TCE Contaminated Soil Gas as a Source of Groundwater Contamination in a Deep Vadose Zone Environment

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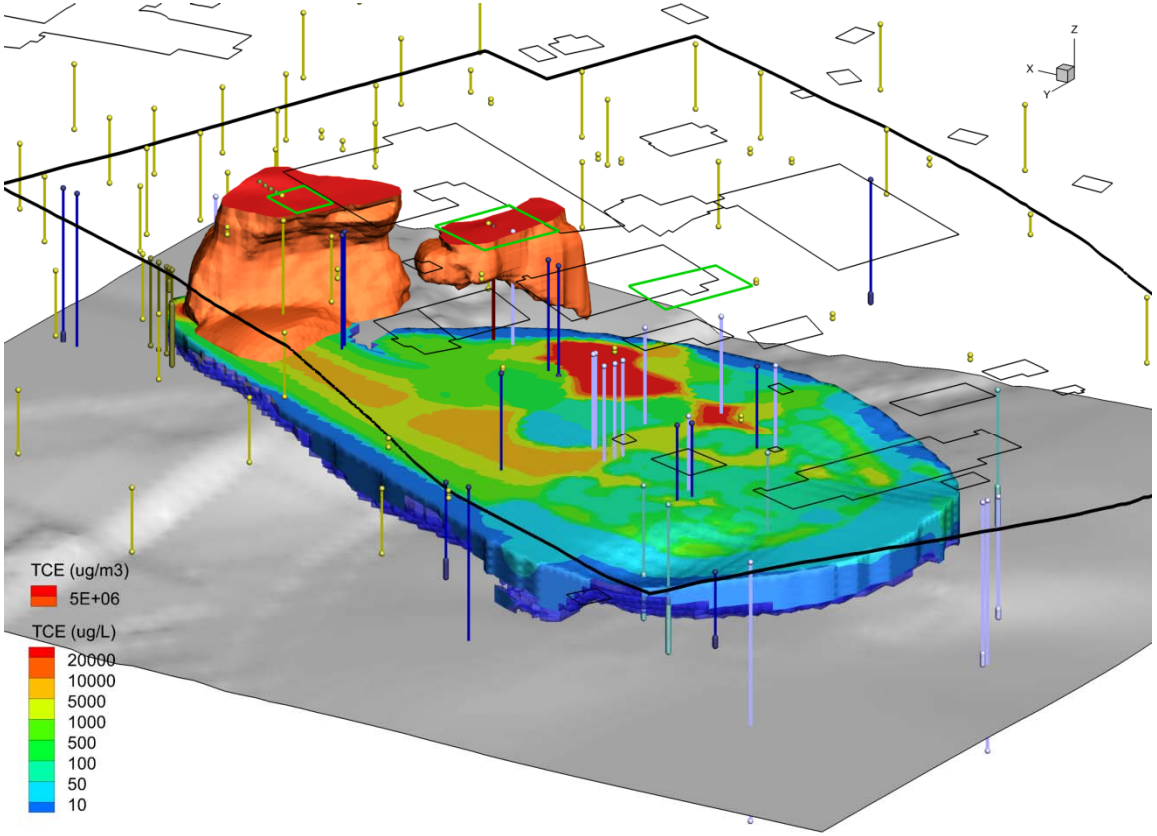
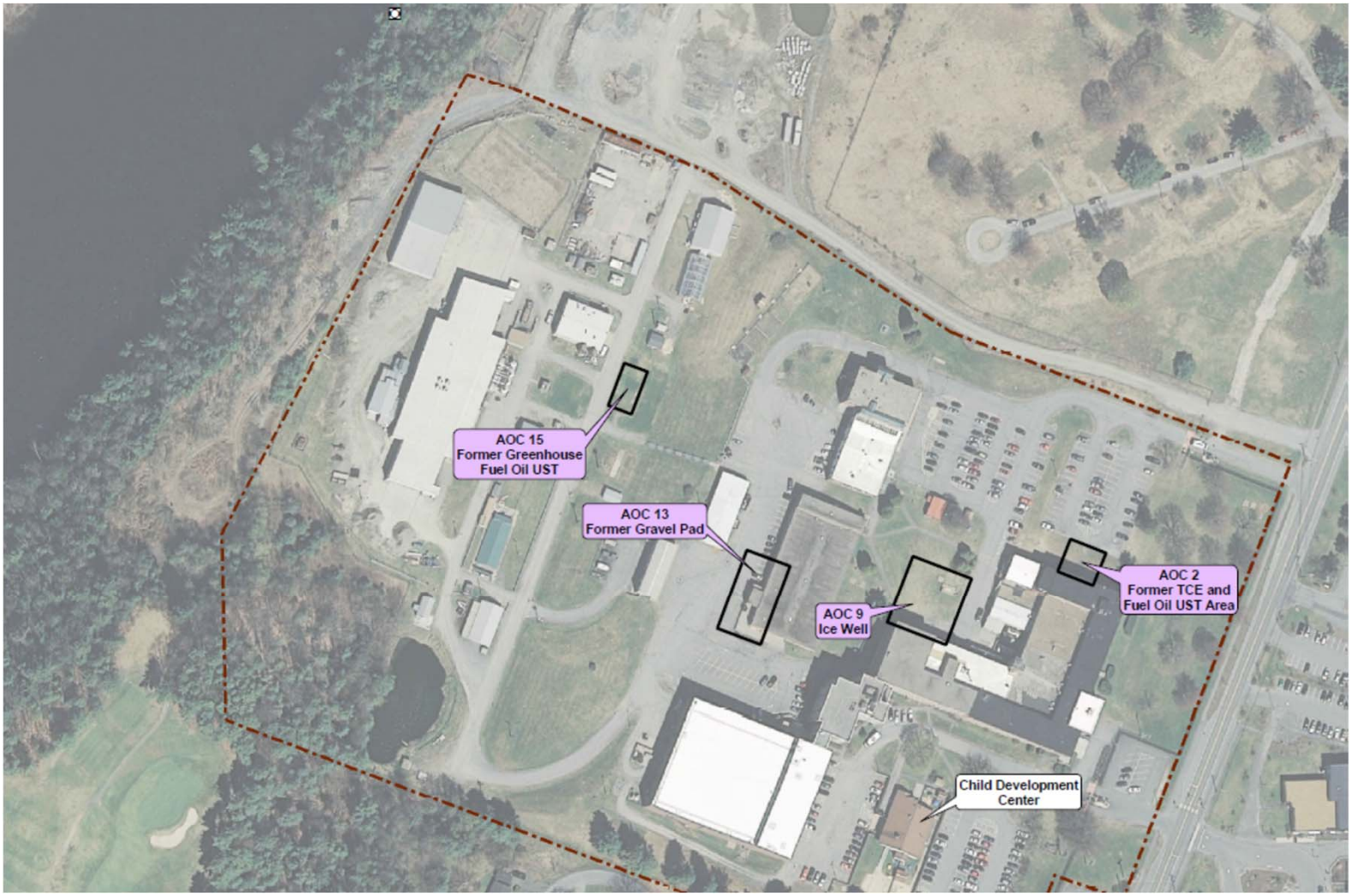
Take Away



