Case Study – Complete Vapour Intrusion Mitigation Services for an Industrial Plant

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Golder Associates Ltd.

SMART Remediation
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SMART REMEDIATION – OTTAWA 2019
FEBRUARY 7, 2019

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PRESENTATION OUTLINE

• Initial Desktop Review
• Preliminary Field Assessment
• Interim Mitigation
• Recurring TCE in IA
• Lessons Learned
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INITIAL DESKTOP REVIEW

- Former steel production (1890s) and small electric motor mfg (1947-1999)
- Historical data implied:
  - Significant sub-surface cVOC plume and IA exceedances
  - Potential IA exceedances of OEPA imminent hazard criteria.
- Extremely high client priority to assess VI risk and mitigate
- Concurrently with project; HVAC assessment upgrades were requested

INITIAL DESKTOP REVIEW

- Historical data suggest strong correlation between GW source, sub-slab, and IA data.

- CVOC soil/GW poorly delineated.

- Background source assessment identified only one “sparingly used” potential indoor source

- Poor floor conditions and other penetrations; large storm drain
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PRELIMINARY FIELD ASSESSMENT

• **Frenzied HVAC conditions;** multiple exhaust fans; very high temperatures

• Field Assessment with Mobile GC/ESD confirmed:
  • Sub-slab and pathway samples well above screening criteria
  • Indoor air above urgent criteria (below imminent hazard); ‘other’ PID hits largely hydrocarbons
  • Mobile lab data verified with TO-15
  • Strong sub-slab:IA correlations
  • Significant sub-slab pressure differentials; installed transducers
  • SSD pilot test reviewed highly variable sub-slab flow conditions

• ~ 60 vapor pins installed

• Initial PCE/TCE investigation with mobile lab
  • Indoor Air
  • SS
  • Pathways

• Air conveyance testing

• Limited SUMMA sampling

• HVAC assessment completed, conceptual design
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PRELIMINARY FIELD ASSESSMENT – SITE PHOTOGRAPHS

[Images of industrial plant and site photographs]

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PRELIMINARY FIELD ASSESSMENT – SITE PHOTOGRAPHS

[Images of industrial plant and site photographs]
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PRELIMINARY FIELD ASSESSMENT - SITE PLAN

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PRELIMINARY FIELD ASSESSMENT - SITE PHOTOGRAPHS

Roof drain
### OEPA SS and IA Response Recommendations

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<th>ANALYTE</th>
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<th>SUB-SLAB</th>
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Recommendations regarding response action levels and timeframes for common contaminants of concern at vapor intrusion sites in Ohio – Ohio EPA, August 2016

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Site plan with sub-slab results.
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TEMPORARY DIFFERENTIAL PRESSURE TRANSDUCERS

Evidence of positive pressure gradient
(Flow from subsurface to building)
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TEMPORARY DIFFERENTIAL PRESSURE TRANSDUCERS

Evidence of a variable pressure gradient
Higher positive gradients observed when ambient temperature increased.

### VI Mitigation at an Industrial Plant

#### AVERAGE GRADIENT BY SHIFT

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</table>
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EVIDENCE OF STRONG INTERIOR GRADIENTS

- Smoke testing; crack and penetration sealing; air flow containment;
- New fresh air and temporary AC (to reduce pressure differentials and increase air exchanges)
- New facility-wide HVAC design and tender
- SSD “phase 1” system design and install; to work in conjunction with HVAC
- Commenced source delineation – VAP Phase 1/2

INTERIM AND SHORT-TERM MITIGATION
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TEMPORARY FRESH AIR INTAKES (1973 BUILDING)

AC reduces, but does not eliminate, positive pressure gradient from sub-slab.

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INTERIM AND SHORT-TERM MITIGATION – MIP / HpT

• Field Assessment (with MIP/Hpt) confirmed:
  • Bulk of CVOC mass in groundwater is deeper than historical data
  • Chlorinated DNAPL extended from just outside the building to inside the rear of the building
  • DNAPL present in shallow vadose clay under building
  • Vadose zone impacts limited to DNAPL area; aligns with storm drain
  • Separate source area(s) identified – those VI pathways eliminated
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STAGE 1 SSD SYSTEM, INFLUENCE AND EXTENT OF DNAPL

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SSD PHOTOGRAPHS
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REOCCURRENCE OF INDOOR AIR TCE

• New fresh air supply fans and AC maintained acceptable IA concentrations – until colder weather
• Reviewed air entrainment potential, extended stack
• New facility-wide HVAC scheduled for 2018
• Occasional TCE hits despite additional fans with heated fresh air
• Reviewed all sub-surface data to assess our delineation
• Expanded sub-slab assessment in potential data gap areas; no additional cVOC source areas found

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CONFIRMATION OF INDOOR TCE SOURCES

• Additional desktop and field evaluation
  • Compound ratio comparisons concluded TCE and other ‘pseudo-tracer’ compounds not from sub-slab sources or SSD effluent
  • Follow-up detailed interviews identified one potential intermittent source and many “hypothetical” sources including process material related
  • Time series monitoring of PCE/TCE with mobile GC/ECD established one definitive indoor source and eliminated most hypothetical sources.
• Additional temporary fresh/heated air is currently maintaining acceptable IA pending full HVAC installation
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TIME SERIES MOBILE LAB SAMPLING – DETECTS FOLLOWING USE OF AEROSOLS

MATCHING GAME – DRAW ARROWS TO MOBILE LAB HEADSPACE TCE CONCENTRATIONS

ND µg/m³  ND µg/m³  8.0 µg/m³  5.2 µg/m³
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Lessons Learned

- Differential Pressure Transducers
  - Confirmed highly variable conditions, temporal and spatial
  - Provided a quick understanding of building conditions
  - Informed need for HVAC upgrades as well as controlling access

- Multiple Lines of Evidence
  - Very useful for this site
  - Demonstrated that SSD or HVAC alone was not sufficient to mitigate issues

- Storm Sewer
  - Was a source but not a significant source despite proximity of DNAPL to sewer
  - Periodic sampling indicated detections but no significant hits
  - Was the maximum concentration measured - Realtime monitoring of VOCs may have provided useful data

- SDS
  - Multiple products stated no TCE, only ‘proprietary’
  - Confirmation that some had TCE in the 5 – 8 µg/m³

Thank you

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