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GROUP 2
AECOM

Vapor Intrusion Mitigation and Remediation of Mercury-Impacted Soil and Groundwater

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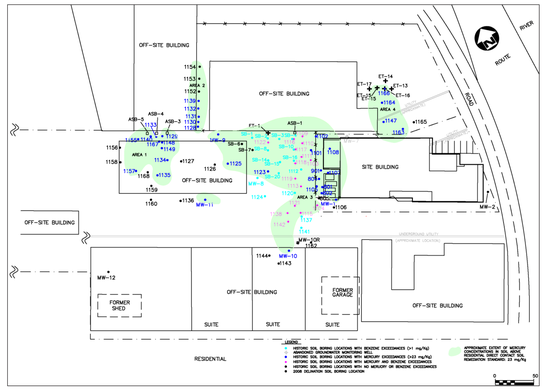
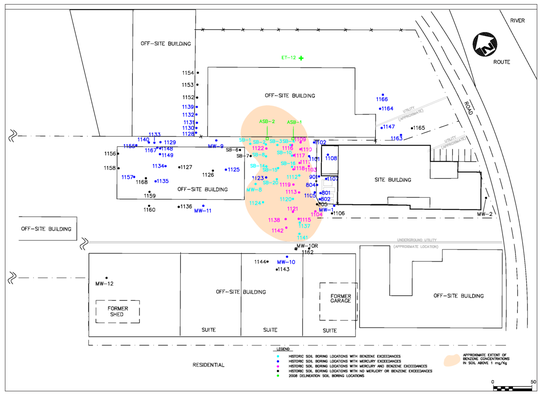
Introduction

- Former New Jersey manufacturing site produced bactericide/fungicide paint additive
- Raw materials: benzene liquid, mercuric oxide powder and acetic acid
- Under aerobic conditions, *in situ* biological processes reverse the manufactured reaction with conversion to elemental mercury and benzene
- **GOAL:** determine appropriate remedy to address mercury and benzene in soils and groundwater.

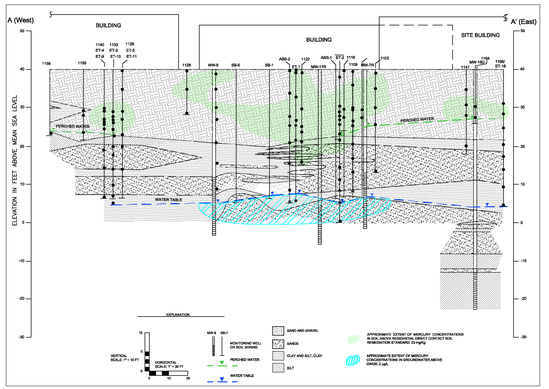




- Mercury speciation testing established the overall forms and mobility of mercury
- Majority of the mercury in soils is either non-extractable/non-mobile or non-extractable/semi-mobile
- Benzene concentrations in soil did not affect species or concentrations of mercury.
- Mercury speciation results and conceptual site model identified the vapor pathway as the major risk associated with the mercury-impacted soils.

Conceptual Site Model

- Geologic cross-sections: mercury distribution across the site. Green in figure shows extent of mercury in soil above remediation standards.
- Conceptual site model: developed to understand mercury and benzene in soils and groundwater, its forms and associated risks.
- Site was complicated by high concentrations of benzene in soil and groundwater:
  - Commingled contaminants
  - Potential synergistic effects



Vapor Intrusion Assessment

Vapor Intrusion Assessment: Assess the potential for benzene and mercury vapors to diffuse into nearby structures.