Vapors in soil gas can be a source of contamination to groundwater

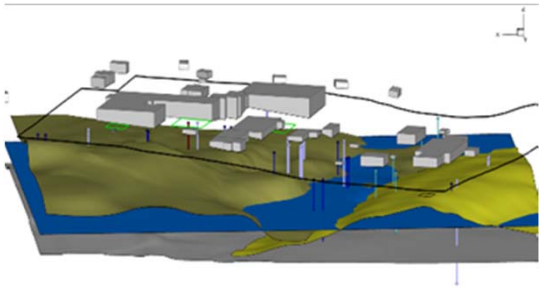
Soil gas sampling is more repeatable than soil sampling, allowing for monitoring of remedial progress

CRREL Facility, Hanover, NH

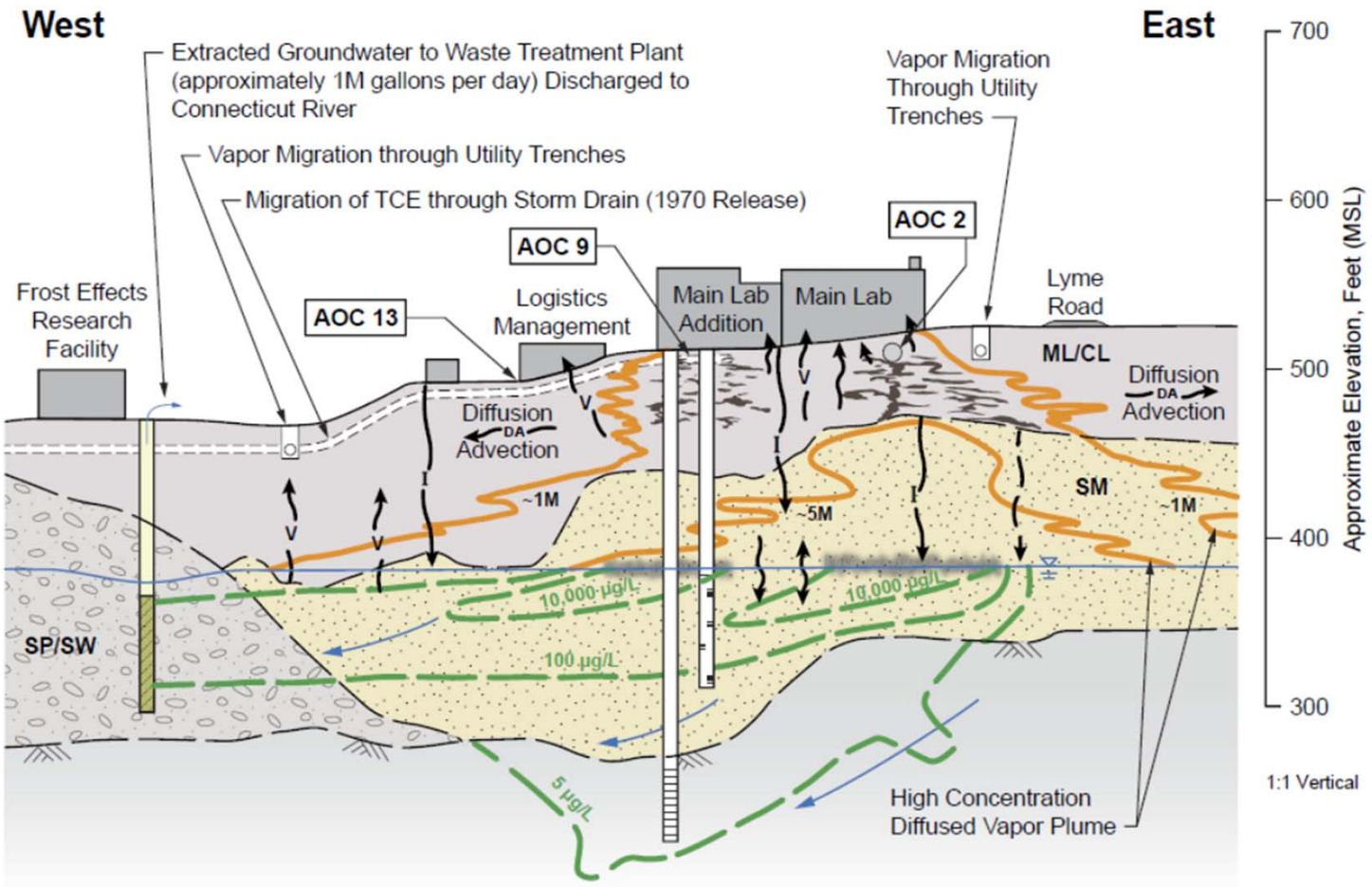


Background

- Cold Region Research and Engineering Laboratory (CRREL) established on 1 February 1961, by the United States Army Corps of Engineers (USACE).
- TCE used extensively as a heat transfer fluid and in various experiments
- TCE detected in CRREL non-contact cooling water supply wells in 1990
- Soil Vapor Extraction pilot tested starting in 2015



