

Specialty Earth Sciences Project Summary :

Low Permeability Media Source Zone Treatment (Mississippi)

Site Logistics

- Client seeking remedial solution with potential for cost savings for site in Mississippi
- Difficult to remediate low permeability soils present (PCE)
- Site logistics and tenant business operations required:
  - **Rapid implementation leaving structures undisturbed**
  - **Minimized recurrent on-site events**

Site Specific Characteristics

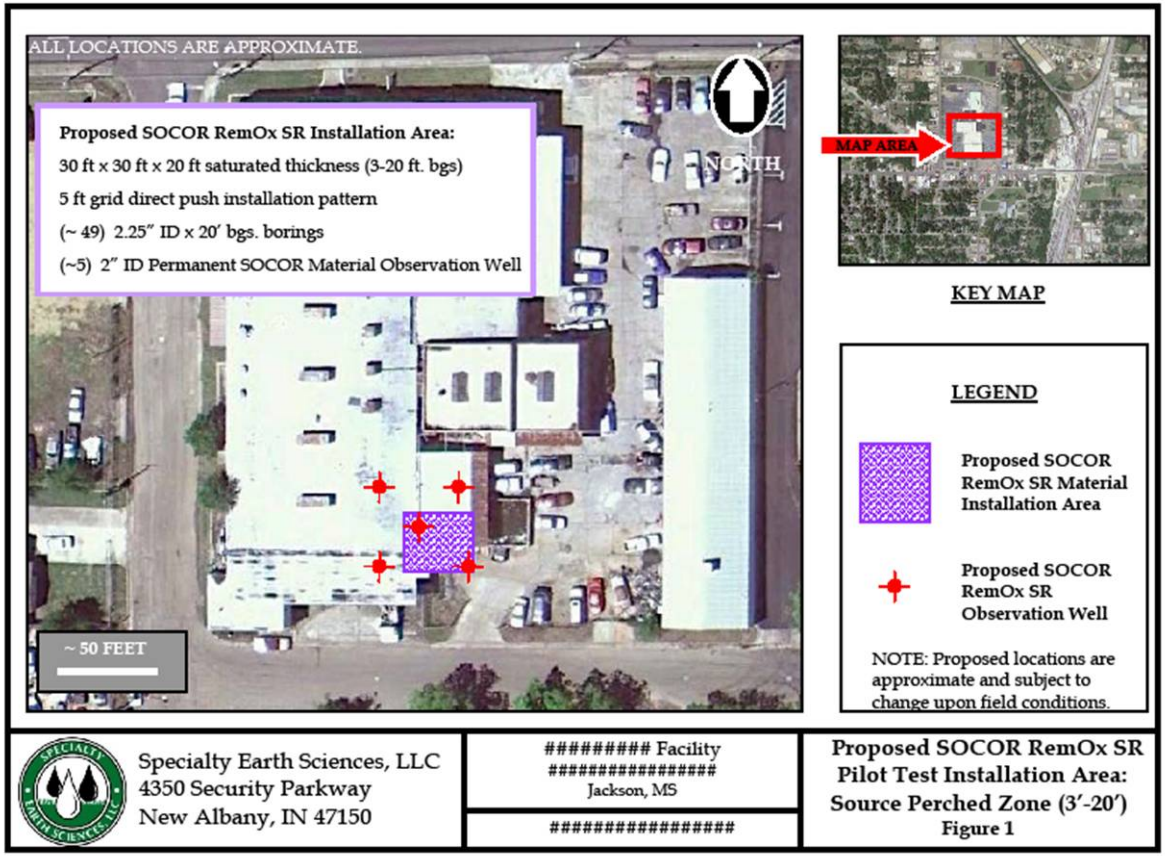
- This site had two vertical zones of PCE impact (shallow and deep zones)
- Groundwater movement in the shallow zone (0-45 bgs)
  - Mississippi blue clays 10^{-9} cm/s
- Groundwater movement in the deeper zone clayey sands (>45 bgs)
  - ranging from 10^{-3} cm/s to 10^{-4} cm/s

Shallow Zone Layout

-Shallow zone layout (3 ft. to 20 ft. below grade target interval)

