

Pilot Scale Remediation of Dissolved
Vinyl Chloride Plume Using *In Situ*
Chemical Oxidation
IR Site 5 – NAS North Island

**U.S. EPA TECHNICAL SUPPORT PROJECT
SEMI-ANNUAL MEETING**

Richard Wong & Mark Bonsavage

San Diego, California

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Roadmap of This Presentation

- **Background**
- **In Situ Chemical Oxidation Using Fenton's Reaction**
 - What, How, and Why
 - In Situ Chemical Oxidation Vendors
- **Pilot Scale Remediation at IR Site 5**
 - Operation and Results
- **Conclusions**
- **Points of Contact**



NAS North Island

IR Site 5



Background

- **Former Hazardous Waste Pits (1940s to 1965)**

- **Site Geology and Hydrogeology**

- Spanish Bight Embayment (dredged fill)

1. Hydraulic Fill - Fine to medium sand and silty sand
2. Bayfloor Sediments - Soft, finer-grained sediments – approx. 10 ft bgs defines the bottom of the contaminated aquifer
3. Bay Point Formation – Poorly consolidated sand unit that constitutes formational material that outcrops at NASNI

- Shallow groundwater (5 ft. bgs)

- **MNA is working via reductive dechlorination**

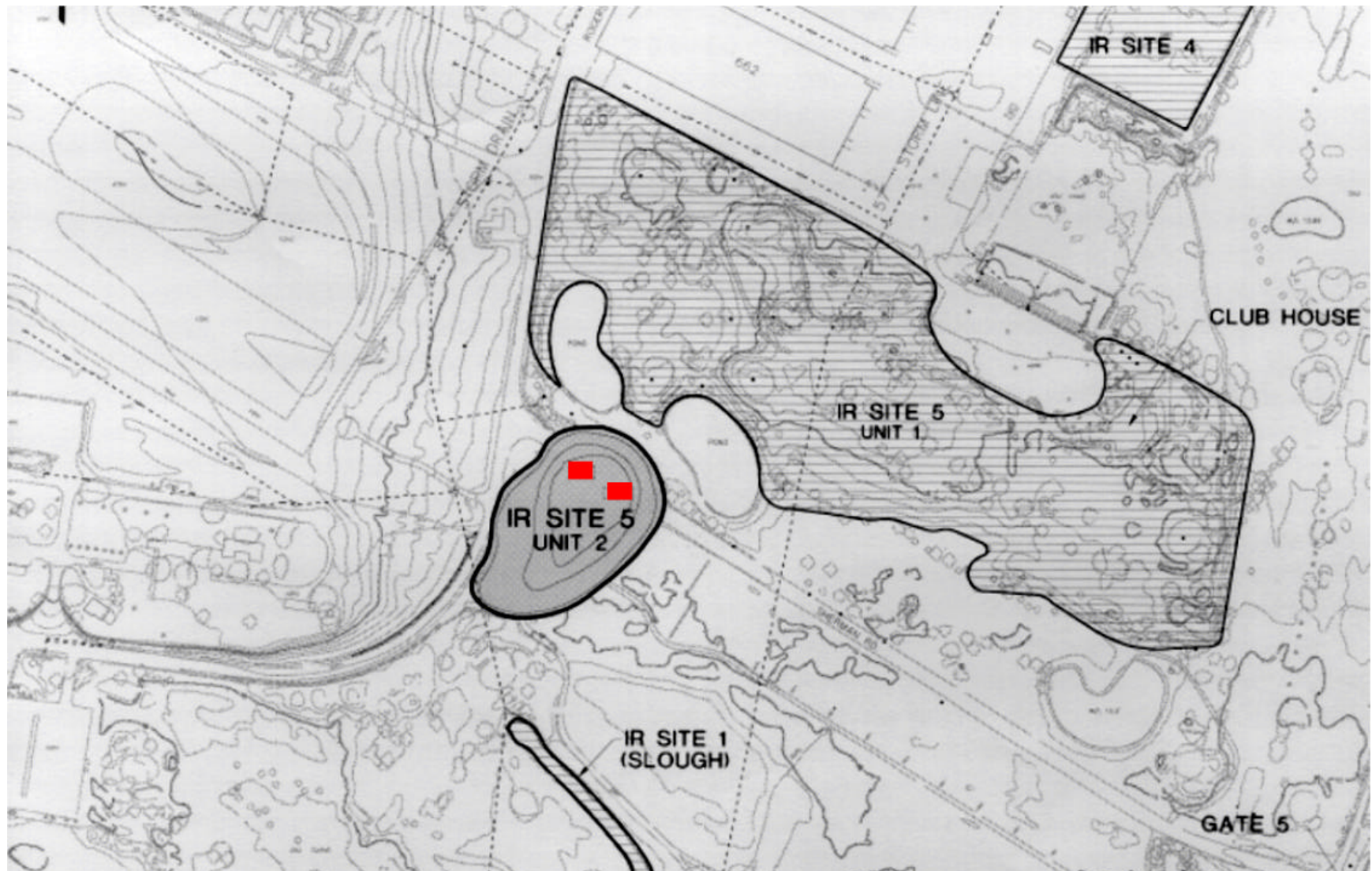
- VOC plume may reach slough

- **TCRA objective**

- Reduce the mass of VOCs in the soil and groundwater

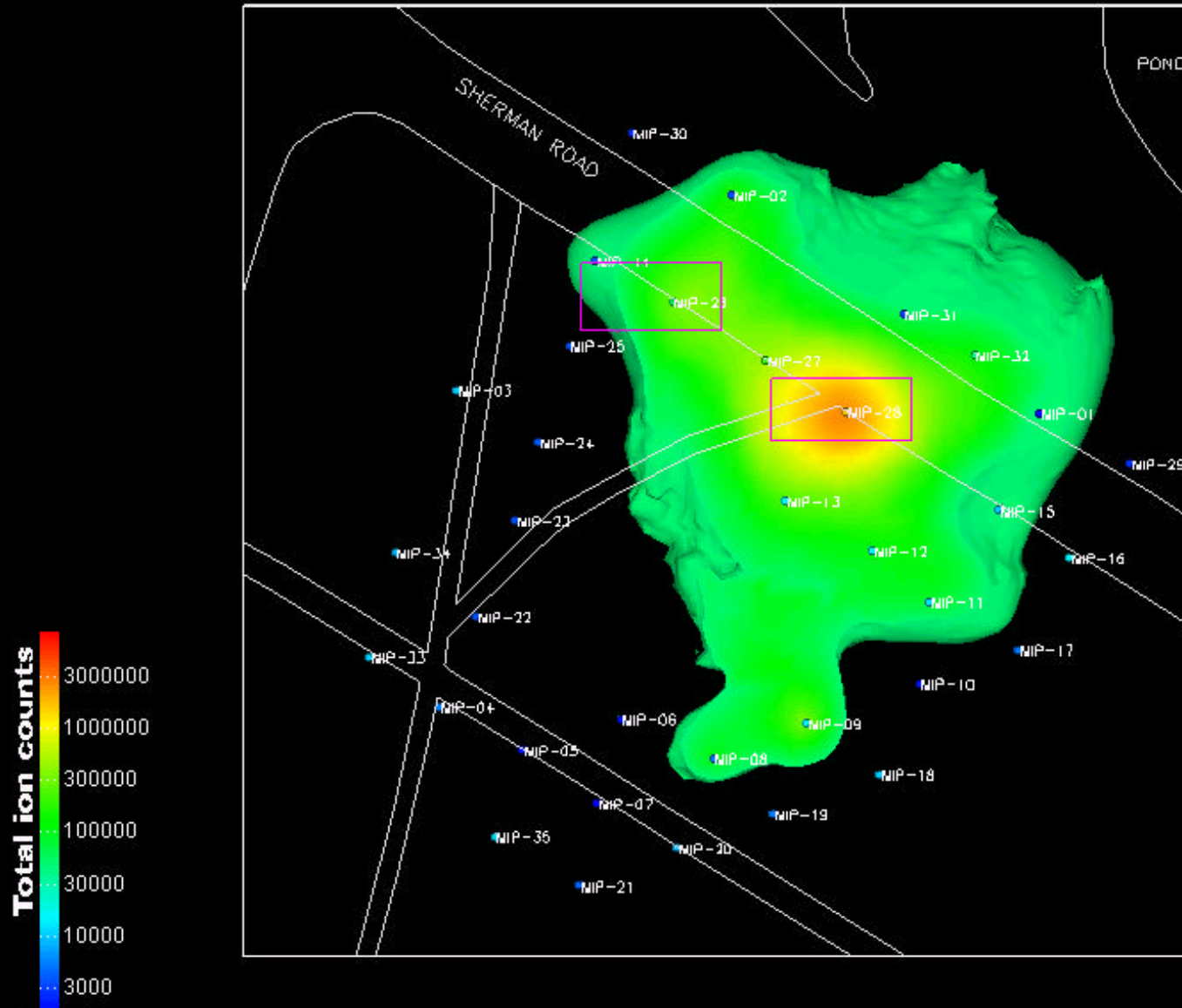


IR Site 5 VOC Groundwater Plume



SCAPS MIP Assessment of VOC Impacted Soil & GW

Total ion counts exceeding 50000



TIC_01

In Situ Oxidation Using Fenton's Reagent

Fenton's Reagent: Iron + Hydrogen Peroxide

- Powerful oxidation technology used by the waste water industry to treat organic wastes