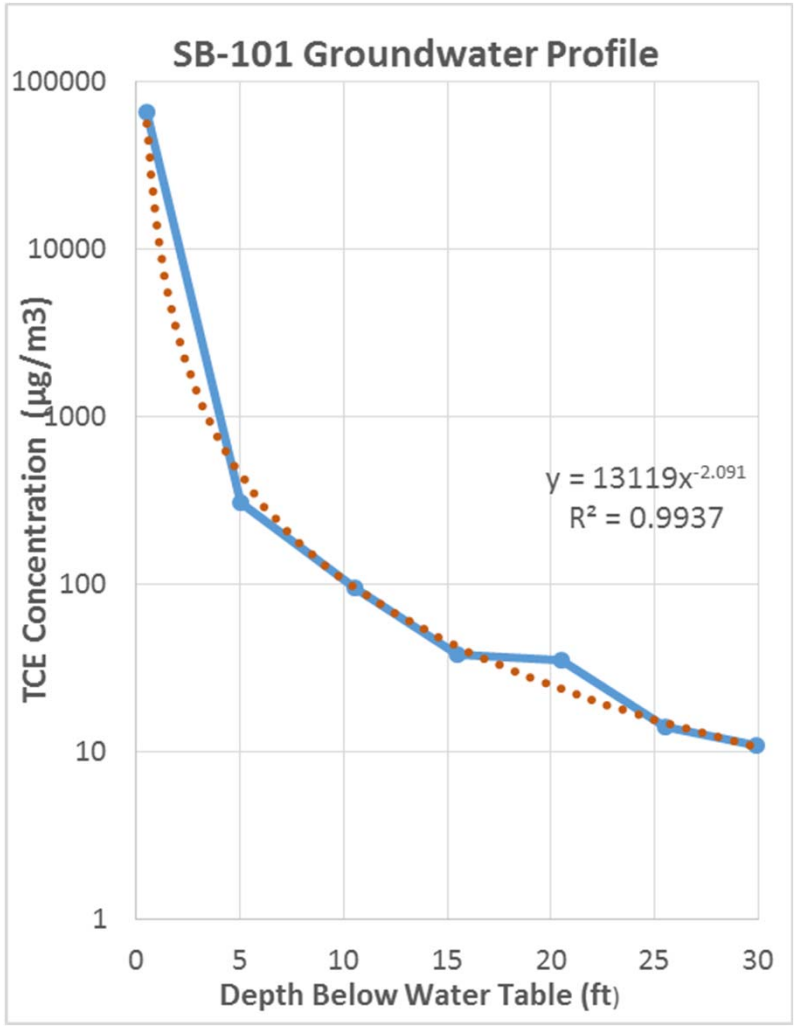
Conceptual Site Model

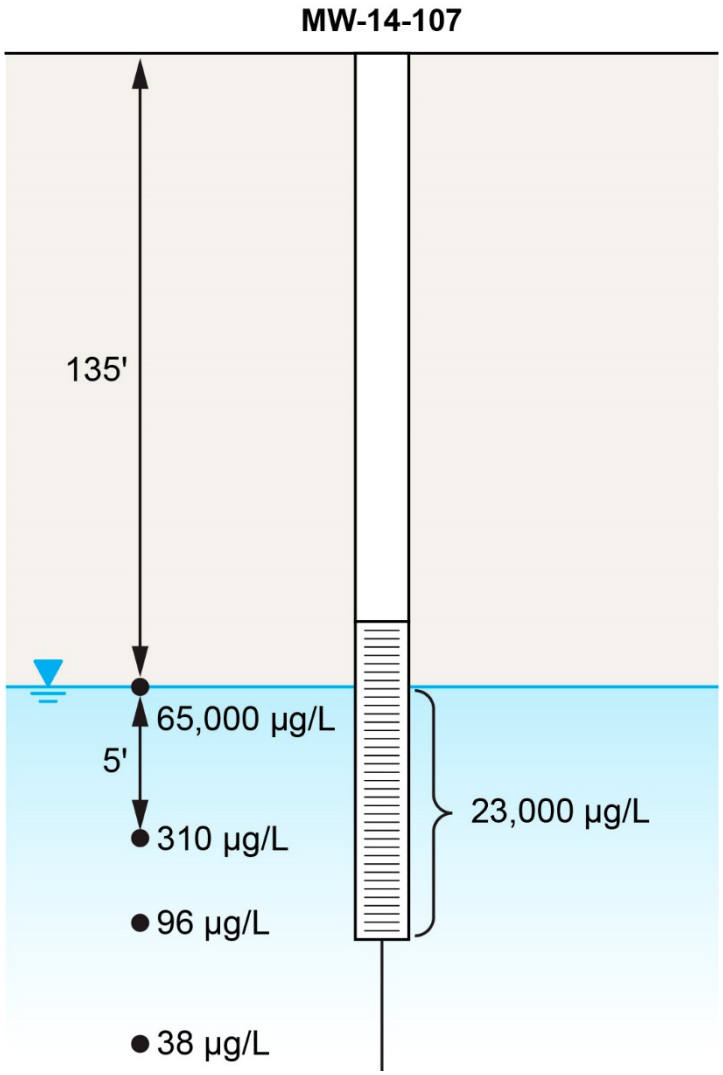


Site Conditions

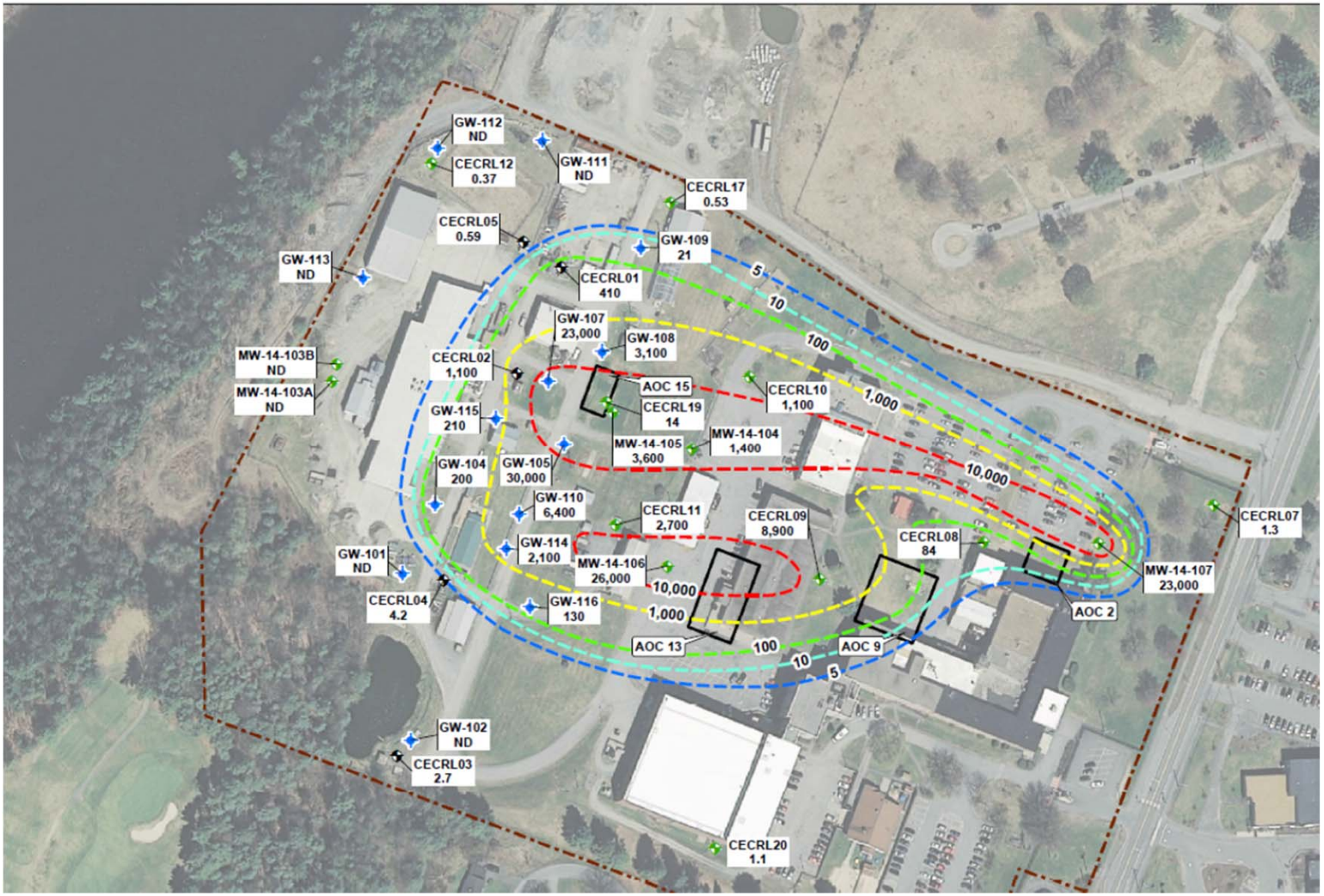
- Soil gas TCE concentrations in source areas of 3,000,000 to 10,000,000 µg/m^3 (550-1,850 ppm_v)
- TCE in groundwater at the water table at 65,000 µg/L (groundwater profiler data)
- Monitoring well (10 ft screen) 23,000 µg/L
- Groundwater and soil gas are in equilibrium based on Henry's law.
- Groundwater velocity is 0.5 to 1 ft/day