-Rectangular grid DPT installations (5 ft. grid spacing)

-(2) product consumption monitoring wells, (3) performance monitoring wells



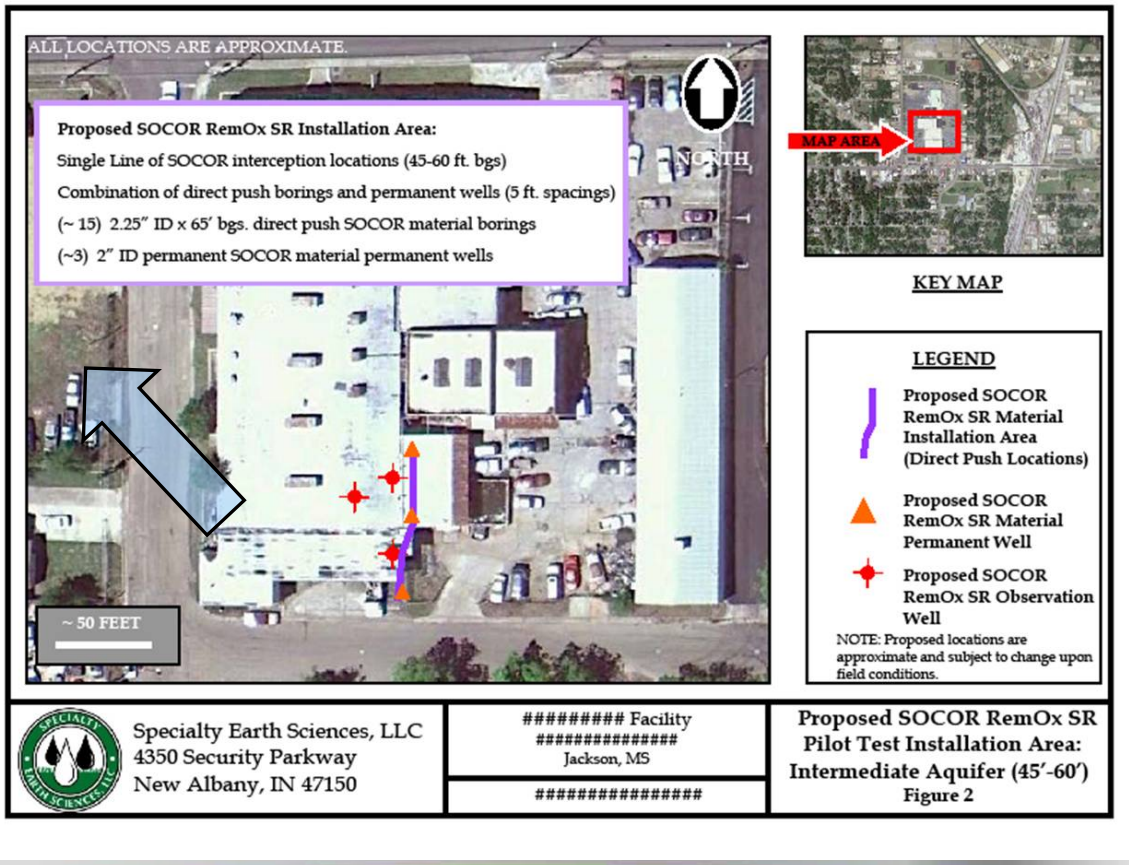
Deeper Zone Layout

-Deeper transmissive zone

-45 ft. to 60 ft. below grade target interval.

