

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

Andrea Leeson, Ph.D.
SERDP/ESTCP ER Program Manager



SERDP



2001
Chlorinated Solvents Workshop

Research Need

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.

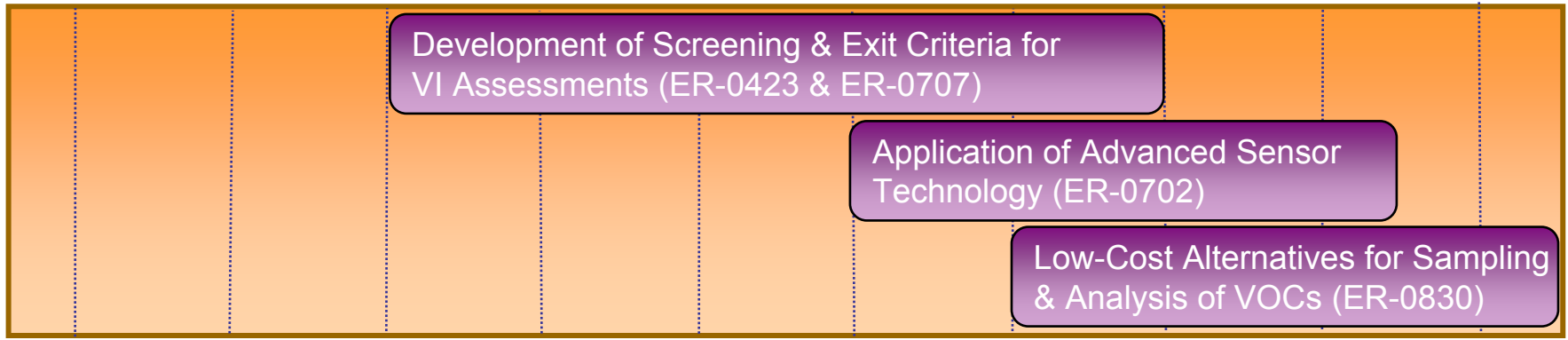
2006
DNAPL Workshop

Research Need

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

Dem/Val



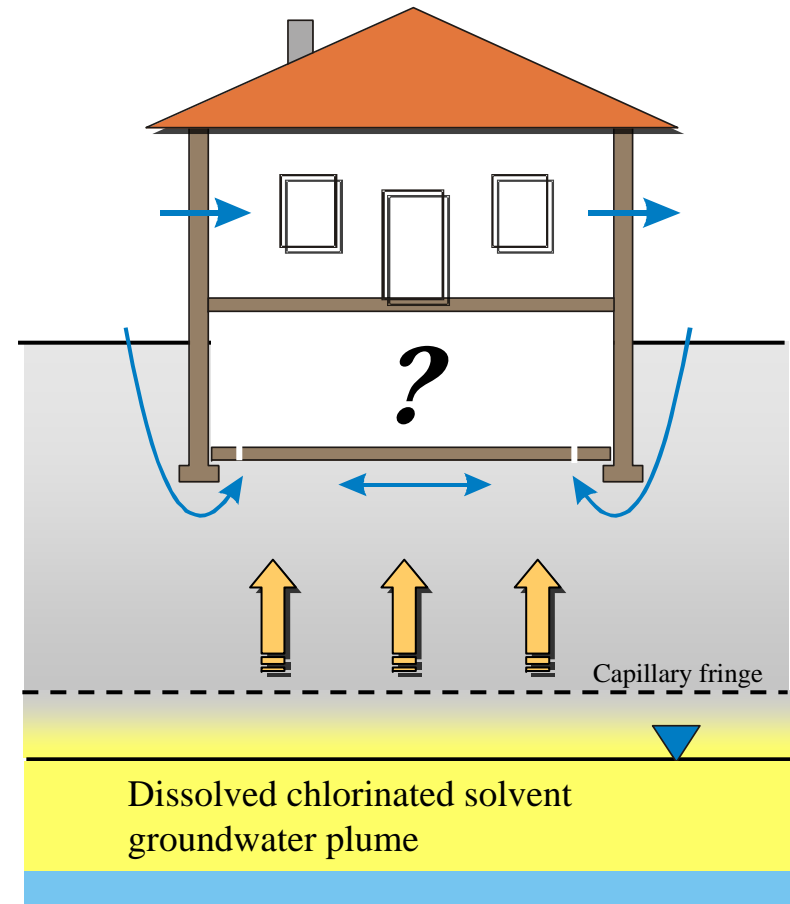
FY02 FY03 FY04 FY05 FY06 FY07 FY08 FY09 FY10 FY11 2

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.

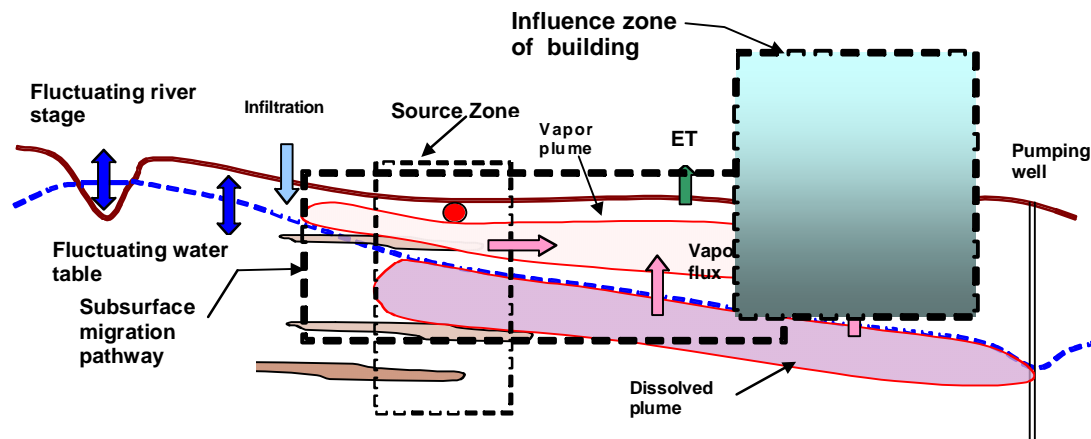
Integrated Field-Scale, Lab-Scale, & Modeling Studies for Improving Ability to Assess Groundwater to Indoor Air Pathway at Chlorinated Solvent-Impacted Groundwater Sites (ER-1686)

- 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

- www.serdp.org
- www.estcp.org
- Andrea.Leeson@osd.mil