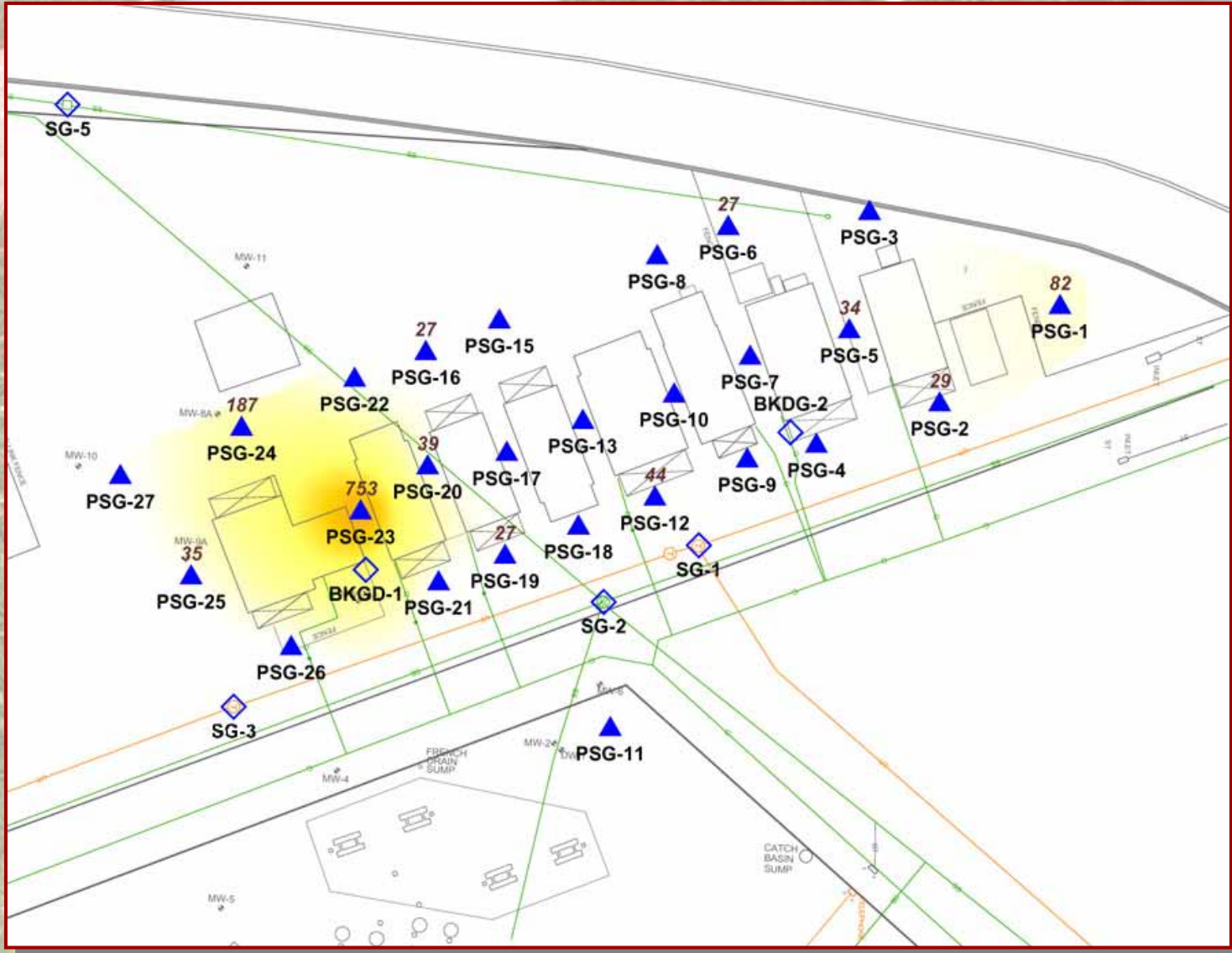
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Passive Soil-Gas Results