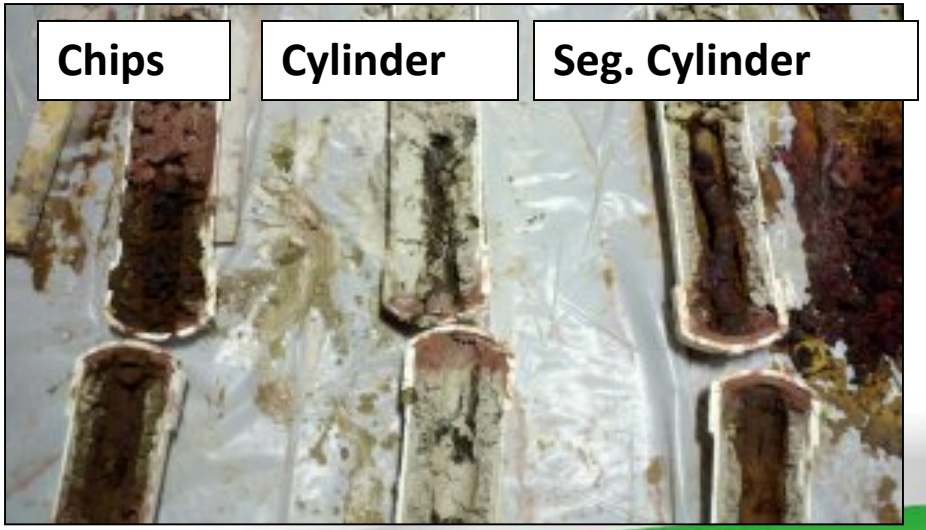
-Reactive barrier pattern direct push installations (5 ft. linear spacings)

-(3) product consumption monitoring wells
(3) performance monitoring wells.

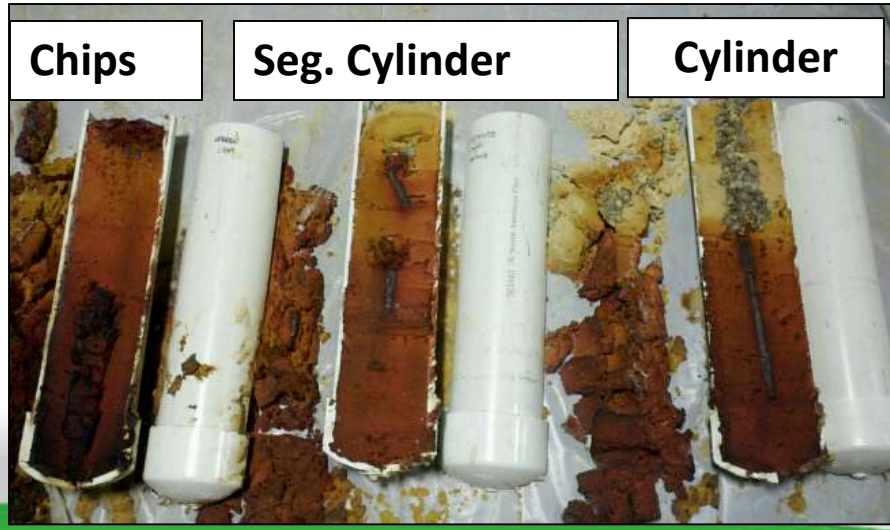


Product Selection Tailored to Site Geology

- Simulations with cylinders and chipped material in medium to fine sands and in clay
- Enhanced permanganate release in clay was seen with chipped material (better contact between SOCORE material and the borehole wall and higher release rate enhanced diffusion into LPM)



CLAYS



SANDS

SOCORE Permanganate: Cylinders and Chips

- 348 cylinders* emplaced with direct push (*approx 40% in chipped form)
- 27 cylinders installed in stainless steel candle holders







Direct Push Installation

- Direct push installation - 2.25 inch tooling and disposable tip
- Lowering cylinders within inner space of rods provides confirmation that cylinder has been placed at desired vertical depth
- Rods retracted leaving cylinders in place within the formation



1 Year Monitoring Results*

	Observation Well ID#	KMnO4 concentration	Approx. distance
Shallow Zone	OW-3	2.2 mg/L	3 ft
	OW-4	6.2 mg/L	12 ft
	OW-5	1.5 mg/L	3 ft
Deep Zone	IOW-1	1.7 mg/L	6 ft
	IOW-2	0.1 mg/L	40 ft
	IOW-3	0.9 mg/L	6 ft

