

Influence of Sampling Parameters and Meteorological Variables on Measured Soil Gas Concentrations

Results from EPA-NERL Funded Research Program on Active Soil Gas Measurements

January 2009

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PROGRAM OVERVIEW

- Project 1:** Effect of Sampling Variables – Vandenberg AFB, IRP Site 15 (October 2006)
- Project 2:** Effect of Meteorological Variables – Vandenberg AFB, IRP Site 15 (March 2007)
- Project 3:** Sub-slab and Near-slab Vapor Concentration Profiles – NAS Lemoore, IRP Site 14 (February 2008)
- Project 4:** Temporal Variability of Vapor Concentration Profiles and Effect of Meteorological Variables – NAS Lemoore, IRP Site 14 (On-going)

PRESENTATION OF RESULTS

- Project 1:** See Center Panel
- Project 2:** See Right Panel
- Project 3:** Go to **Sampling and Assessment Session Case Study: Sub-slab vs. Near-slab Soil Vapor Profiles at a Chlorinated Solvent Site.** Presented by Dr. Brian Schumacher.

Project 4: Stay tuned!
 Further research is currently ongoing at NAS Lemoore to evaluate:

- The 12-month variability in vertical vapor concentration profiles
- The effect of meteorological variables on vapor concentrations in low permeability soils
- The effect of different sampling methodologies on measured vapor concentrations



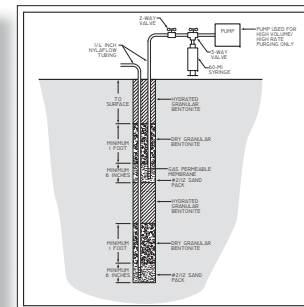
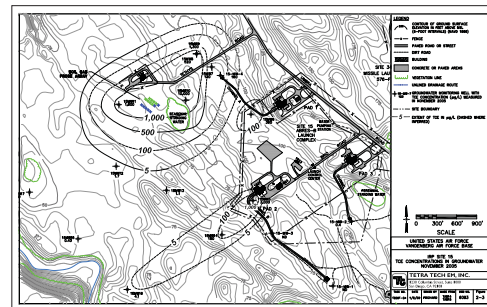
Results to be reported throughout 2009



Vandenberg AFB IRP Site 15

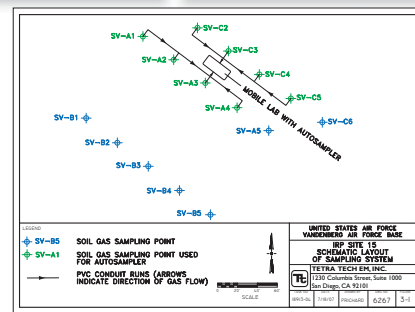
SITE SETTING

- Sand dune environment (uniform high permeability)
- TCE plume in groundwater from rocket engine degreasing
- Groundwater at 18 to 20 ft bgs



SAMPLING PROBES

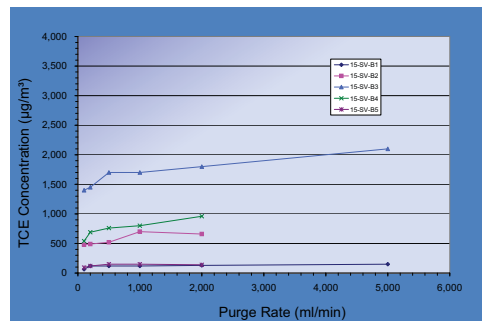
- Three transects of five soil vapor sampling locations
- Probes installed at approximately 2 feet above groundwater at each location (depths of 14 to 19 feet bgs)
- Additional nested probes installed at depths of 3 and 8 feet bgs at two locations



Project 1: Effect of Sampling Variables

PURGE RATE EXPERIMENT

- Purge volume = 3 system volumes
- Sample volume = 60 ml
- Purge rate varied from 100 to 5,000 ml/min

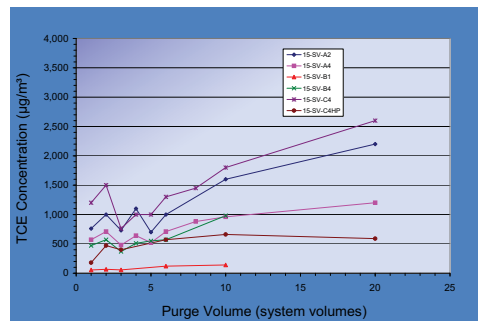


TCE Concentration Vs. Purge Rate

- Slight positive correlation overall
- Relatively sharp increase from 100 to 200 ml/min
- Variability generally within analytical error

