

# Environmental Restoration Branch



## Detailed Indoor Air Characterization and Interior Source Identification by Portable GC/MS

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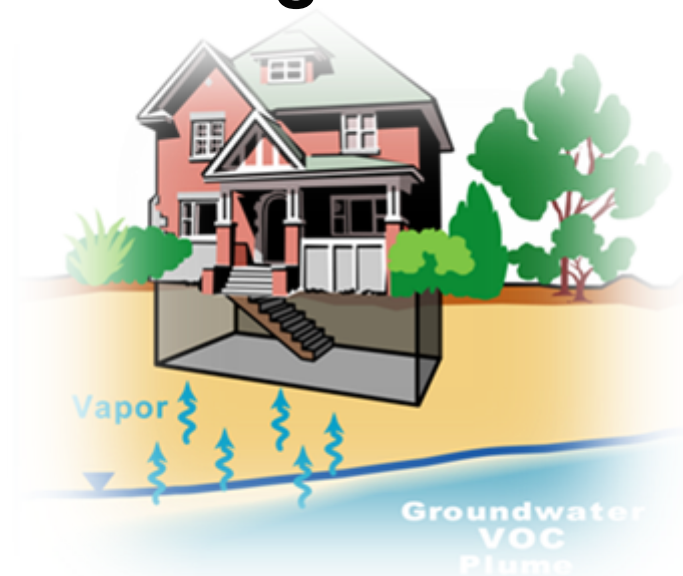


# Presentation Overview



75TH AIR BASE WING

- Acknowledgements:
  - Jarrod Case (Hill Indoor Air Program manager)
  - Erik Dettenmaier (Select Engineering Services)
  
- Summary of Hill AFB Vapor Intrusion Program
  - Methods and challenges
  
- Portable GC/MS description
  
- Investigation examples







# Vapor Intrusion Program Approach



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- **Sample indoor air**
  - Determine if exposure is occurring
  - 24-Hour samples analyzed to EPA Method TO 15
  - Project-dedicated, batch-certified clean Summa® canisters
  - **Chemical inventory and inspection prior to sampling**
  - **Doesn't distinguish vapor source**
  - Public relations

