Lockformer ERH Case Study

The Removal Action is being conducted under a Unilateral Administrative Order issued by U.S. EPA

- ERH was selected as treatment technology for the 32,000 cubic yards of upper clay till/fill which is contaminated with TCE
- Soil Vapor Extraction was selected for the underlying sand and gravel
Lockformer Case Study

- Site contaminants include TCE and breakdown products
- Historical Spills of TCE with high levels of soil contamination (range 1 ppm – 2,000 ppm of TCE)
- Ground water and lower till is being addressed under Illinois EPA order (concentrations were below Removal Action Levels)
Electric Resistive Heating

- Same a Six Phase Heating
- Developed by Batelle but several contractors provide the technology
- Utilizes electric current to heat the soil to 90-100 C
- Vapor extraction is provided at the electrodes and at the surface under the plenum
1. Soil grains act as electrical resistors
2. Steam generation is uniform through the heated zone
3. Discrete intervals can be heated

150 V to 600 V

ELECTRODE
<15 V
NEUTRAL
ELECTRODE

HEATED ZONE
Surface Equipment

- 500 kW PCU
- Air Cooling Tower
- Emergency Shutoff
- Steam Condenser Skid
- Operating Electrode

Photo Courtesy of Brown and Caldwell
ERH Remediation
Beneath a Building

Limited overhead access

Electrode Co-located w/ Recovery Well

Photo Courtesy of Brown and Caldwell
ERH Remediation
Beneath a Building
ERH Plenum
Electrode Locations for ERH System in Upper Till
Soil Vapor Extraction Cross-Section

Vapor pumped out of soil

Clean Air

Moisture collected for treatment

Air & moisture separated

Vapor moves through the soil

Clay

Sand & Gravel

Clay

Vent
ERH and SVE Overlay
Requirements of the Administrative Order

- Clean-up objectives for TCE in the upper till were set at 8.9 ppm (IEPA TACO Industrial Worker Inhalation Standard).
- Installation of plenum with vapor recovery system.
- Installation of temperature monitoring points
- Operation of the ERH in conjunction with the SVE system to eliminate vapor migration vertically or horizontally
Requirements of the Order

- Vapor recovery and Granular Activated Carbon Treatment of the vapor phase and collected water.
- Continuous Air Monitoring of stack emissions and site work zone and perimeter monitoring is required due to the close proximity of residences.
Total Hydrocarbon Analyzer
ERH and SVE Vapor Treatment System
Regulatory Requirements

- Granular Activated Carbon Treatment of the recovered vapor and collected water prior to discharge.
- Continuous Air Monitoring of stack emissions and site work zone and perimeter and residential samples were required due to close proximity of residences.
Roll-Off Box with Granular Activated Carbon
Lockformer Case Study

- Clean-up objectives for the upper clay till of 8.9 ppm (IEPA TACO Industrial Worker Inhalation Standard) have been met at 95% of the site. (average concentrations are less than 1ppm for TCE)
- Installation of plenum with vapor recovery system temperature monitoring points
- The Off Gas Carbon Treatment System has been effective, no vapor release detected
- Operation of the ERH in conjunction with the SVE system has eliminated vapor migration vertically or horizontally
Conclusions

- The use of ERH in conjunction with SVE to treat TCE contaminated soil in-situ has been operational since February of 2003. Approximately 95% of the site has been remediated below 1ppm TCE.
- The design and construction of temperature and vapor monitoring probes was required to evaluate movement of the vapor phase.
- Air monitoring of stack emissions, site work zones, perimeter and residential have shown no exceedances of health standards.
Conclusions (cont.)

- ERH technology is capable of treating soil with low permeability and with high concentrations of chlorinated solvents
- Other potential uses include; petroleum contaminated soil, other volatile and semi-volatile compounds
ERH Costs

- Contract with Thermal Remediation Systems ($3.1 Million)
- Electrical usage $330,000
- Approximate cost/yard = $100 to $120
- Current Landfill costs were $200/ton
- Some high level TCE soils require pre-treatment prior to disposal at a landfill