

# A Biobarrier Case Study Using A Non-Emulsified Vegetable Oil

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## Presentation Overview

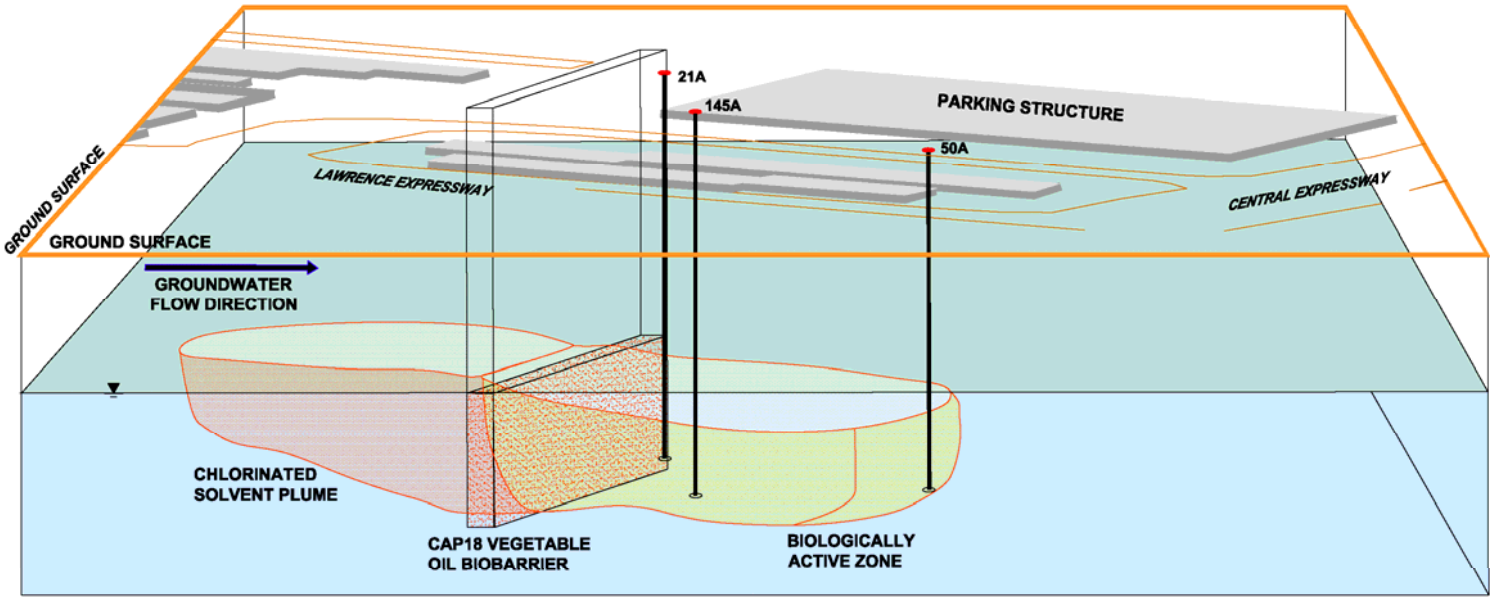
- Large-scale pilot test of vegetable oil biobarrier in Santa Clara, California
- Case Study Details
  - Vegetable oil reagent and application
  - Monitoring results over 20 months since application



- Location: Santa Clara, California
- Contaminants: Chlorinated ethenes (primarily TCE and cis-1,2-DCE)
- Concentration Range: 300 to 900 µg/L
- Geology: Sandy Aquifer
- History: Several years of "Pump and Treat" with diminishing returns