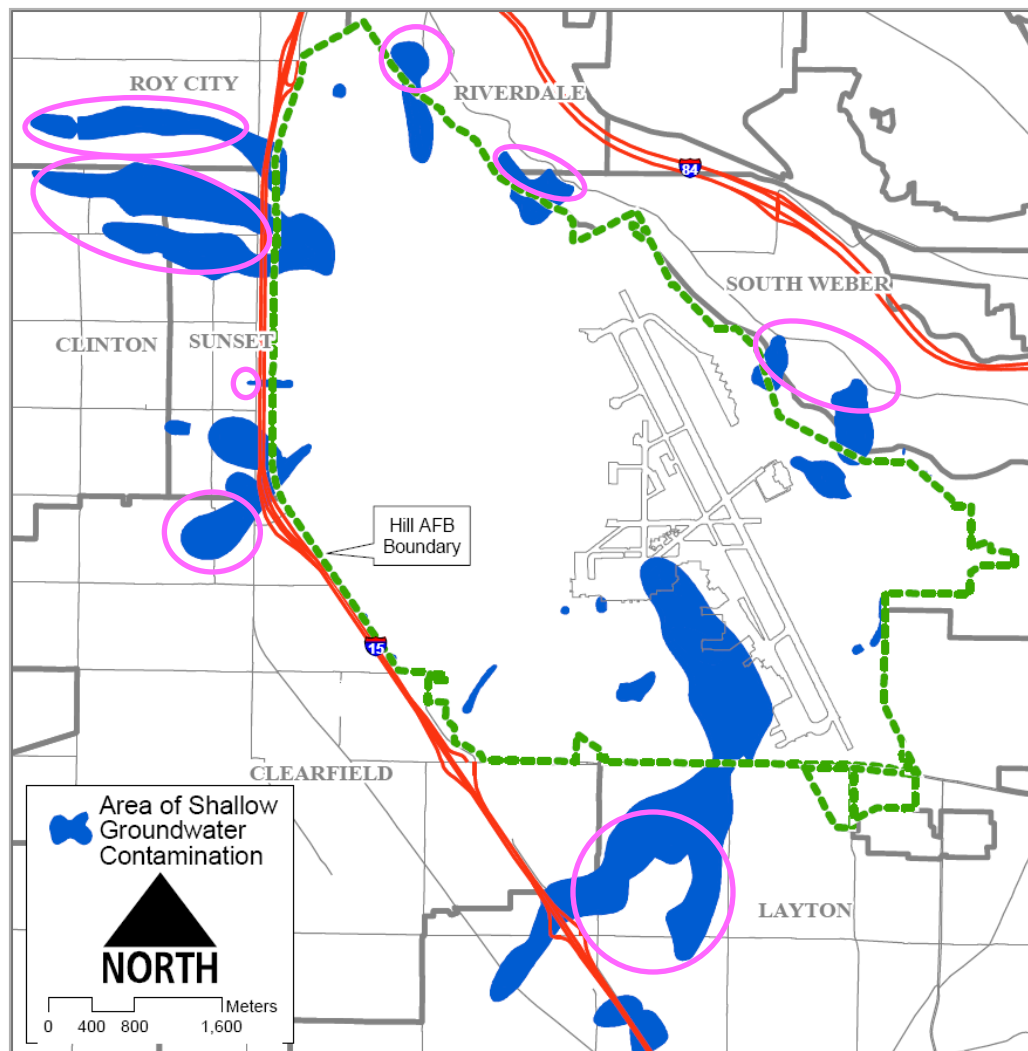




# Air Sampling Focus Areas



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**Areas of shallow groundwater contamination**



**General Area of Indoor Air Sampling Locations**

**7 cities,  
~2,900 Homes**



# Characterization Objectives



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- “Fix the problem”
  - Get below action levels
    - TCE < 2.3, PCE < 0.61 (ppbv)
- Evaluate vapor intrusion
  - Mitigate if necessary
- Rapid location of interior sources of target VOCs
- Positive identification of target VOCs in consumer products
  - Residents can remove sources







# Portable GC/MS



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- Inficon HAPSITE® GC/MS
- Key features:
  - Sample collection with attached heated probe
    - Variable sample volume
  - “Clean” chromatograms
    - Target VOCs in SIM mode
  - “Positive” identification
    - Full scan using NIST library
  - Short (~6 min) sample turn time
  - Low quantitation limits
    - Chlorinated aliphatics in ppt





# “Real Time” Screening



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- **“Survey” feature**
  - **Continuous sample collection**
  - **Sample bypasses GC**
  - **MS operated in SIM mode**
    - **Real time response to ions in target compound**
  - **Detection limits in 100 ppb range**
  
- **Allows very rapid screening of containers and/or individual products**
  - **Results confirmed with GC/MS**





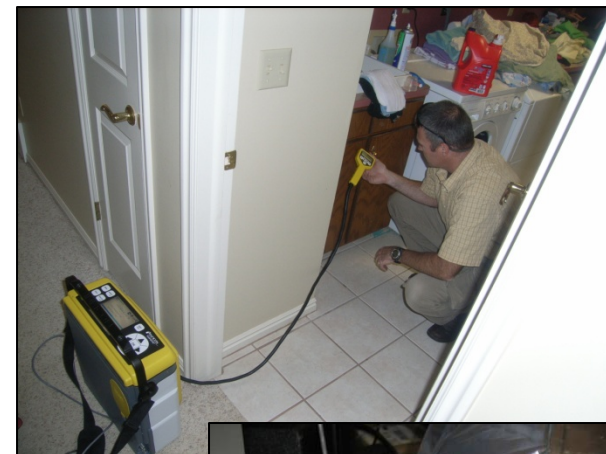
# Investigation Approach



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## Follow the data...