Well MW-14-107

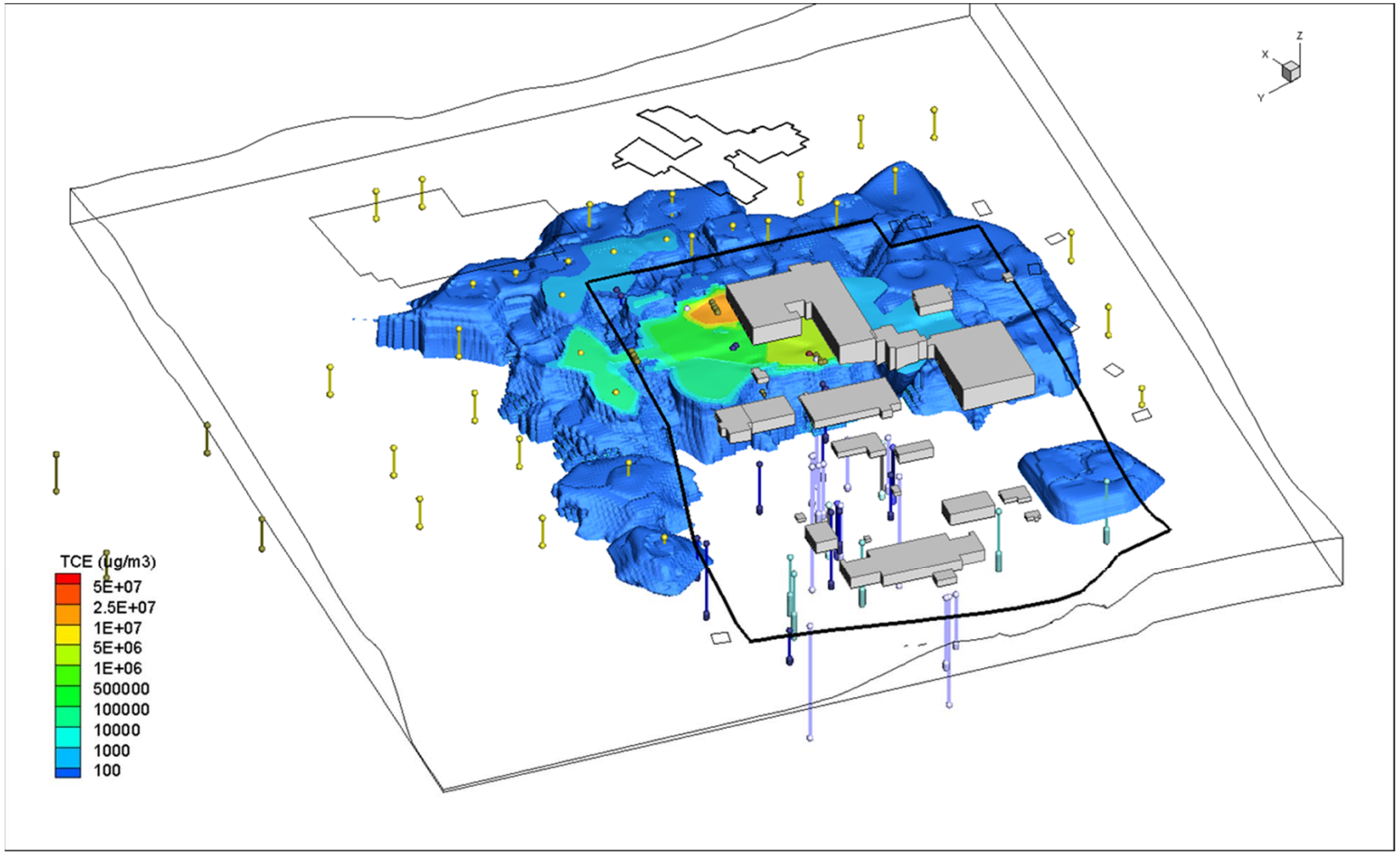




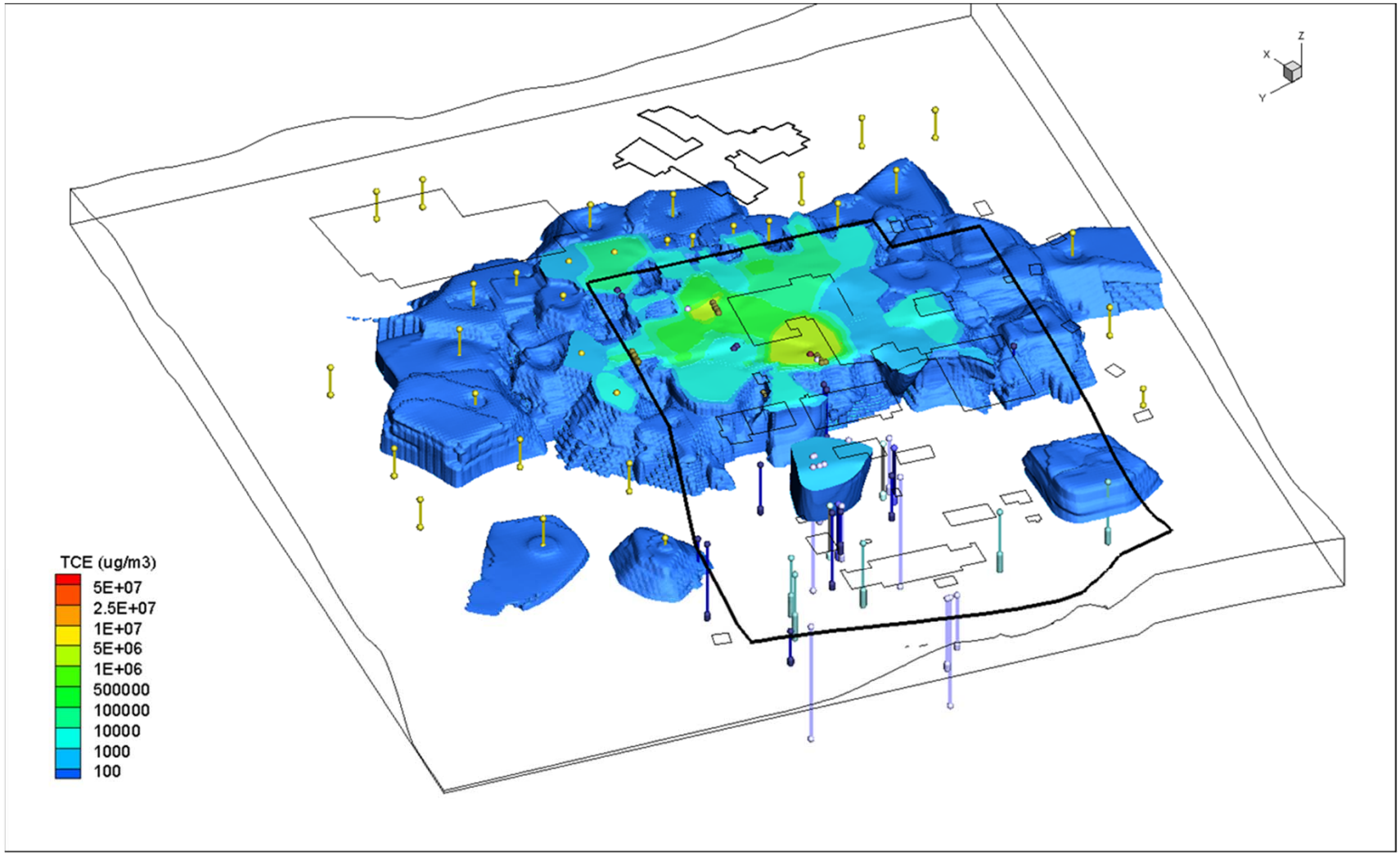
Groundwater Concentrations Pre-SVE



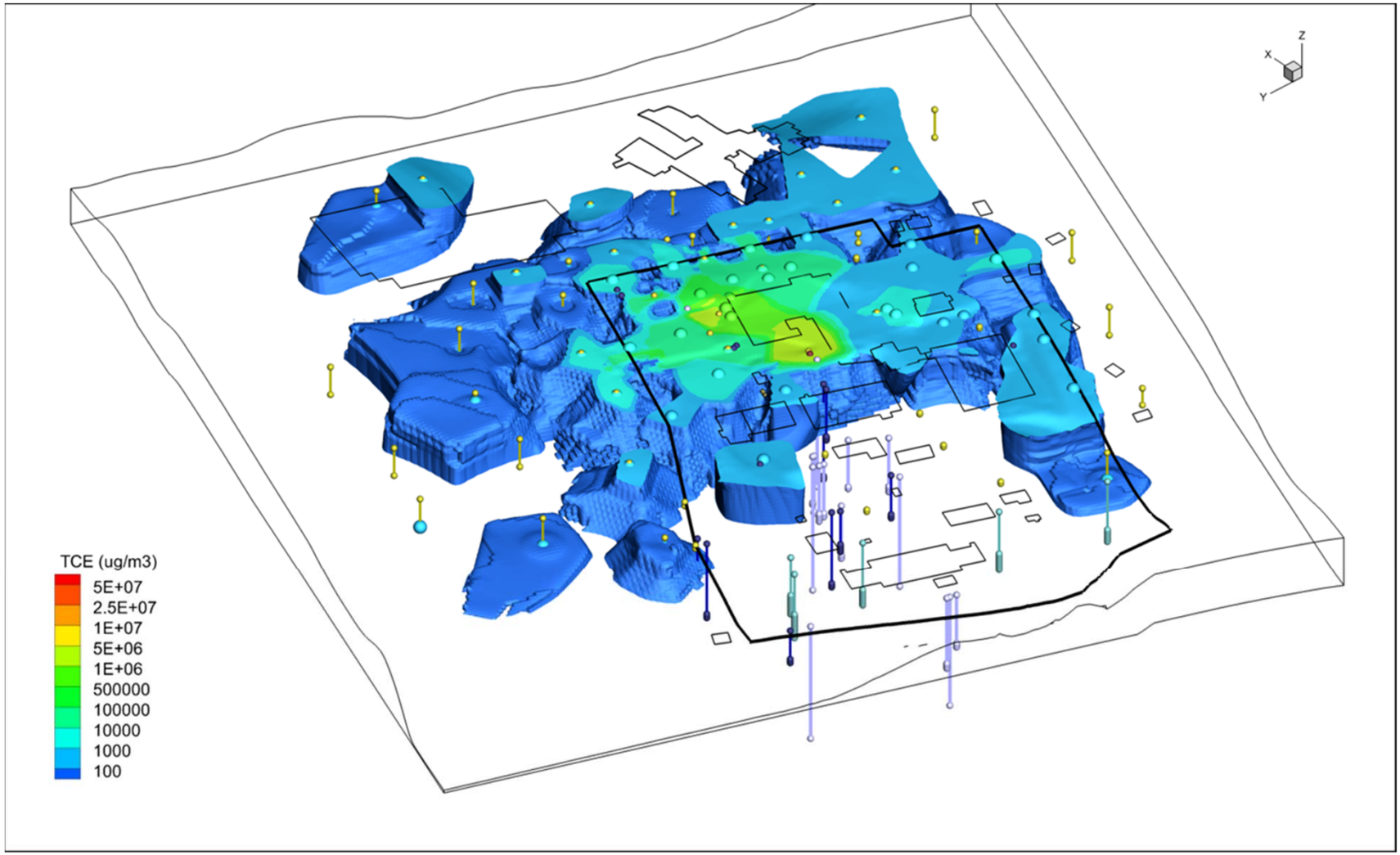
Soil Gas Pre-SVE



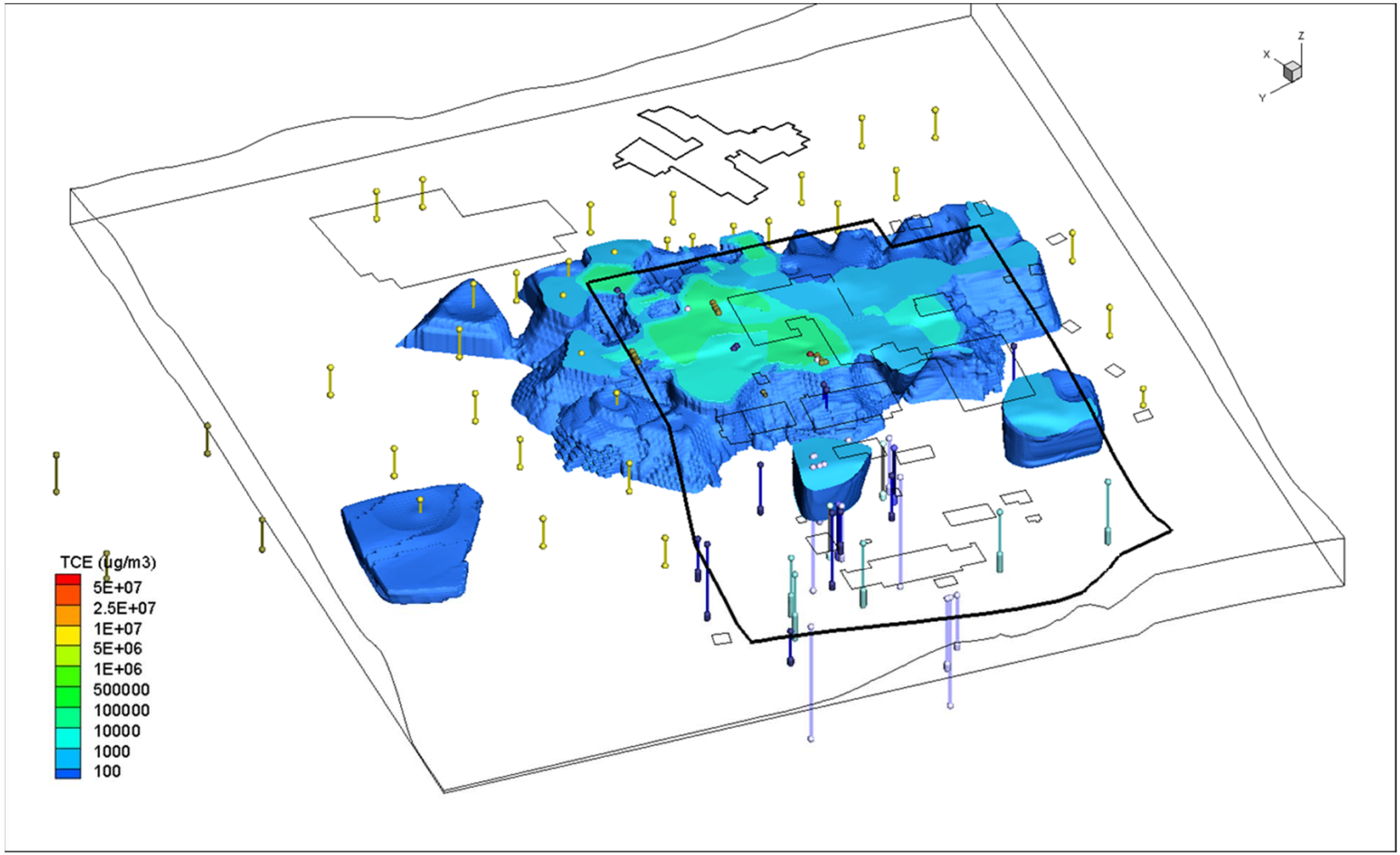
