



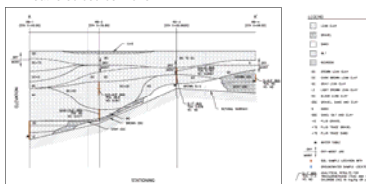
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## Site Information

- 38-acre rail car maintenance facility located near El Dorado, Kansas.
- Rail car servicing, cleaning and painting had been conducted at the Site since 1963.
- Spent car cleaning liquids were discharged to a 5-pond recirculating system equipped with an oil recovery unit. Water was discharged to "dirty pond" which was equipped with an oil recovery unit.
- The pond system was closed and decommissioned in 1987. Replaced with a pretreatment system with discharge to POTW.



- Surficial soil consist of a silt loam underlain by clay overburden, underlain by limestone and shale bedrock.
- Groundwater (8-10' bgs) occurs in the clay overburden and weathered bedrock zone.



### Key Aquifer Parameters

	Unconsolidated Overburden	Upper Bedrock
Hydraulic Conductivity	$2.9 \times 10^{-4}$ cm/sec	$2.5 \times 10^{-6}$ cm/sec
Velocity	5-20 ft/year	1-5 ft/year



### Summary of Remediation Activities

### Soil Blending

- A total of **3,246 gallons** of Anaerobic Biochem (ABC<sup>®</sup>) and **104,105 pounds** of zero-valent iron (ZVI) were introduced via soil blending
- Each blending cell was approximately 20 feet by 20 feet
  - Subdivided into 6-foot vertical lifts



### Direct Injections

- A total of **24,280 pounds** of ABC®+ were injected through **147 Geoprobe®** soil boring injection points.
- 12 of the borings were located west (upgradient) of the blending area due to concerns of blending near subsurface utilities and rail spur adjacent to the excavation
- 135 of borings were located downgradient of the former pond source area to help address the groundwater contaminant plume.



## Results

- Post-remedy performance monitoring was initiated November 2015 on a semi-annual basis.
- Temporal trends for VOCs and geochemical parameters in the blend and direct injection treatment areas indicate greater than (>) 85% to >99% VOC decreases comparing 2017 data to pre-remedy concentrations.
- Ethene concentrations have increased by up to two orders of magnitude, chloride has increased up to 180%, and oxidation-reduction potential (ORP) has decreased by over 300%.

### Blend Source

[illegible]

### Direct Injection

[illegible]

### Leading Edge of the Plume

[illegible]

## Conclusions

- Full-scale implementation of the ISCR soil blending and injection remedy has significantly reduced parent COC concentrations.
  - *Blend Source (W-12):* 80% decrease in 1,1-DCE
  - 99.9% decrease in 1,1,2-TCA
  - *Direction Injection (W-3):* 99.9% decrease in 1,1-DCE
  - 99.9% decrease in 1,1,2-TCA
- Concentrations of daughter products in select wells have indicated temporary increases followed by decreasing concentration trends.
  - *Blend Source (W-12):* 240% increase in VC
  - *Direction Injection (W-3):* +19,000% increase in VC (11/2015) followed by a +18,000% decrease in VC (04/2017)
- Low ORP values in select wells indicating the aquifer has remained anaerobic (reducing) and ISCR treatment of COC is occurring.
  - *Blend Source (W-12):* -448 mV (04/2017)
  - *Direction Injection (W-3):* -150 mV (04/2017)

## Future Steps

- Continue performance groundwater monitoring on a semi-annual basis
- Environmental Use Control (EUC) and Risk Management Proposal (Off-Site Risk Management) for groundwater use restriction.