- Area-by-area sampling
  - Basement, main level, attached garage
- Focused sampling in high concentration area
  - Typically considered higher if 2X other areas
  - Room-by-room sampling
  - Container survey/sampling
  - Individual product survey, sampling, and emission rates





# Investigation Approach



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- Vapor intrusion investigation
  - Isolation of potential preferential pathways
    - Cracks in foundation
    - Slab penetrations
  - Sampling from VRS suction points
  - Shallow soil gas sampling





# Example Results



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- **Residence #1**
  - 'Typical' and relatively easy case
  
- **Residence #2**
  - More challenging example
  - Indoor source + vapor intrusion
  
- **Residence #3**
  - Interesting finding
  - Indoor source



# Residence # 1 Investigation



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- **TCE < action level**
  - VRS did not reduce concentration
- **Samples suggest garage source**
- **Survey containers and products**
  - Identified possible source in ATV saddle bags
- **Tire repair kit and 'oil'-stained gloves**
  - Repair kit lists TCE ingredient
  - Isolated gloves [TCE] ~300 ppbv

Sample Location	TCE ppbv
Basement	0.2
Attached Garage	0.6





# Residence #1 Summary



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- 1 sampling event
- 4 samples
- ~1.5 hours
- Requested resident store items in shed



- Next 'routine' air sample
  - TCE = 0.22 ppbv
- Items not the source, OR ...





# Residence #2 Initial Sampling



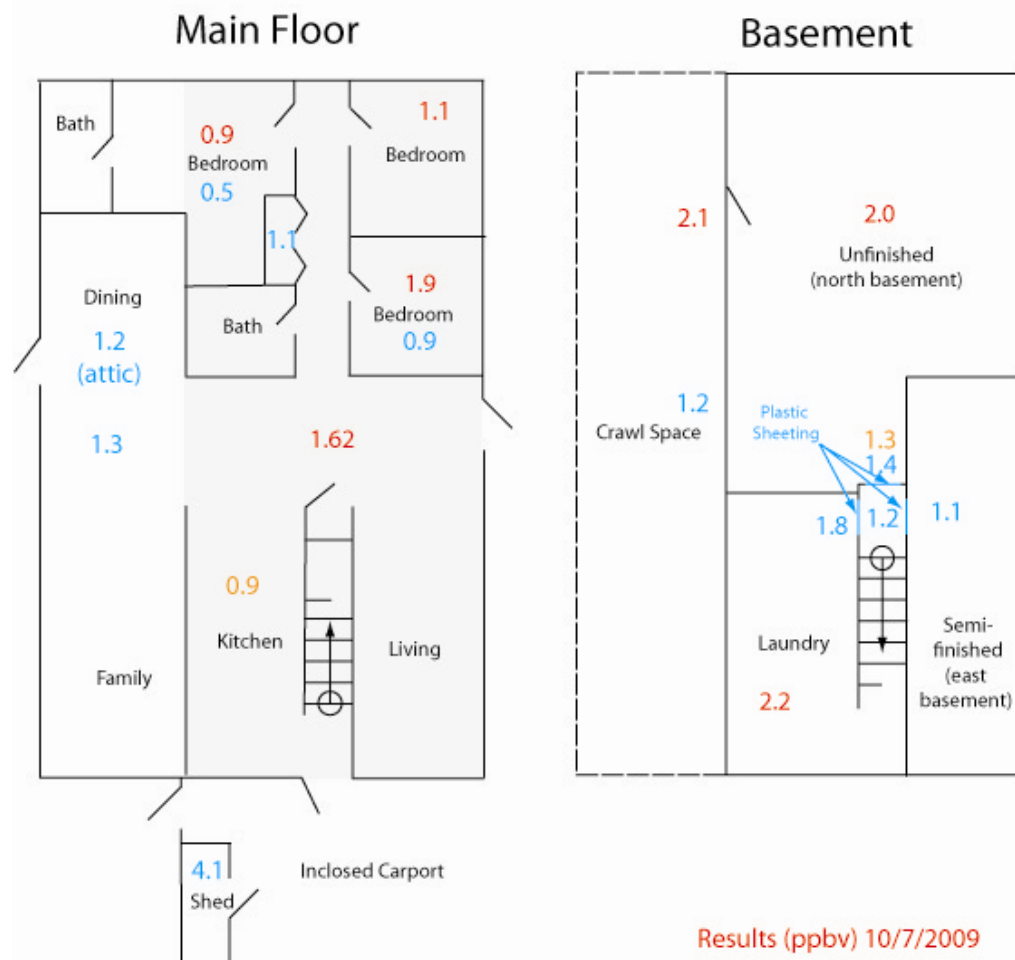
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## ■ PCE > action level