Soil Gas October 2015



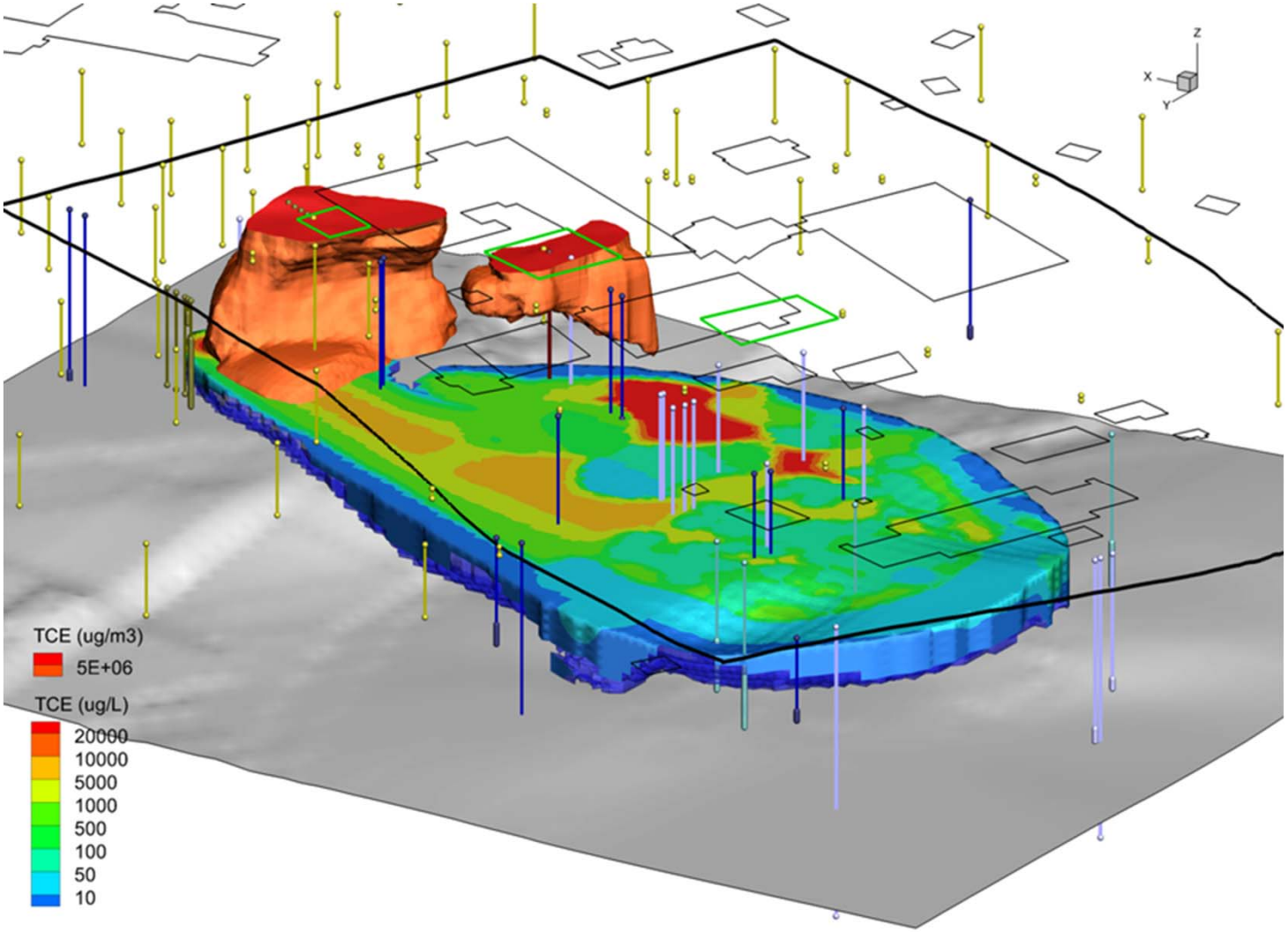
Soil Gas November 2016



Soil Gas October 2017



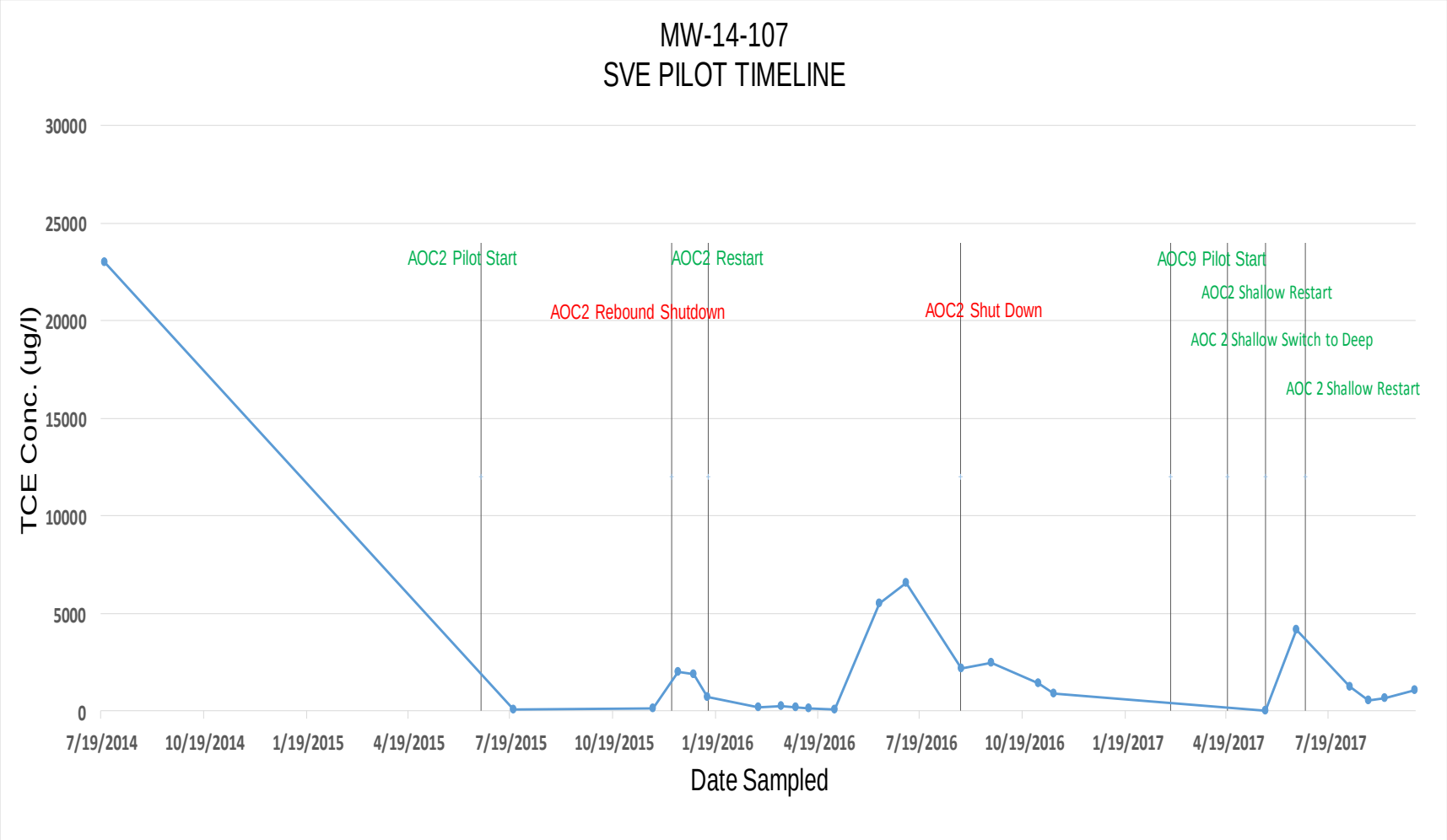
Soil Gas Acting – Groundwater Relationship



Results

- Soil vapor extraction interrupted soil gas to groundwater mass transfer
- Source area groundwater concentrations dropped >200x (from 23,000 to 83)
- Groundwater rebounded similar to soil gas during SVE shut-downs

SVE Operation Influence on Groundwater



Conclusions

- Deep soil gas concentrations were reliable indicators of groundwater contamination
- Soil vapor extraction interrupted soil gas to groundwater mass transfer
- Soil gas allows repeatable sampling to track vadose zone remedial progress

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