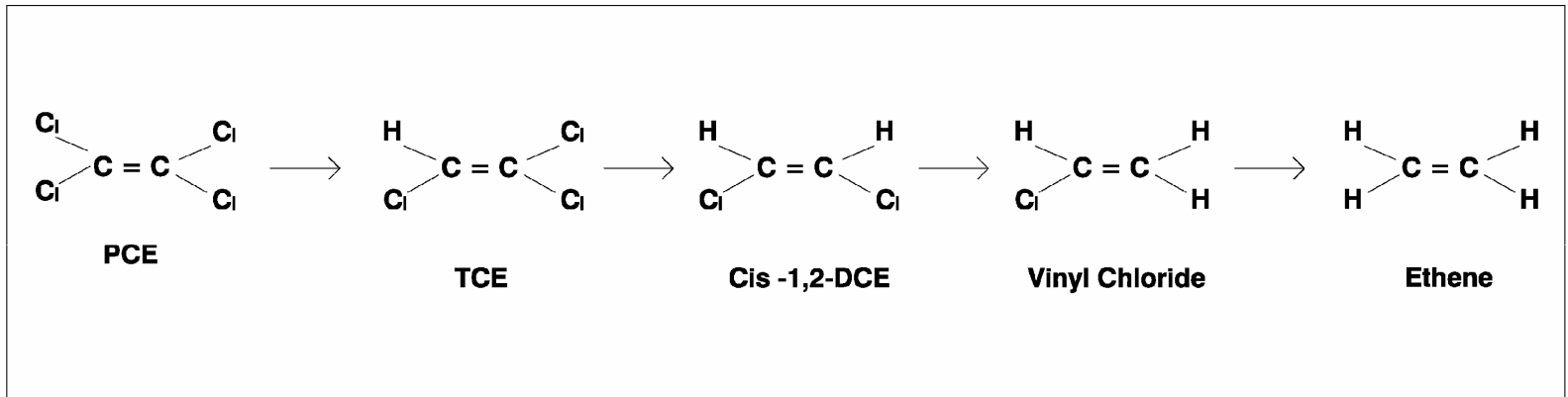
# National Semiconductor Site

## Site Map



# Reductive Dechlorination

## Degradation Pathway

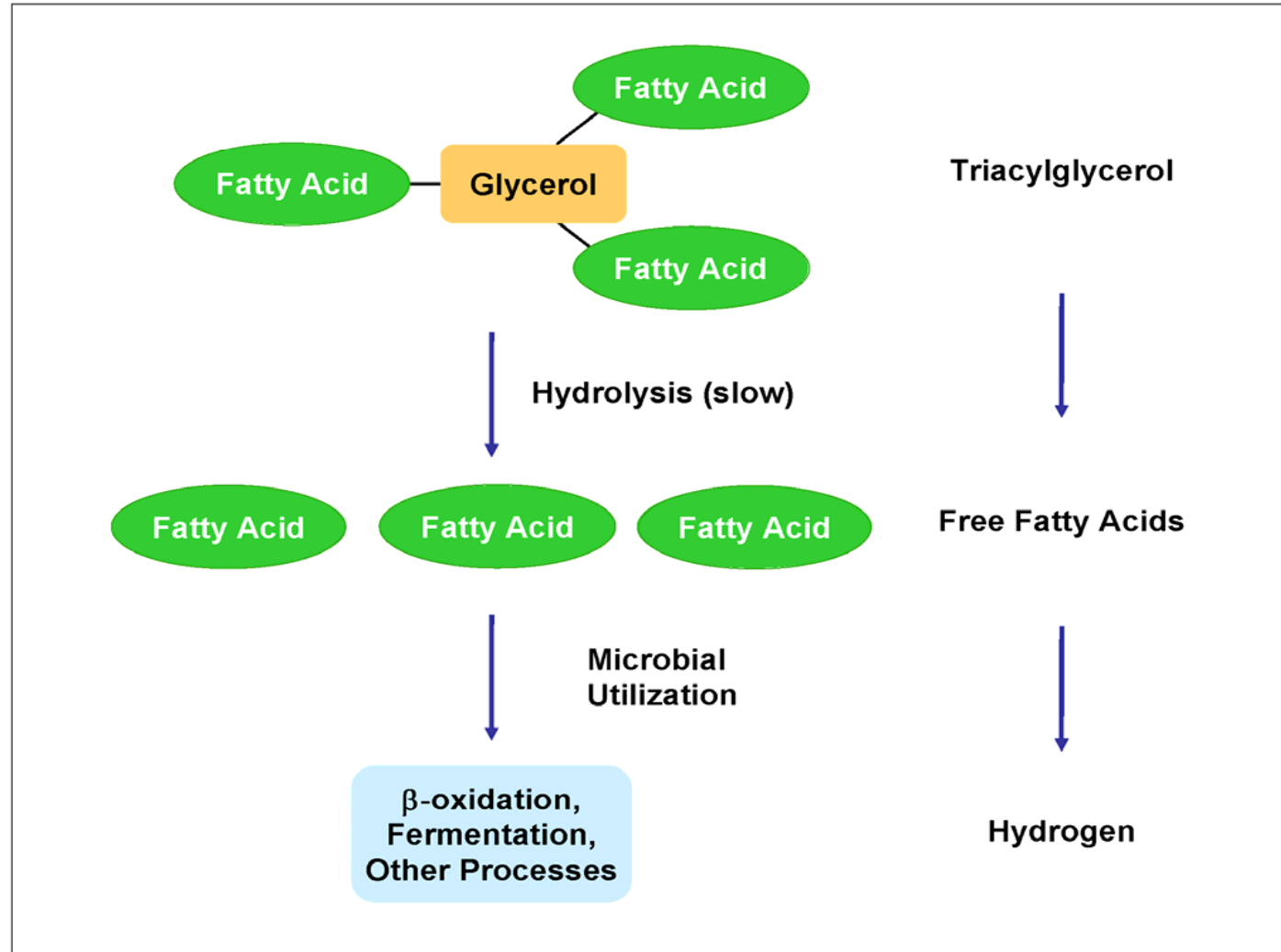


- 16s RNA indicated presence of DHC prior to active remediation

- Cap18<sup>®</sup> selected based on:
  - Longevity in subsurface
  - Ease of injection
  - Low-cost donor
- Non-emulsified soybean oil
- High Concentration of 18-Carbon Chains
- Provided by DBI Remediation Products (now Carus Corporation)

# Vegetable Oil Reagent

CAP18<sup>®</sup> to H<sub>2</sub> Breakdown



- Length: 450 feet, perpendicular to groundwater flow
- Injections placed on 5-foot centers
- Vertical Interval: 15 to 25 feet bgs
- Total CAP18<sup>®</sup> Vegetable Oil: 30,000 pounds
- Materials and Installation Cost: Approximately \$80,000

