Lessons learned from In-situ Heating at the Frontier Fertilizer Superfund Site

Bonnie Arthur, Project Manager, EPA Region IX
Frontier Fertilizer Superfund Site
In-Situ Thermal Treatment (ISTT)

- History and Background
- Lessons Learned
  - Design/Construction
  - Community Issues
  - Operations
  - Shut-off Criteria
FRONTIER FERTILIZER SUPERFUND SITE
Davis, California

- Added to NPL in 1994; ISTT selected remedy in 2006 ROD (along with continued GW extraction and treatment)

- Chemicals of concern (COCs):
  1,2-dibromo-3-chloropropane (DBCP), 1,2-dichloropropane (1,2-DCP), ethylene dibromide (EDB), 1,2,3-trichloropropane (TCP), carbon tetrachloride
Site viewed from the South

- GW Treatment System
- GW Extraction Well Field
- Pesticide Source Zone
Design/Construction

Effective:
- Expediting fieldwork; multiple drill rigs to install electrodes
- Process Hazard Analysis
- By-products “White Paper”

Not effective:
- Investigate concurrent with install
- Changing design once contract in place
- Contract too restrictive
MAJOR DESIGN ISSUE--POWER

Heated in stages due to energy limitations on the grid (new commercial developments)

52,478 cubic yards
Community Relations Activities

- Developed “Community Notification” document
- Meeting format: larger full community meetings and smaller meetings w/TAG
- City & County emergency personnel tours—useful for training exercise
ISTT Operated February 2011-October 2012
Electrode Array
111 deep electrodes
125 shallow electrodes
Case for Lower Temperature Heating

- Save energy and time by heating to lower temps
- Must collect temperatures and system vapor samples earlier in process
- Key stakeholders against low temp heating at FF
ISTT Extracted Mass—97 pounds COCs
99.99% Groundwater COC Reduction; 95% Mass Reduction

Mass Removal

Date


Pounds

0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0

Mass Removal

Primary COCs removed, lbs
Cumulative Mass removed, lbs

2016 Design and Construction Issues at Hazardous Waste Sites
Case for Hydrolysis

- Stack & Electrode data indicated hydrolysis
- Extra lab subcontract needed for Ethylene glycol, glycerol
Effluent Data “Surprises”

- Stack data: chloroform, vinyl chloride and vinyl bromide
- Added permanganate zeolite to vapor treatment train
Shut-Off Criteria—
Diminishing Returns and Temperature

- **Temperature**
  (>100 degrees C from 15 to 80 ft bgs)

- Diminishing returns
Stuff Happens

Fire started at electrical splice connector in heating area
Acknowledgement

EPA Staff:
Jim Cummings (OSWER), Kira Lynch (R10),
Eva Davis (ORD)

State of CA:
Amy Terrell, Steve Ross