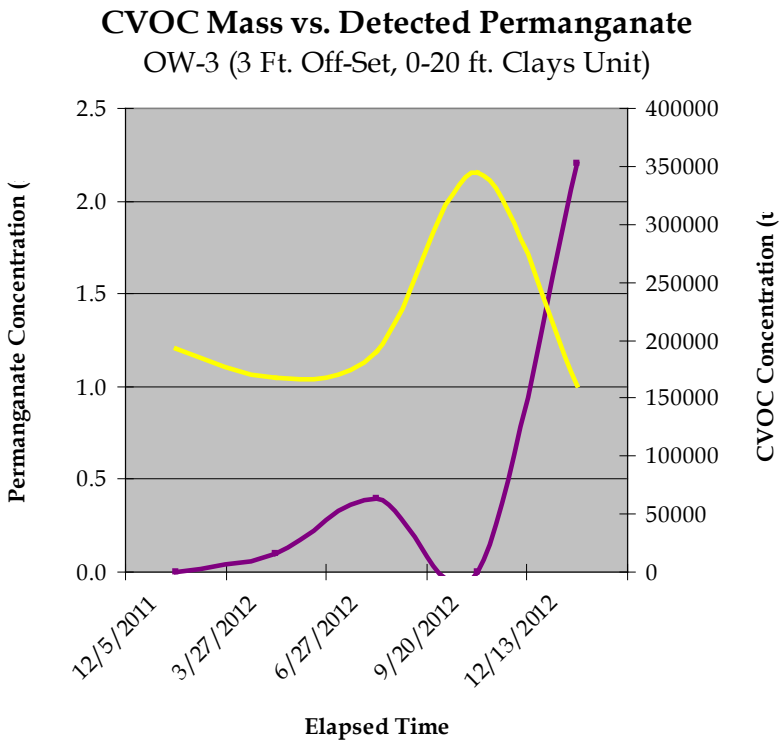
***Highest recorded concentrations to date in shallow clays**

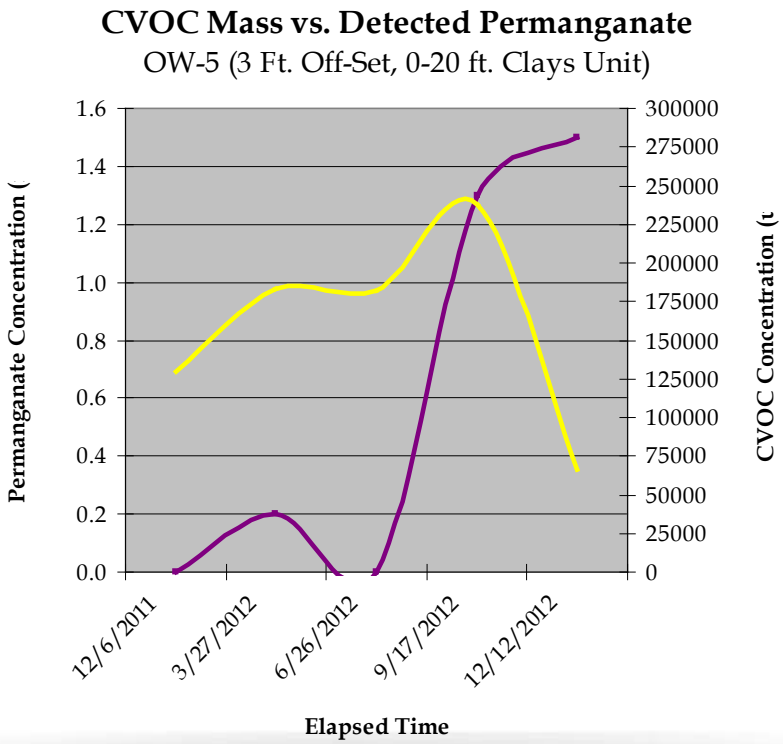
December 2012 Monitoring Results

	Observation Well ID#	Total CVOCs Reduction	Approx. distance
Shallow Zone	OW-3	53%	3 ft
	OW-4*	11%	12 ft
	OW-5	72%	3 ft
Deep Zone	IOW-1	84%	6 ft
	IOW-2	49%	40 ft
	IOW-3	77%	6 ft