- Identified benzene and mercury vapors in sub-slab soil gas and indoor air above screening levels
  - Resulted in Immediate Environmental Concern requiring response action
  - Sub-basement of site building identified as main source of mercury vapors

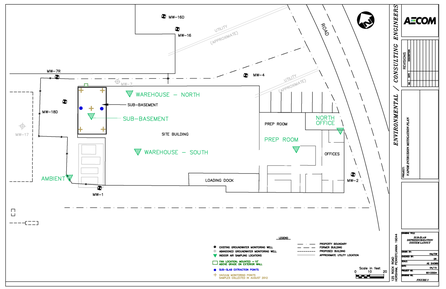
Table 1
Indoor Air Sampling Results - February 2019

Parameter	Mercury (µg/m³)	Benzene (µg/m³)
Previous Indoor Air Screening Levels (Non-residential):	1*	2
2013 Indoor Air Screening Levels (Non-residential):	1**	2**
Previous Indoor Air Rapid Action Level (Non-residential):	2*	14
2013 Indoor Air Rapid Action Level (Non-residential):	2**	200

Matrix	Location	Sample Type	Sample Date	Mercury (µg/m³)	Benzene (µg/m³)
Indoor Air	Warehouse North	Monitoring	2/26/2019	2.1	1.7
Indoor Air	Warehouse South	Monitoring	2/26/2019	0.88	1.6
Indoor Air	Sub-Basement	Monitoring	2/26/2019	10.0	0.99
Indoor Air	North Office	Monitoring	2/26/2019	0.95	1.8
Indoor Air	Prep Room	Monitoring	2/26/2019	1.1	1.8
Ambient Air	Outside Upwind	Background	2/26/2019	0.14 U	0.54 J

NOTES

	Mercury and benzene concentrations are reported in micrograms per cubic meter (µg/m³).
U	Not detected at reporting limit shown
J	Estimated concentration
2.1	Concentration exceeding respective Indoor Air Screening Levels
10.0	Concentration exceeding Indoor Air Screening Levels and Rapid Action Levels
*	Site-Specific Screening Levels are based on NJDEP memo dated January 28, 2011.
**	Analytical results for mercury and benzene were rounded to one significant figure for comparis- to screening levels in accordance with the Update To The New Jersey Department of Environmental Protection (NJDEP) Vapor Intrusion Screening Levels (March 2013)



Remedial Action

Vapor Intrusion Mitigation: Focus on sub-basement

- Floor sealed with epoxy coating
- Sub-slab depressurization system installed to address benzene and mercury vapor intrusion
- Restricted access to sub-basement to reduce exposure
- Routine inspections and monitoring
- Indoor air quality in the sub-basement affected by residual mercury present in the building materials

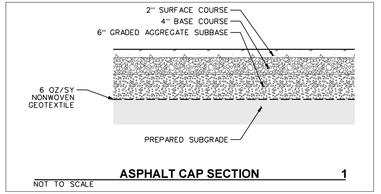
Above: Photograph showing interior walls and sealed floor of sub-basement

Soil and Groundwater Remediation: Extended Pilot Study/Interim Remedial Action (6-12 months)

- Soil Vapor Extraction
  - Three SVE wells installed in areas of highest benzene impacts
  - VOC and mercury vapor treatment
- Biosparging
  - One biosparging well installed at center of benzene plume increased DO to enhance indigenous aerobic biodegradation
- Significantly reduced benzene soil impacts and remediated benzene groundwater impacts

Deed Notice and Capping as Engineering Control for Direct Contact and Impact to Groundwater Exceedances

- Asphalt cap installed as low permeable cap to prevent direct contact and infiltration to mercury and benzene impacted soils
- Stormwater control measures implemented for additional runoff



Conclusions

The sub-slab depressurization system was effective at reducing benzene and mercury vapors in the occupied areas of the site building. Interim remedial actions addressed benzene soil and groundwater impacts without affecting the form of mercury. Institutional and engineering controls addressed potential future impacts.

Value of Conceptual Site Model

- Provides complete understanding of site conditions
- Considers synergistic effects of remedial approaches on differing constituents of concern
- Identifies risks and pathways
- Remedial approach targets key risk pathways and receptors to meet regulatory requirements