- $\text{H}_2\text{O}_2 + \text{Fe}^{+2} \rightarrow \text{Fe}^{+3} + \text{OH}^- + \text{OH}\cdot$
- Produces hydroxyl radicals ($\text{OH}\cdot$)
- Typically requires acidified pH (acid injection)
- Exothermic (heat producing) reaction



Why *In-situ* Chemical Oxidation?

- **Powerful In-situ technology**
 - Complete of contaminants to CO₂ and H₂O
- **Cost Effective**
- **Rapid Treatment**
 - Weeks to Months
- **Eliminates Waste Generation and Transportation**
- **Minimal Site Disruption**

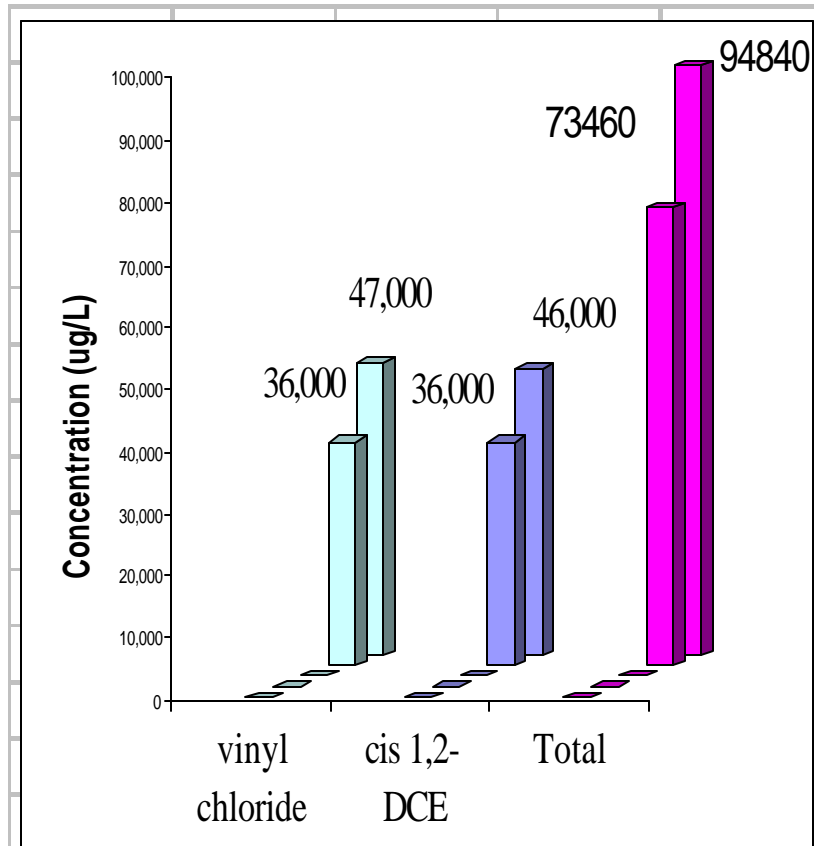


Fenton's Reagent Vendors

- Each has a unique delivery/injection scheme
 - Patented processes
- Vendors include:
 - Clean OX, ManTech Environmental Corp.
 - ISOTEC
 - Geo Cleanse
 - On-Contact, EBS