PURGE VOLUME EXPERIMENT

- Purge rate = 200 ml/min
- Sample volume = 60 ml
- Purge volume varied from 1 to 20 SVs

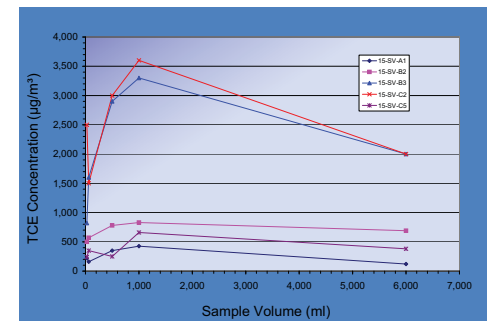


TCE concentration vs. purge volume

- Consistent increase in conc. from 1 to 2 purge volumes
- Only minor variability in conc. from 1 to 5 purge volumes
- More significant increase in conc. from 5 to 20 purge volumes

SAMPLE VOLUME EXPERIMENT

- Purge rate = 200 ml/min
- Purge volume = 3 system volumes
- Sample volume varied from 25 to 6,000 ml



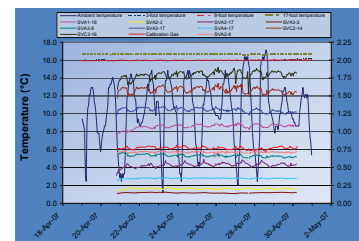
TCE concentration vs. sample volume

- Moderate positive correlation from 25 to 1,000 ml
- Decrease in conc. at 6,000 ml (equal to 6-liter Summa!)

Project 2: Effect of Meteorological Variables

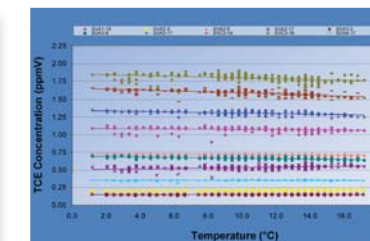
METEOROLOGICAL VARIABLES AUTOMATED SOIL-GAS ANALYSES

- Ambient and subsurface temperature
- Barometric and soil-gas pressure
- Precipitation and soil moisture
- TCE measured using SW8021
- 12 sample probes/2 vertical profiles
- 12 samples/hour, 24 hours/day



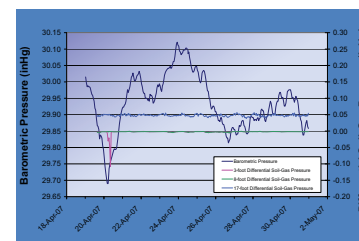
Ambient and subsurface temperature with TCE

- Limited diurnal variability within analytical error
- Constant soil temperature
- Observed variability more likely related to ambient temperature in on-site laboratory than changes in sample concentration



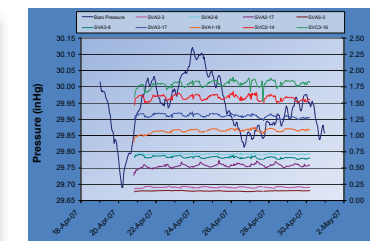
Ambient temperature vs. TCE concentrations

- Slight negative correlation at higher conc.
- Very slight positive correlation at lower conc.
- Variability all within analytical error



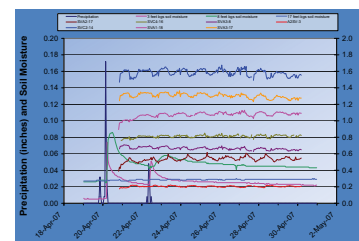
Barometric and differential soil pressure

- Soil pressure tracks with barometric



Barometric pressure and TCE concentrations

- No significant correlation



Precipitation, soil moisture, and TCE concentrations

- Soil moisture responds to precipitation as expected
- No discernable effect on TCE concentrations
- Only minor rainfall events occurred



CONCLUSIONS

At Vandenberg AFB IRP Site 15 Study Site:

- Purge rate had insignificant effect on measured TCE concentrations
- Purge volume had minor effect on measured TCE concentrations
- Increasing sample volume from 25 to 1,000 ml had minor effect on measured TCE concentration
- Concentrations decreased with 6,000 ml sample volume: 6-liter Summa canisters may not be appropriate for soil gas samples
- Ambient temperature did not significantly affect measured concentrations
- No correlation between barometric pressure and measured TCE concentrations

Stay tuned for results from ongoing experiments at NAS Lemoore!