- First detection after change in resident

## ■ Initial sampling

- $MF_{avg} = 1.4$  ppb
- $B_{avg} = 2.1$  ppb
- Basement source
- Laundry room?
- No PCE sources
- Possible VI?



Results (ppbv) 10/7/2009

Results (ppbv) 10/14/2009

Results (ppbv) 10/15/2009

Slide 14



# Residence #2 VI Investigation



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## ■ Vapor intrusion investigation

Sample Location	PCE (ppbv)	TCE (ppbv)
Basement air	2	0.1
Isolated foundation crack	1.7	0.2
Crawl space air	2.1	0.1
Crawl space soil gas	1.8	2.0

- PCE vapor intrusion unlikely
- Evidence of TCE vapor intrusion
  - TCE concentration inside << action level



# Residence #2 Follow-Up



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- Follow up area-by-area sampling
  - Attic sampled, PCE  $\approx$  inside
  - Outside inspection
  
- Car port storage area shares attic
  - PCE 4 times higher than indoor air
  - Sealant containing PCE identified
  - Resident removed product
  - Indoor air sampled 14 days after removal
    - PCE not detected



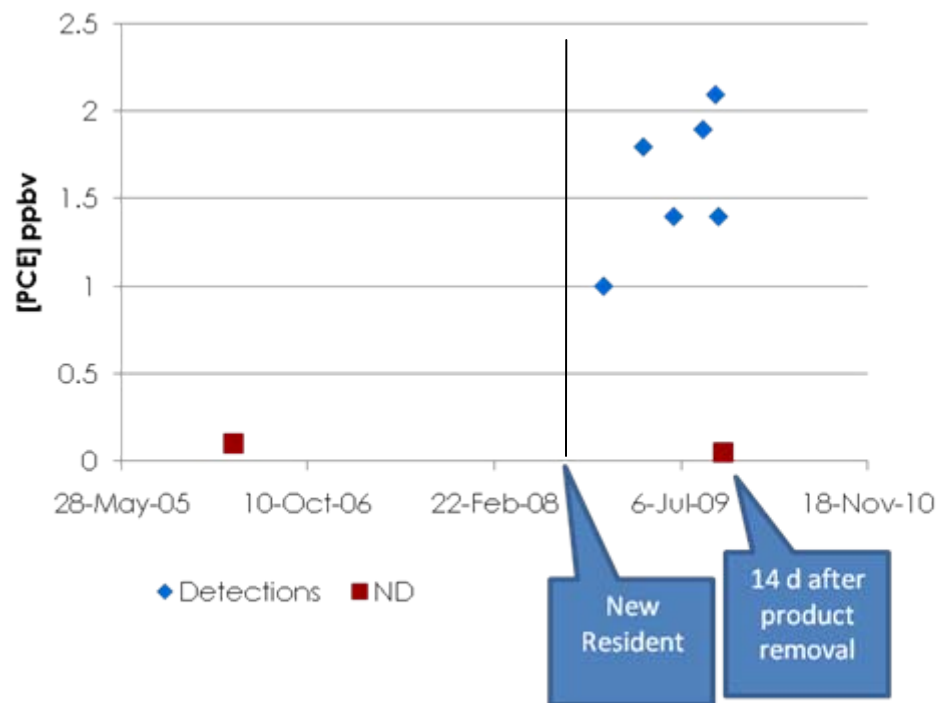


# Resident #2 Summary



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- Sealant apparent source of PCE
- TCE vapor intrusion possible, but below action level
- 3 sampling events
- 26 samples
- ~8 hours
  - Continue 'routine' indoor air monitoring

