Overview of SERDP & ESTCP Investments in Improving our Understanding of Vapor Intrusion

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Improved Prediction of the Risks to Indoor Air from Soil Vapors
- Additional field studies at a variety of sites to understand conditions at which vapor to indoor air may be a significant risk pathway;
- Upgrading of currently-used models to make them more realistic, using data from real-world DoD sites for calibration;
- Technical transfer of information that is available to RPMs & their consultants.

Better Understanding & Monitoring of Vapor Transfer from Sources
- Develop a better understanding of processes controlling vapor attenuation
- Develop improved monitoring techniques and methods to discern between subsurface and surface sources of chlorinated solvents in indoor air

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Development of Screening & Exit Criteria for VI Assessments (ER-0423 & ER-0707)

Application of Advanced Sensor Technology (ER-0702)

Low-Cost Alternatives for Sampling & Analysis of VOCs (ER-0830)
Improved Understanding of the Vapor Intrusion Pathway from Chlorinated Solvent-Contaminated Groundwater Plumes

Objective: Produce fundamental and applied research that leads to better pathway assessment for vapor intrusion from chlorinated solvent-contaminated groundwater. Specific objectives include:

- Gain a better understanding of natural spatial and temporal variations in vapor intrusion measurements and how to account for such variability in pathway assessment.
- Improve our ability to obtain accurate and cost-effective characterization of key site parameters that impact the vapor intrusion pathway.
- Improve our ability to predict vapor behavior under various physical, climatic, and/or geochemical conditions.
- Improve our understanding of vapor attenuation mechanisms.
Integrated Field-Scale, Lab-Scale, & Modeling Studies for Improving Ability to Assess Groundwater to Indoor Air Pathway at Chlorinated Solvent-Impacted Groundwater Sites (ER-1686)

- Principal Investigator: Dr. Paul Johnson (Arizona State University)
- Key research topics
  - Temporal variability of indoor air concentrations
  - Relationship between groundwater concentrations and indoor air impacts
  - Spatial & temporal variability in sub-slab and near-foundation soil gas
  - Changes with time in vapor emissions from chlorinated solvent groundwater plumes
  - Investigation of alternate assessment monitoring approaches
  - Indoor chemical sources
**Vapor Intrusion From Entrapped NAPL Sources and Groundwater Plumes: Process Understanding and Improved Modeling Tools for Pathway Assessment (ER-1687)**

- **Principal Investigator:** Dr. Tissa Illangasekare (Colorado School of Mines)
- **Overall objective:** To improve understanding of processes & mechanisms of vapor generation, migration, & attenuation in a naturally heterogeneous vadose zone under various natural physical, climatic, & geochemical conditions
  - Understand the mechanisms of vapor generation from contaminant source zones under varying hydrogeologic and climatic conditions.
  - Understand processes & mechanisms that contribute to spatially & temporally varying measurements of soil moisture & vapor concentrations in vadose zone & how to account for such variability in VI & pathway assessment.
  - Evaluate the ability of existing modeling tools to capture the fundamental processes of vapor generation, migration and attenuation and up-scale them for field sites with varying hydrogeologic and climatic conditions.
ER-0423: Detailed Field Investigation of Vapor Intrusion Processes

- Principal Investigator: Tom McHugh (GSI Environmental)
- Objective: To identify a cost-effective and accurate protocol for investigating vapor intrusion into buildings overlying contaminated groundwater.
- Three performance goals were established, and all objectives were met:
  - Collection of data representative of site conditions
  - Determination of vapor intrusion impacts at demonstration sites (i.e., indoor air concentration of chemical above risk-based screening limit, not attributable to background indoor air sources)
  - Development of a reliable vapor intrusion investigation approach (i.e., identify a limited scope investigation approach with higher accuracy than current approaches).
ER-0707: Protocol for Tier 2 Evaluation of Vapor Intrusion at Corrective Action Sites

- Principal Investigator: Tom McHugh (GSI Environmental)
- Objective: Develop and validate Tier 2 procedures for screening vapor intrusion at corrective action sites along with exit criteria indicating no further need for site evaluation.
- Builds on data from ER-0423
- Procedures will use easily obtainable site-specific information to support the application of screening concentrations that are less conservative than the Tier 1 screening concentrations provided in U.S. EPA and many state vapor intrusion guidance documents.
- The Tier 2 procedures will fill the current gap in available guidance documents between generic (Tier 1) screening concentrations and detailed site investigations of vapor intrusion.
ER-0702: Application of Advanced Sensor Technology to Soil Vapor Intrusion Problems

- Principal Investigator: Jim Reisinger (IST)
- Objective: To take existing and emerging technology and build and demonstrate sensor packages for VI applications. Specific project objectives include:
  - Screening available advanced sensor technologies
  - Selecting the most promising technology for VI
    - The SPIRON micro-gas chromatograph (micro-GC; Dr. Ted Zellers, University of Michigan) sensor technology was selected in Phase I
  - Building and demonstrating sensor packages for the following VI applications:
    - Portable “sniffer” unit for near real-time compound-specific determination for contaminant source assessment
    - Fixed “smoke detector” unit for compound-specific exposure concentrations interfaced with remote communications.
ER-0830: Development of More Cost-Effective Methods for Long-Term Monitoring of Soil Vapor Intrusion to Indoor Air Using Quantitative Passive Diffusive-Adsorptive Sampling Techniques

- Principal Investigator: Todd McAlary (Geosyntec)
- Objective: To demonstrate the applicability of lower-cost alternatives for sampling and analysis of VOCs in indoor air and soil gas during investigation of subsurface vapor intrusion to indoor air.
  - Four distinct types of passive diffusive samplers will be tested against two active gas sampling methods under controlled laboratory conditions and under field conditions
    - SKC Ultra II Passive Sampler
    - Crump
    - PDMS Sampler
    - Radiello Sampler
Additional Information

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