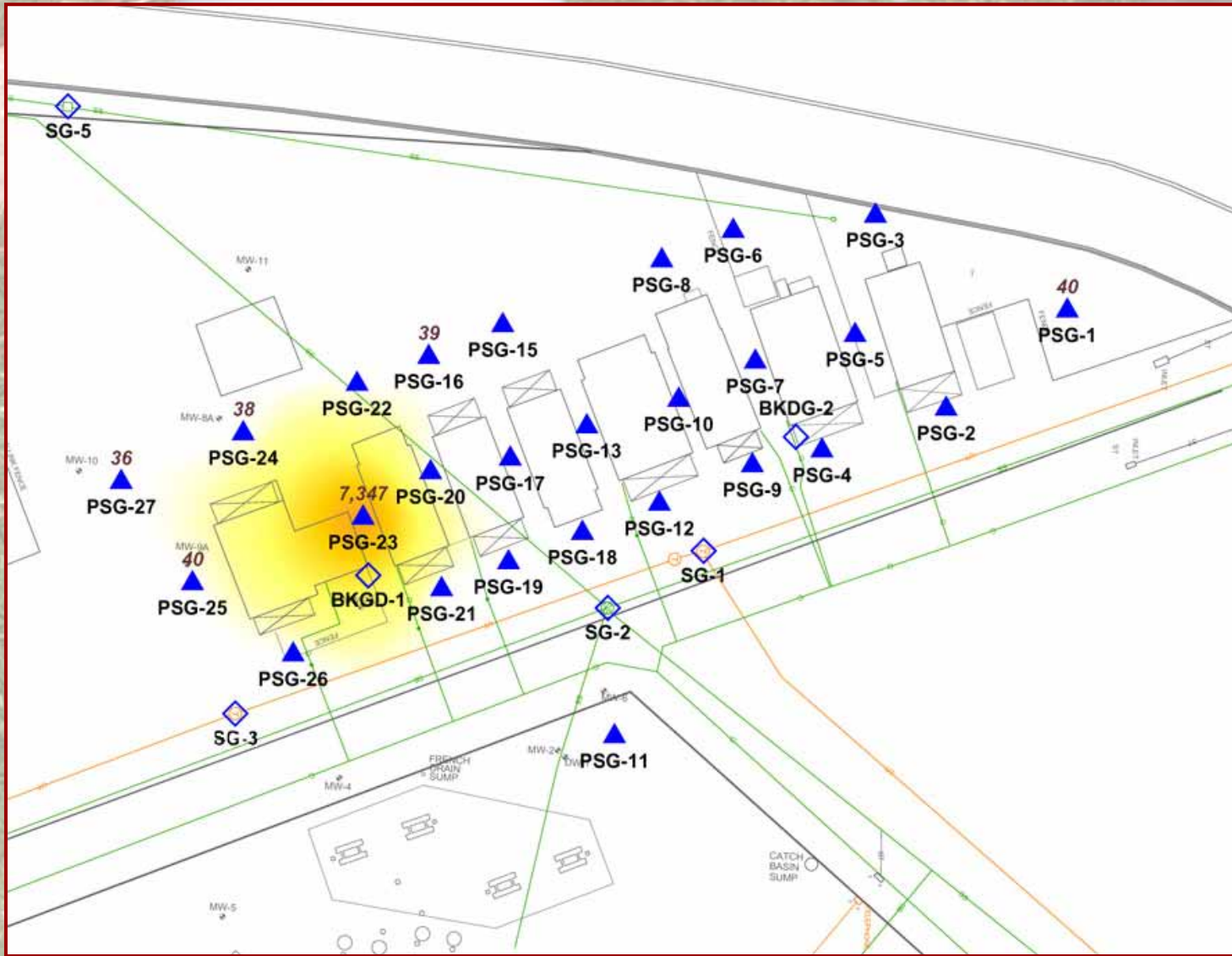
- **Semi-quantitative screening data**
- **Nanograms**
- **Elevated concentrations coincide with former gasoline plume**
- **Trace benzene detected near driveway**
- **PCE plume not detected**



