Subsurface Intrusion at Superfund Sites in Missouri

Valerie Wilder
Superfund Section Chief
Missouri Department of Natural Resources
Presentation Overview

• Superfund in Missouri
• Case Studies
  – First SSI NPL Site to be Proposed
  – Show Cave Assessments
• Site Assessment VI Investigations
  – Issues/Lessons Learned
Sporlan Valve Plant #1 Site Overview

- Vacant 4-acre lot located in Washington, Missouri
- Surrounded by residential homes
- Made refrigerator valves from 1939 to ~2003
- Factory totaled 80,000 square feet in 1968
- Trichloroethylene (TCE) used as degreaser
- TCE and heating oil tanks
- Buildings demolished in 2011
Site Contamination

- Media
  - Soil and soil gas
  - Groundwater
  - Public drinking water wells not contaminated

- Vapor Intrusion
  - 19 homes with VMS
  - Majority of them pre-emptive
  - HRS based on SSI
Sporlan Valve Site Transition Over Time

- 2003 - Discovered in Phase I by prospective property owner
- 2008 - Entered State Voluntary Cleanup Program
- 2014 - Referred to MoDNR Superfund
- 2015 - Referred to EPA for Time-Critical Removal Action
- 2016 - EPA issues Unilateral Order to site owner
- 2017 - EPA takes over removal action & evaluates site for NPL
- 2018 - EPA to propose for NPL – State Supports
Show Cave Assessments in Missouri

• Oak Grove Village Well NPL Site – Meramec Caverns
  – Documented VI issues
  – TCE Contaminated groundwater flowing through cave
  – Highly elevated levels of TCE in air in touring rooms
  – Mitigation efforts include artificial ventilation of cave

• Missouri has 12 Show Caves

• Is groundwater or air in caves visited by the public affected by nearby sites with a release?
Missouri State Commercial Caves & VOC in Groundwater Sites
April 1, 2016

Legend
- Interstate
- Federal Highway
- State Lettered Highway
- State Numbered Highway
- Major Rivers
- Privately Operated Caves (12 Caves)
- State Operated Caves (4 Caves)
- BVCP Sites with VOC in Groundwater (58 sites)
- RCRA Sites with VOC in Groundwater (45 Sites)
- Superfund Sites with VOC in Groundwater (71 Sites)
- Federal Facility Sites with VOC in Groundwater (187 Sites)
- Municipal Boundary
- Missouri Boundary
- County Boundary
- 10 Mile Distance Ring

Cave locational data provided by The Missouri Speleological Survey.

Data Source: Missouri Department of Natural Resources, Missouri Department of Transportation.
Show Cave Assessments in Missouri

• Pre-CERCLA Screenings at 6 caves in 2016
  – Within 10 miles of VOC groundwater plumes
  – 4 State Park Caves
  – 2 Privately Owned
  – Sampled water, indoor air and ambient air
  – 4 quarters of monitoring except for State Parks sites

• No release – no further assessment at 5 of the 6
Cave Entrance at Ozark Caverns
Summa canister at stop on tour
SSI Example: TCE in a Commercial Show Cave

- Karst landscape
- Dye trace connects source area to cave
SSI Example: TCE in a Commercial Show Cave

- High temporal variability of TCE in cave air
- 2 orders of magnitude
SSI Example: TCE in a Commercial Show Cave

- High spatial variability of TCE in cave air
- Indicates potential entry points
SSI Example: TCE in a Commercial Show Cave

- Soil gas sampled between source and cave
- 80 soil gas locations
- TCE or daughter products detected at 23 locations
- Max TCE 7.7 µg/m³
MoDNR Superfund

- Over 12 sites with VI pre-remedial assessments
- Time and money to evaluate
  - Frog 4000
  - Helium detector for leak testing
  - Training all staff
  - Geoprobe for soil gas sampling
  - Contract labs - TO-15 analysis on a Summa canister is $200+
SSI Pathway Assessment Issues

• Reopening Old Sites
  – Lower toxicity numbers
  – Criteria?
  – Public perception?
  – Push-back from regulated community?
Steps in the Installation of a Subslab Vapor Sampling Port

1. A 1-inch hole is drilled through the foundation floor.

2. View of the sampling port prior to installation.

3. The sampling port is installed into hole in the foundation.

4. A vapor sample is collected through the sampling port.

5. A flush-mount cap is installed to protect the port between sample collection events.

6. After the flush-mount cap & sampling port are removed, the hole is patched with concrete.

7. View of patched hole in the foundation.

SSI Pathway Assessment Issues – Gaining Access
SSI Pathway Assessment Issues

• Soil gas sampling near structures
  – Use as screening tool prior to more invasive indoor air & subslab vapor sampling
  – Less invasive = easier access
  – Impervious surface mimic foundation
    • Sidewalks, parking lots
SSI Pathway Assessment Issues

• Sampling Objectives

  Exposure risk (addressed through Removal)

  vs.

  HRS scoring (addressed through Remedial)
EPA OLEM: Population Needed to Qualify for NPL

• 23 Level I exposed people
  – 8 homes
  – Daycare facility with 23 students and staff
  – 69 full-time workers
  – 138 part-time workers

• 230 Level II exposed people

• 165 – 1400 potentially exposed people living or working above a soil gas or groundwater plume
SSI Pathway Assessment Issues

• Active vs. Passive Samples
  – Short term (≤24hrs) active samples more likely to miss VOCs when variability is high
  – Passive sampling data more applicable for comparing to benchmarks based on chronic exposure
    • Issues with detection limits
SSI Pathway Assessment Issues

• Decision Matrix: When to take action and what action exactly?
  – VOCs > VISL in subslab vapor, non-detect in indoor air
  – VOCs > VISL in subslab vapor, <VISL in indoor air
  – Action levels vs. screening levels
  – Risk levels: $10^{-6}$ for screening, $10^{-5}$ for action, $10^{-4}$?
  – Hazard Quotient: 1 vs. 3?
Sample Data for Risk Management Decisions

- Indoor data and sub-slab data are both needed for risk management decisions
  - Some PRPs have been recalcitrant to conduct/allow both sets of data to be collected
- Pre-emptive mitigation can be more cost effective in the long run versus continued sampling events
- One year of quarterly sampling data is recommended
  - Seasonal variations can allow for varying orders of magnitude of concentrations shifts
SSI Pathway Assessment Issues

- How much <VISL data is enough to walk away?
  - Institutional controls
- Are multiple sampling events at every VI site affordable?
- Timing of sample collection
  - Quarterly
  - Based on what indicators, tracers & surrogates data tell us
VMS Operation and Maintenance Considerations

1. The monometer should be checked periodically by the owner.
2. The initial system operating pressure should be documented.
3. Operation of the fan can be indicated by the following:
   - Observation of the audible fan noise
   - Observed, but not excessive fan vibration on vent pipe
4. Observe new cracks in foundation floors and walls:
   - Ensure previous addressed cracks remain sealed
5. Significant home interior changes can change the flow:
   - Changes/Additions to bathroom fans, HVAC system, etc.
6. Check the fan breaker after power outages, storms, etc.

Photos Courtesy of St. Louis Radon
Contact Information

Valerie Wilder, Superfund Section Chief
Valerie.wilder@dnr.mo.gov
573-751-7880

Missouri Department of Natural Resources
Hazardous Waste Program
PO Box 176
Jefferson City, MO 65102-0176
Find us on the web at dnr.mo.gov
Call toll-free at 800-361-4827