# Biobarrier Installation

Photos



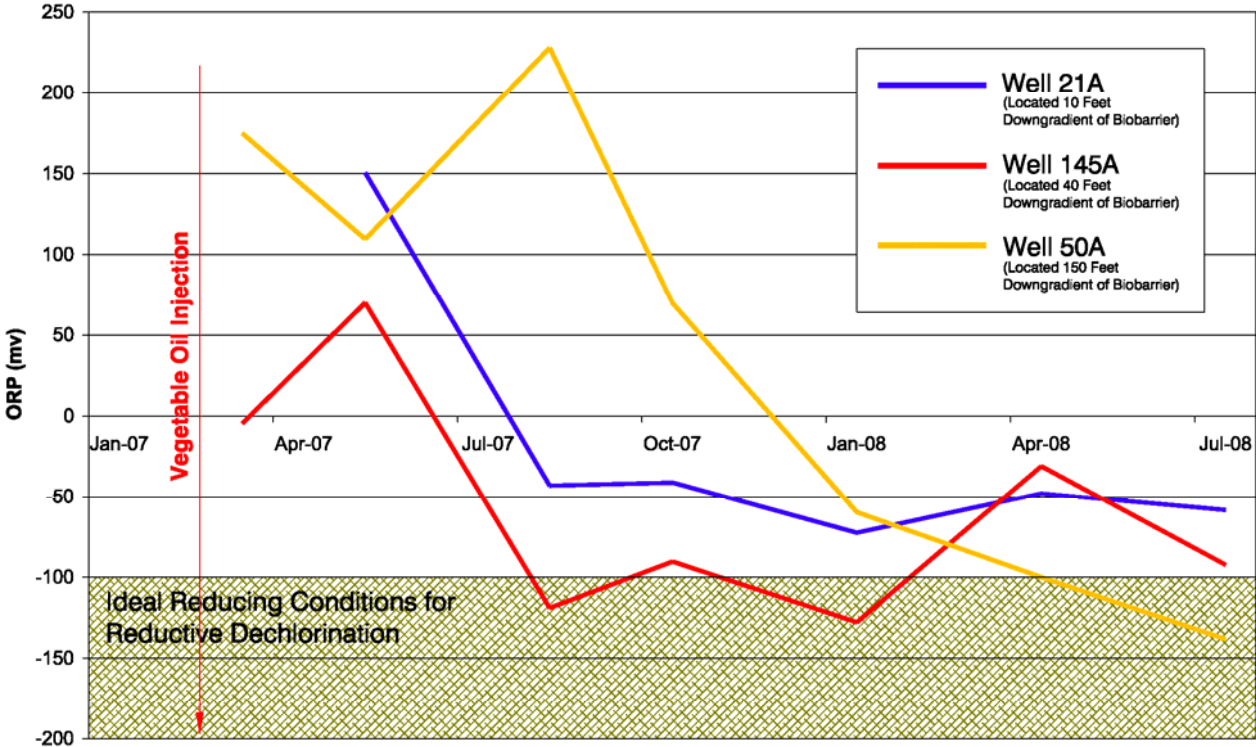
# Biobarrier Installation

Photos



# Monitoring Results

## Effect on ORP

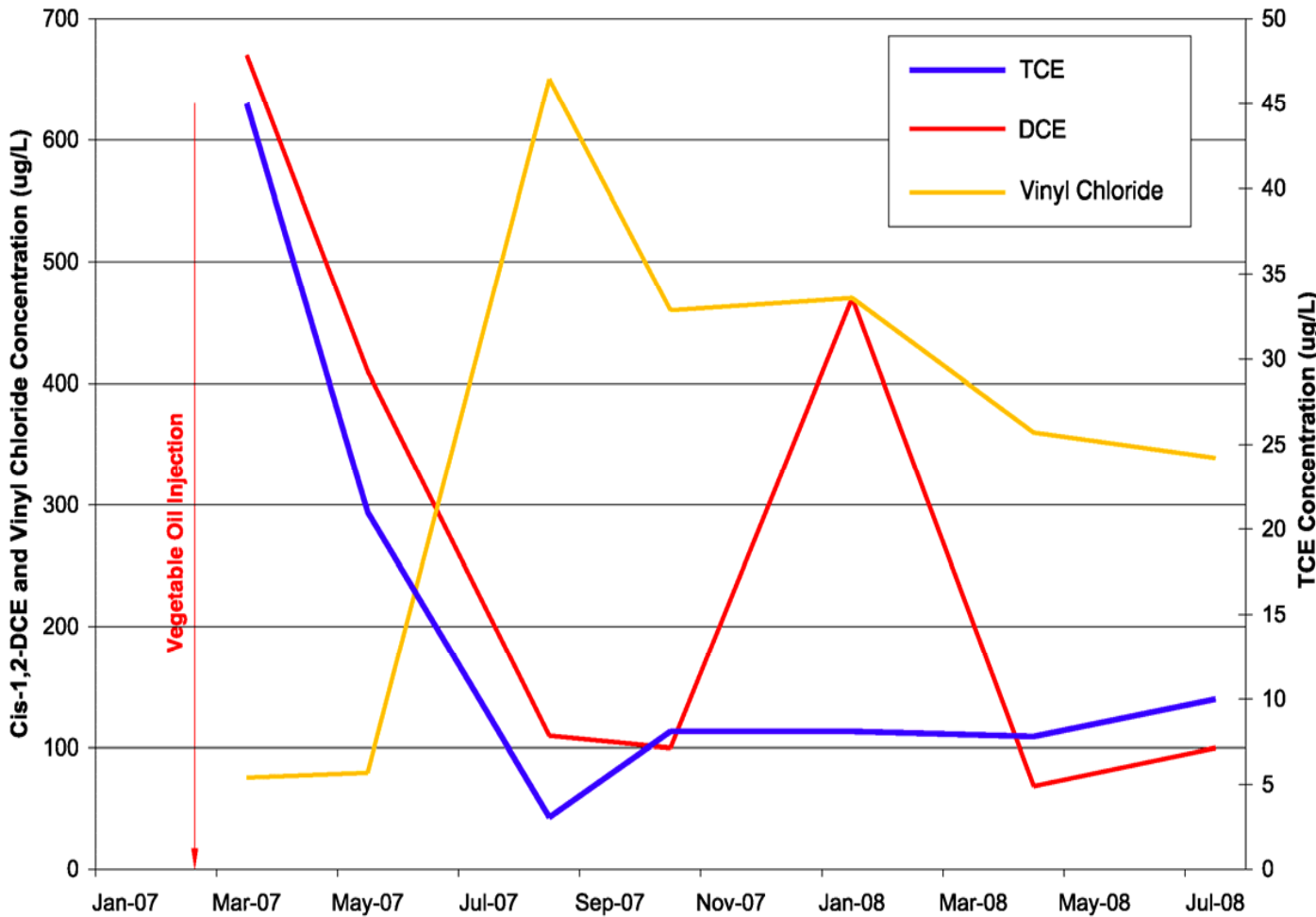


### Electron Acceptors

- Oxygen: Decrease to ~0.5 mg/L
- Nitrate: ND
- Iron (II): Increasing, indicating conversion of Iron (III) to Iron (II)
- Sulfate: Decreasing, from 130 mg/L to 90 mg/L range

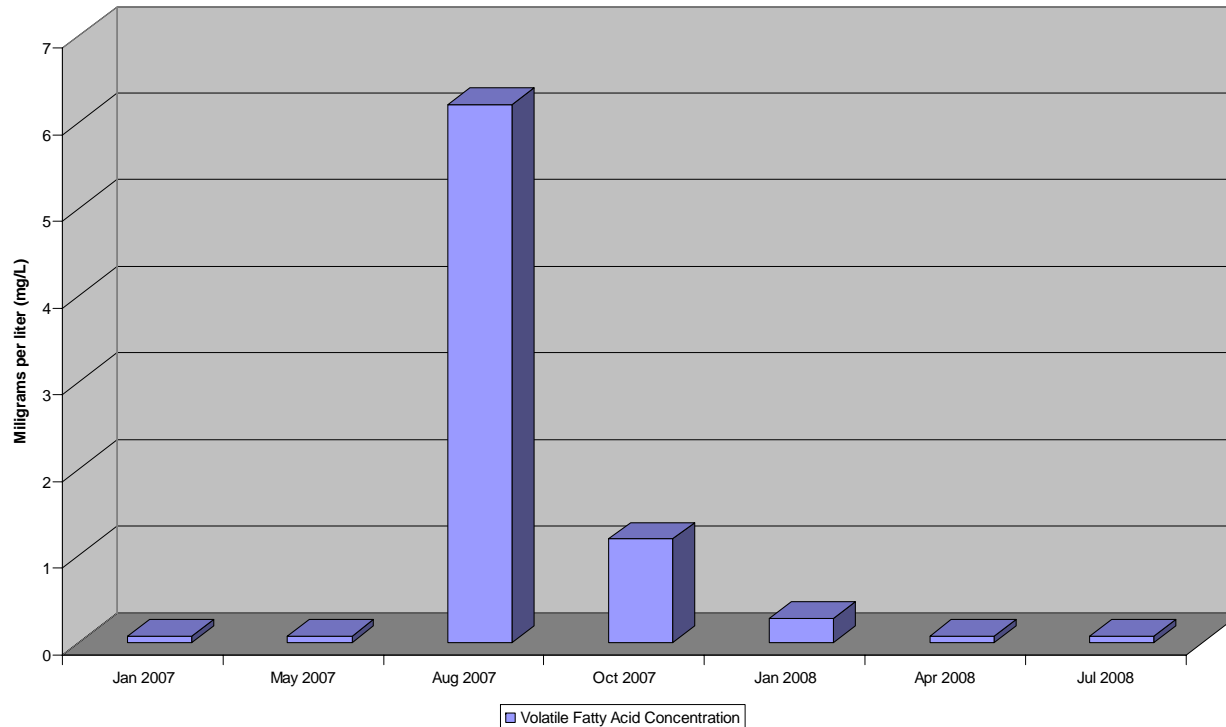
# Monitoring Results

VOCS



# Monitoring Results

VFAS



- Volatile fatty acids detected
  - Spiked 6 months following injections
  - Decreased as microbial mass grew to consume fatty acids

- Creation of optimal reducing conditions up to 150 feet downgradient
- Reductive dechlorination pathway to ethene is active
- Future monitoring will determine whether vinyl chloride completely degrades
- Oil remains active 20 months after injection
- Successful technology demonstration

# Acknowledgements

Co-Authors

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Questions?

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