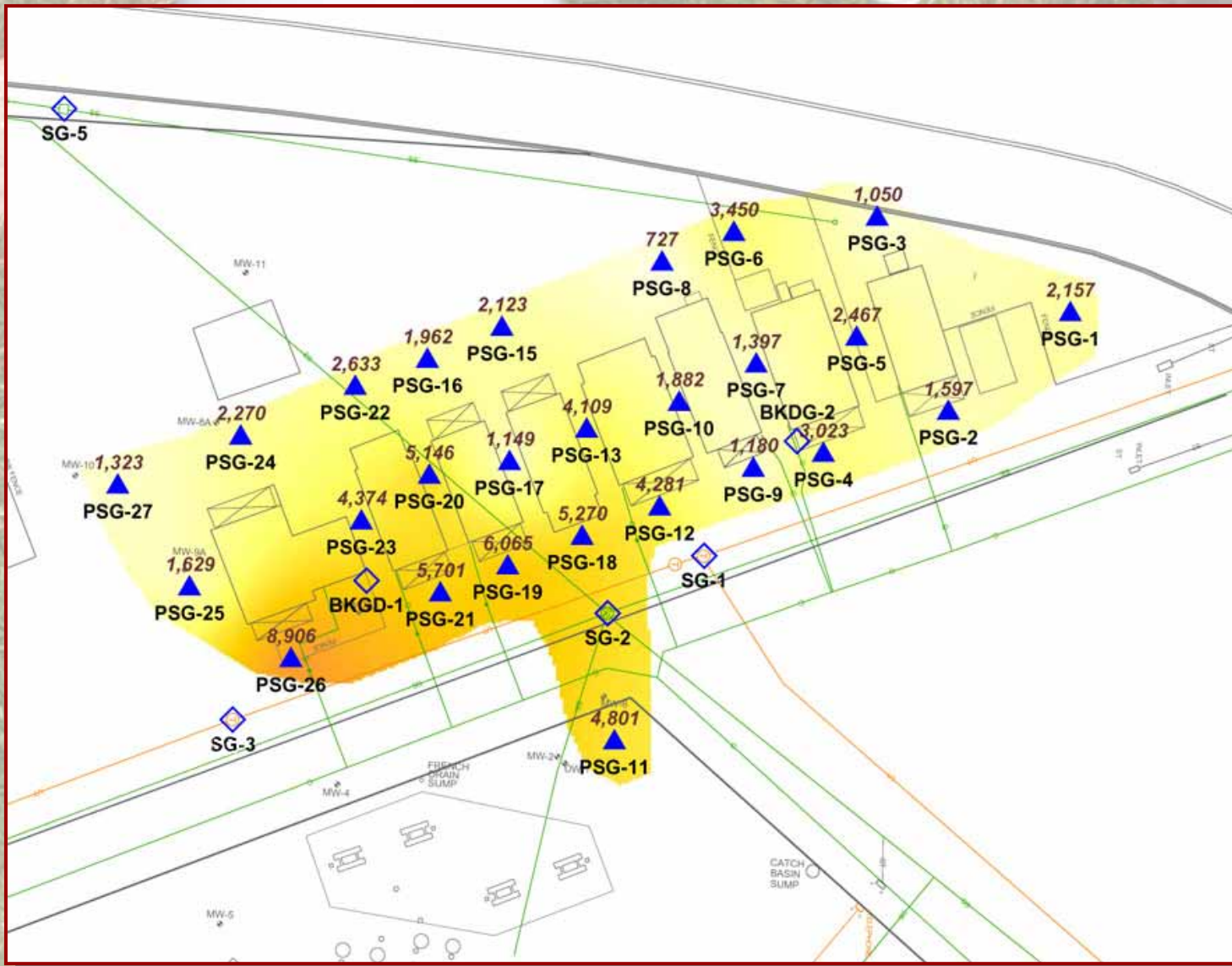
Benzene



Toluene



1, 2, 4 -
Trimethylbenzene



Chloromethane



Groundwater Sampling

- **12 existing wells, one new well**
- **Split samples with gasoline stations' consultant**
- **Sampled with disposable bailers**
- **Tested for TCL VOC, SVOCs and TAL metals**
- **Also one seep sample**

Groundwater Sampling Results

- **MTBE detected above Act 2 Residential Statewide Health Standards (SHS) 20 µg/L**
- **26 µg/L in one well (MW-9A)**
- **Other VOCs <RL or B flagged**
- **SVOCs <RL or B flagged**
- **Elevated sodium chloride in one well**

Indoor Air Sampling Procedure

- **Permission obtained to enter 6 of 8 homes**
- **Sampled in March, June and November**
- **Requested that potential sources removed**
- **Summa canisters, method TO-15**
- **Home closed, 24 hour sample**
- **Basement, first floor and outside air**
- **November, one sewer gas sample**



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Results of Indoor Air Sampling

- **22 compounds detected in indoor air**
- **17 of 22 also detected in outdoor air**
- **Most chemicals detected less than Act 2 Residential Statewide Health Standards (SHS)**
- **Chloroform above the SHS 0.44 ug/m^3 in every home**
- **1,4-Dichlorobenzene above SHS in one home, but ND in soil gas and lower concentrations in sewer gas**

Results of Indoor Air Sampling *continued*

- Benzene detected in indoor air but concentrations similar or less than ambient outdoor air, in soil gas, ND in groundwater
- Methylene chloride above SHS in one home, but ND in soil gas, groundwater and lower concentration in sewer gas
- PCE and TCE higher in outdoor air than indoor air, ND in soil gas, sewer gas and groundwater
- MTBE was detected above the SHS in groundwater, but was ND in indoor air and soil gas

Chloroform

- Chloroform detected in 20 of 23 indoor air samples
- Chloroform not detected in outdoor air
- Residential SHS 0.44 ug/m³
- Maximum concentration 23 ug/m³
- Median concentration 1.3 ug/m³
- Sewer gas 49 ug/m³
- Tap water 27 to 29 ug/l vs. MCL 80 ug/l

Conclusions

- The EMFLUX[®] System was generally effective for detecting a weathered gasoline plume
- EMFLUX[®] System did not detect MTBE
- EMFLUX[®] System is cost effective screening tool
- Chloromethane was widespread in soil gas and air, with no chloromethane plume in groundwater
- Chloroform was detected in the indoor air of all homes with a median concentration of 1.3 ug/m³
- Vapors in the home of the resident were not the result of a contaminant plume

Acknowledgements

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- **Baker**

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- **Brad Mikula – Field Assistant**



Questions?



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