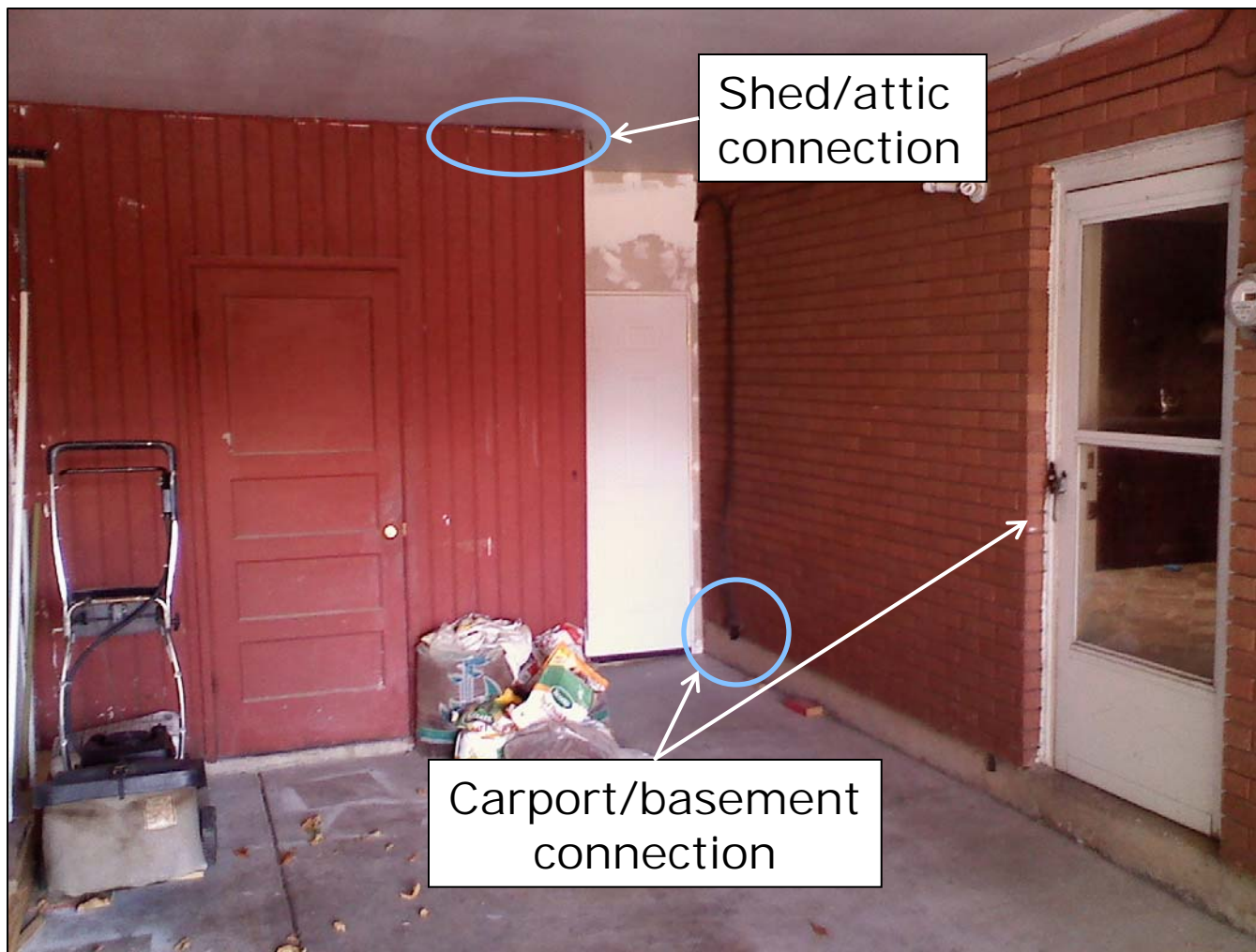




# Residence #2



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# Residence #3

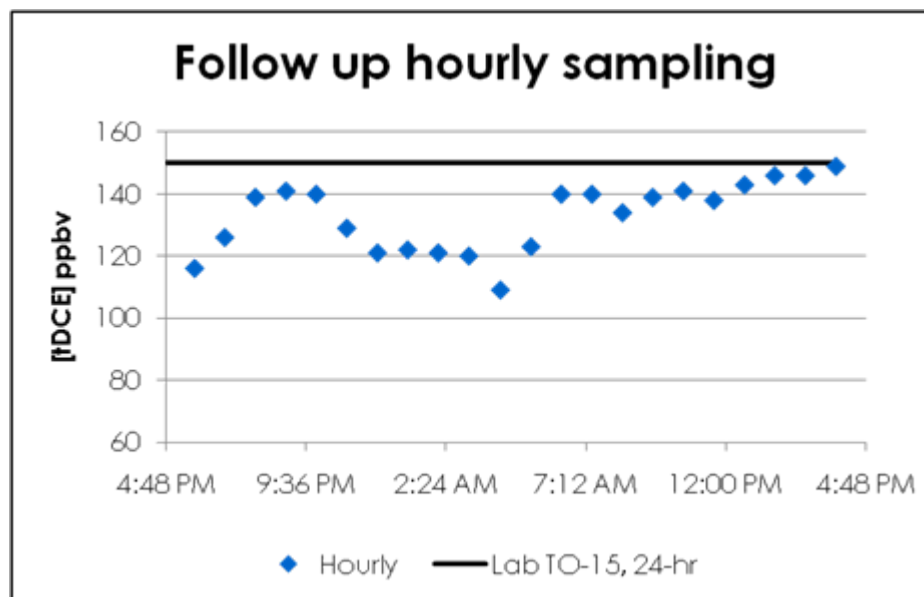
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- Routine sample: trans 1,2-DCE = 170 ppbv
  - Action level = 70 ppbv
  - tDCE not observed in nearby GW
- Detailed Investigation results

Location	tDCE ppbv
SE Bedroom	840
SW Bedroom	890
NE Bedroom	930
Garage*	100
Sprinkler standpipe**	ND

\*Door had been open

\*\*Open to soil @ bottom





# Residence #3 Follow up



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trans 1,2 Dichloroethylene is a specialty chemical product with unique solvency characteristics and a favorable toxicological profile. It has negligible global warming potential and is not regulated as an Ozone Depleting Chemical in the USA. It is not listed as a Hazardous Air Pollutant, not regulated as a Prop 65 chemical, and not classified as a carcinogen or suspected carcinogen in the USA. trans 1,2 Dichloroethylene is flammable in its pure form. It may be used neat or as a co-solvent in a variety of azeotropic or non-azeotropic blends to enhance the functionality and economics of a wide array of solvent formulations. Applications include:

- precision cleaning in the electronics and computer components industries,
- aerosol cleaning (high-end precision parts),
- foam blowing products,

Source: Diversified CPC website

- Resident confirmed foam insulation
- Indoor air = 700 ppbv
- Electrical box = 2270 pbbv
- Isolated foam = 55 ppbv





# Residence #3 Summary



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- tDCE very likely from foam insulation
- 4 sampling events
- 44 samples (23 hourly)
- ~6 hours
- Would be interesting to study temporal concentrations

Arkema's Transcend™ additive technology approved by EPA as replacement for HCFCs

FOR IMMEDIATE RELEASE

Philadelphia, PA - January 24, 2005

The United States Environmental Protection Agency (EPA) has granted Arkema's Significant New Alternatives Policy (SNAP) petition to allow Arkema's new Transcend™ additive technology to be used as part of a blowing agent system for the direct replacement of various chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) blowing agents in most rigid polyurethane foam (PUR) applications.



# Key Points



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- Hill AFB chose to sample inside air for vapor intrusion characterization
- Indoor sources are very problematic
  - Despite chemical inventory and inspection
  - Portable GC/MS successful for locating interior sources
  - Sources located in 15 of 18 homes investigated
    - PCE, TCE, tDCE, 1,2-DCA, carbon tetrachloride
- Techniques for VI investigation show promise
- Upcoming efforts
  - Additional 24-hr comparisons (hourly vs. average)
  - Further development of field emission procedures



# Questions



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