Bench Test

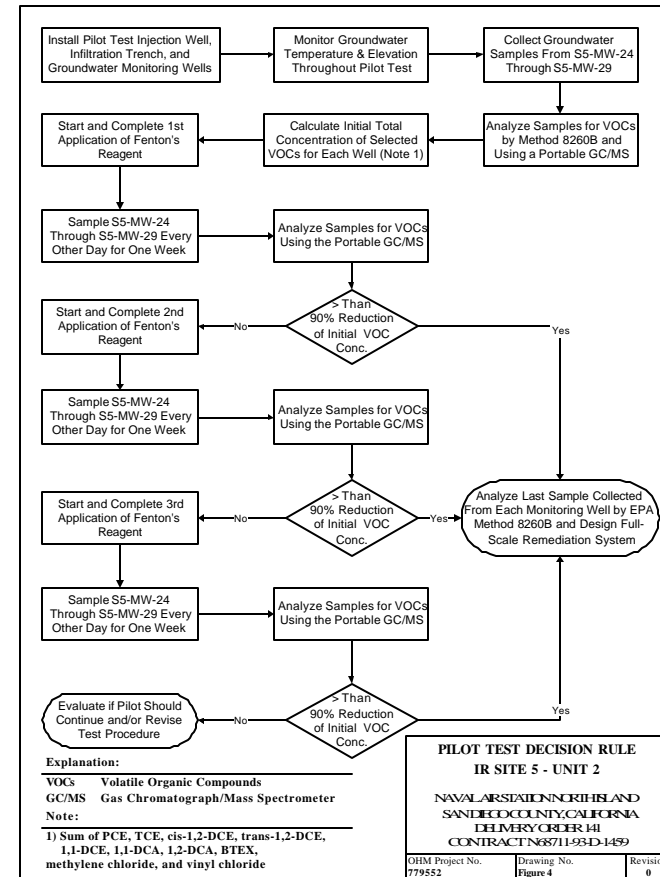


- Utilized soil and groundwater samples collected at the site
- Three tests performed
- Achieved 99.99% to 100% concentration reduction of the target VOCs
- Test results confirm *in-situ* chemical oxidation is a viable technology