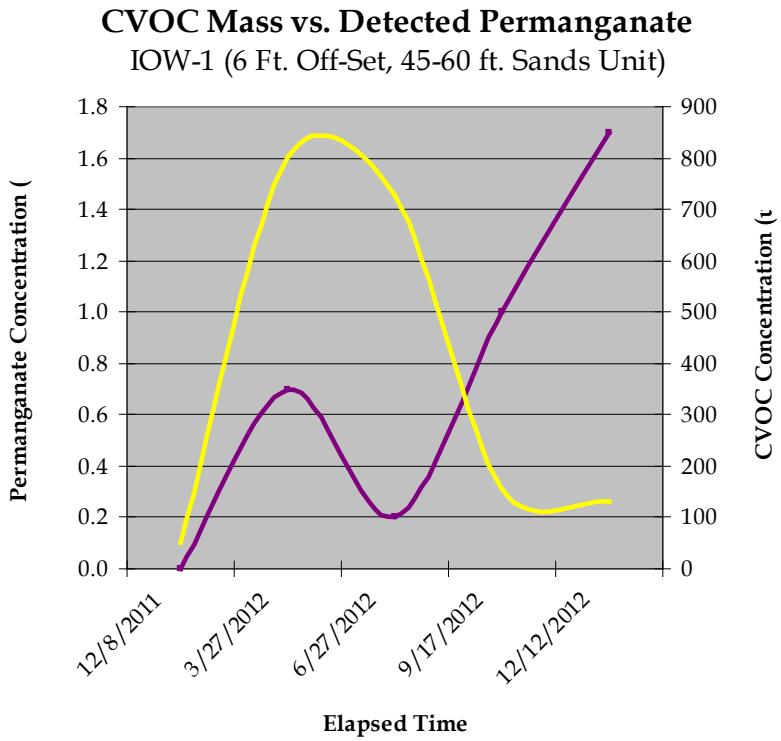
***OW- 4 is located 12-feet outside of the direct push grid.**

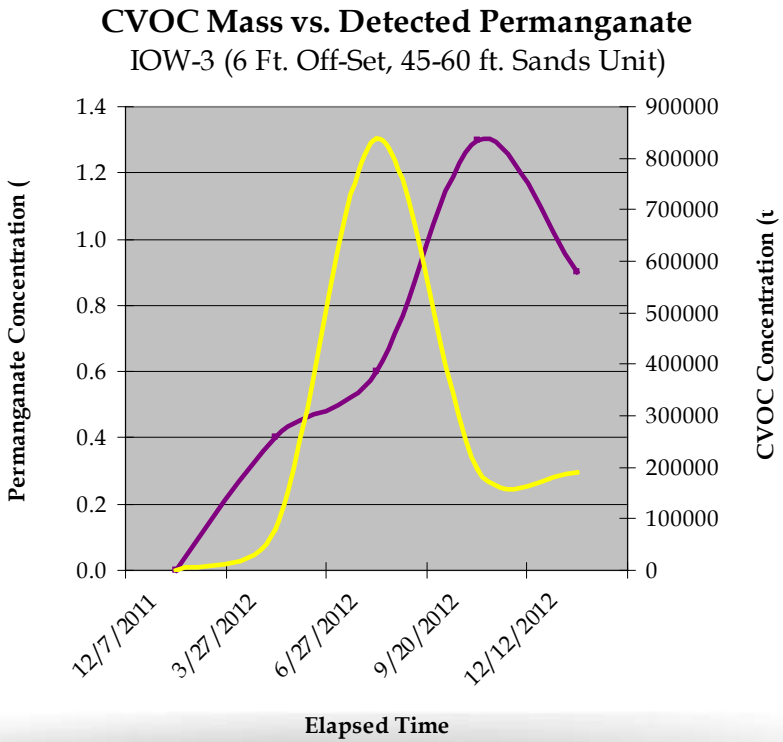
CVOCs vs. Detected Permanganate
Shallow Clays Unit (3'-20' bgs)





CVOCs vs. Detected Permanganate
Deeper Sands Unit (45'-60' bgs)





Contact Us

Specialty Earth Sciences, LLC

www.sesciences.com

812-945-0733

Jason Swearingen, Technical Director:
jswearin@sesciences.com

Lindsay Swearingen, Managing Partner:
lswearin@sesciences.com

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