Trihydro

COMBINED ACTIVE AND PASSIVE TREATMENT OF LARGE, DILUTE PCE PLUME

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Project Overview

- Solvent recycling facility since 1975
- RCRA program / TCEQ oversight / TRRP
- Groundwater impacts 10-25 ft
 - PCE + degrad. products
 - TCA + degrad. products
 - Chlorinated benzenes (CBs)



Conceptual Site Model

- Large, dilute plume
- Cis-DCE and vinyl chloride indicate reductive dechlorination
- ORP, DO, and other parameters suggest moderately reducing conditions





Conceptual Site Model

- Thin fine sand bounded above and below by finegrained strata
- Impacted zone 1 to 15 ft thick at 15 to 25 ft bgs
- GW seepage velocity 130 ft/yr



Conceptual Site Model





Early Stage Plume - COCs in high permeability (K) zones, with diffusion moving COCs into lower K zones



Middle Stage Plume -COCs equally distributed between high and low K zones



Late Stage Plume – High K zones flushed out, COCs in low K zones, backdiffusion sustains plume





Site Strategy



Monitored Natural Attenuation

- Applied to TCA and chlorinated benzenes (CBs)
- Monitoring well specific
 Attenuation Action Levels
 - Log concentration vs. distance per TCEQ guidance





Remediation Technology Selection

- Economical reagents required for large plume
- Expanding footprint of treatment needed for large plume with access restrictions
- Persistent process needed for middle/late stage plume
- Cis-DCE and vinyl chloride indicated reductive dechlorination ongoing

In-Situ Bioremediation (ISB) most compatible with above criteria



ISB Pilot Study: Design

- Performed near denselyspaced well cluster
- Used Trihydro mobile injection system
- Injected 2,500 gallons of 1.5% to 3% ISB amendment into each of 4 injection wells



ISB Pilot Study: Results

- 99% treatment of parents and byproducts
- Possible abiotic component
 - Sulfate reduction
 - Increased iron
 - Black precipitate



RW-1 - Inside Area of ISB Pilot Test

26-Months



ISB Pilot Study: Results



- 99% PCEtreatment
- Shift from parent to daughter products
- At perimeter of ROI, so relatively less treatment

PZ-1 Inside Area of ISB Pilot Test



ISB Pilot Study: Results



- Downgradient well
- COPCs plus ORP,
 TOC indicate
 expansion of active
 treatment zone

PZ-3 - Downgradient of ISB Pilot Test



ISB Full-Scale Design

- Grid for source, biobarrier for plume
- Increased reagent volumes to increase ROI





ISB Full-Scale Design

How long will it take to get treatment 2,100 ft away?

- 2,100 ft / 130 ft/yr
 - = 16 years
- RemChlor model

Answer: ~25 years, longer than acceptable, and longer than GW velocity would suggest



ISB Full- Scale Design

- Two off-site biobarrier transects added to expedite cleanup
- Groundwater recirculation element to increase lateral spread



2015 ISB Full- Scale Implementation

- 33 injection wells Sand thickness 1 to 13 ft, amendment scaled accordingly
- 126,000 gal of 4% EVO using Trihydro's personnel and mobile injection system
- Approximately 1,200 hrs worked with Zero Accidents
- \$2.5/yd³ for wells and injection



ISB Full-Scale Implementation



EVO Totes With Static Mixer



Water Totes and Water Pump



2017 ISB Full- Scale Implementation

- 39 injection wells Sand thickness 1 to 13 ft, amendment scaled accordingly
- 172,000 gal of 2.5% to 4% EVO
- Bioaugmentation
- $1.5/yd^3$ for wells and injection



ISB Full-Scale Results



MW-12 - Inside Full-Scale ISB Area

0.3



Summary and Conclusions

- Institutional controls (PMZ) and MNA used to the extent possible
- ISB optimal technology for site conditions
- ISB effectively up-scaled from pilot test to full-scale system in one year
- Framework in place for mediumterm compliance







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Poster #90, Session F5, Solar-Powered ISB Wednesday, May 24, 2017 5:45pm to 7:00pm