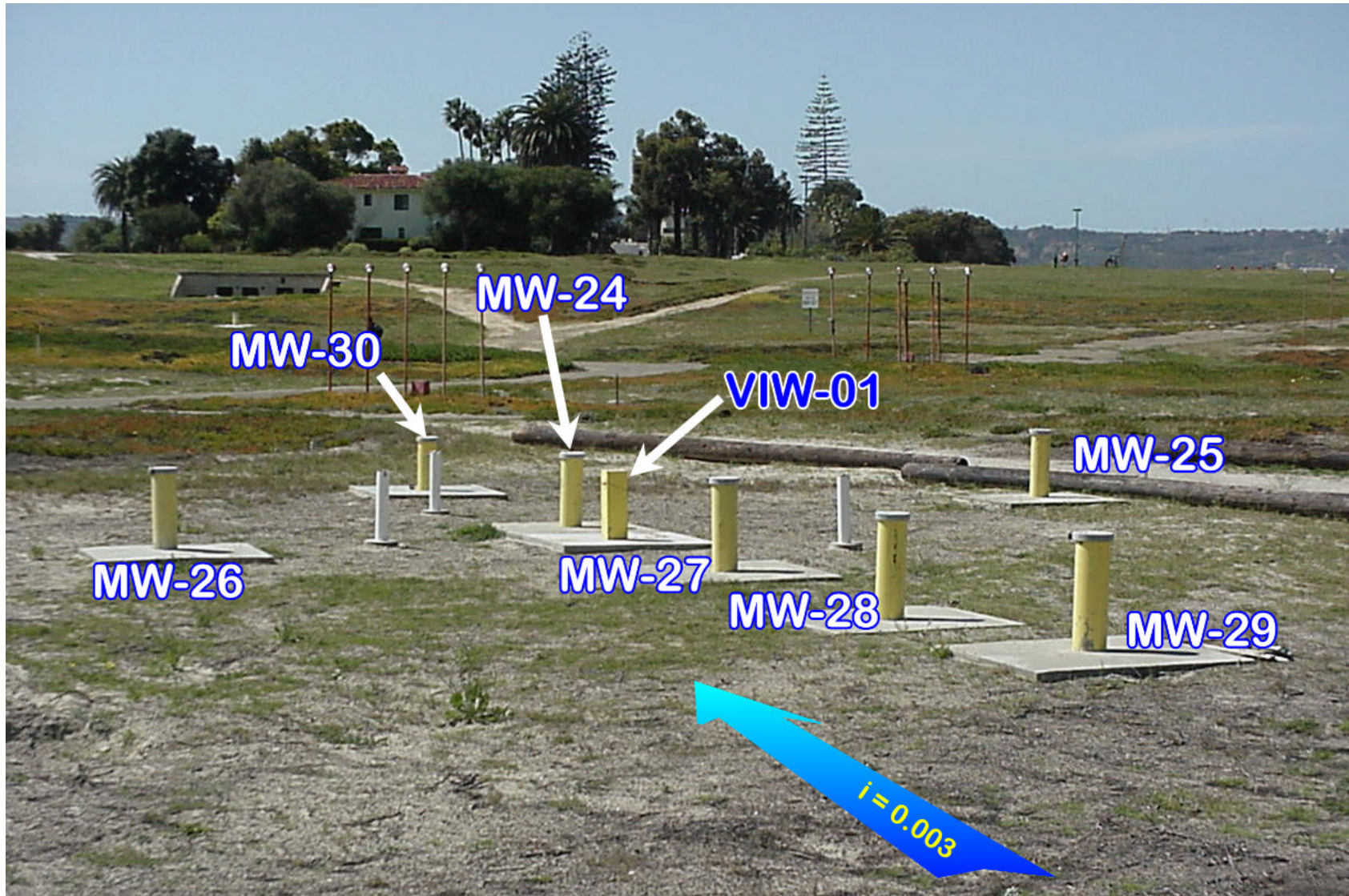


Pilot Test Objectives

- Confirm that *in situ* chemical oxidation is capable of achieving the cleanup objectives
- Develop full-scale design parameters (rate of contaminant reduction, well spacing)
- Develop preliminary operational parameters (chemical concentrations and injection rates)
- Exit Strategy



Pilot Test Well Array



Injection Well



Injection Wellhead



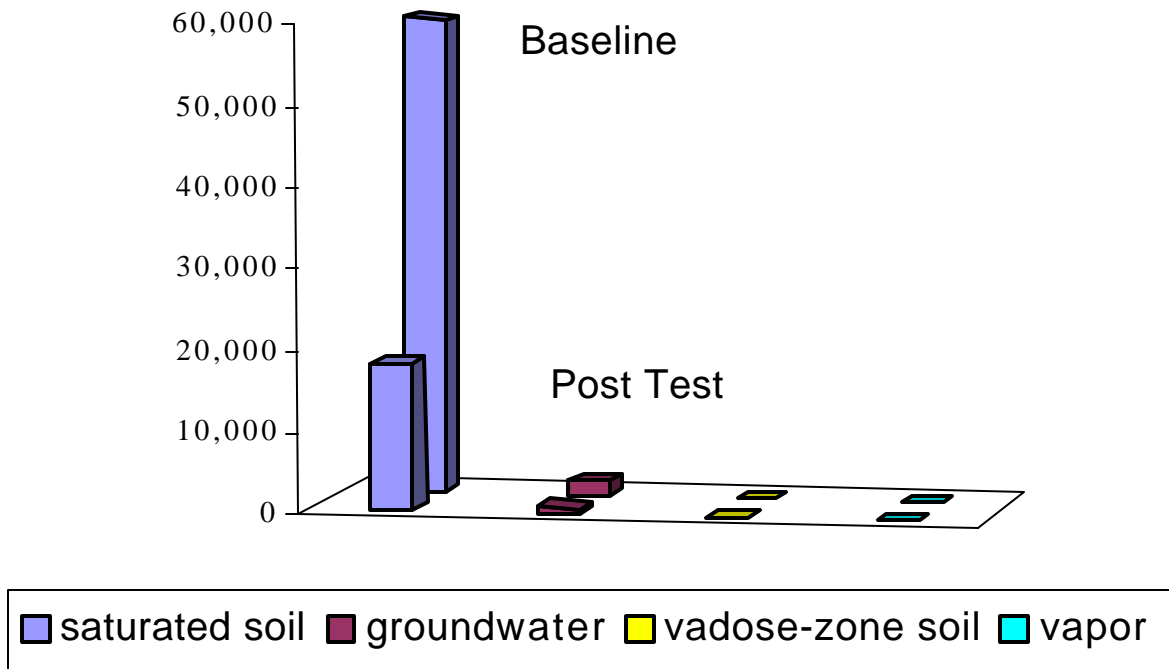
Test Results — Summary

- **Effect of injection seen at full 30-ft radius in monitoring and sampling data**
- **VOC GW concentrations reduced by ~ 50% to ~ 90%**
- **VOC mass reduction of ~ 50% throughout 25-ft treatment radius**
 - ~ 70% mass reduction in saturated soil
- **Viable technology for full scale source removal treatment**



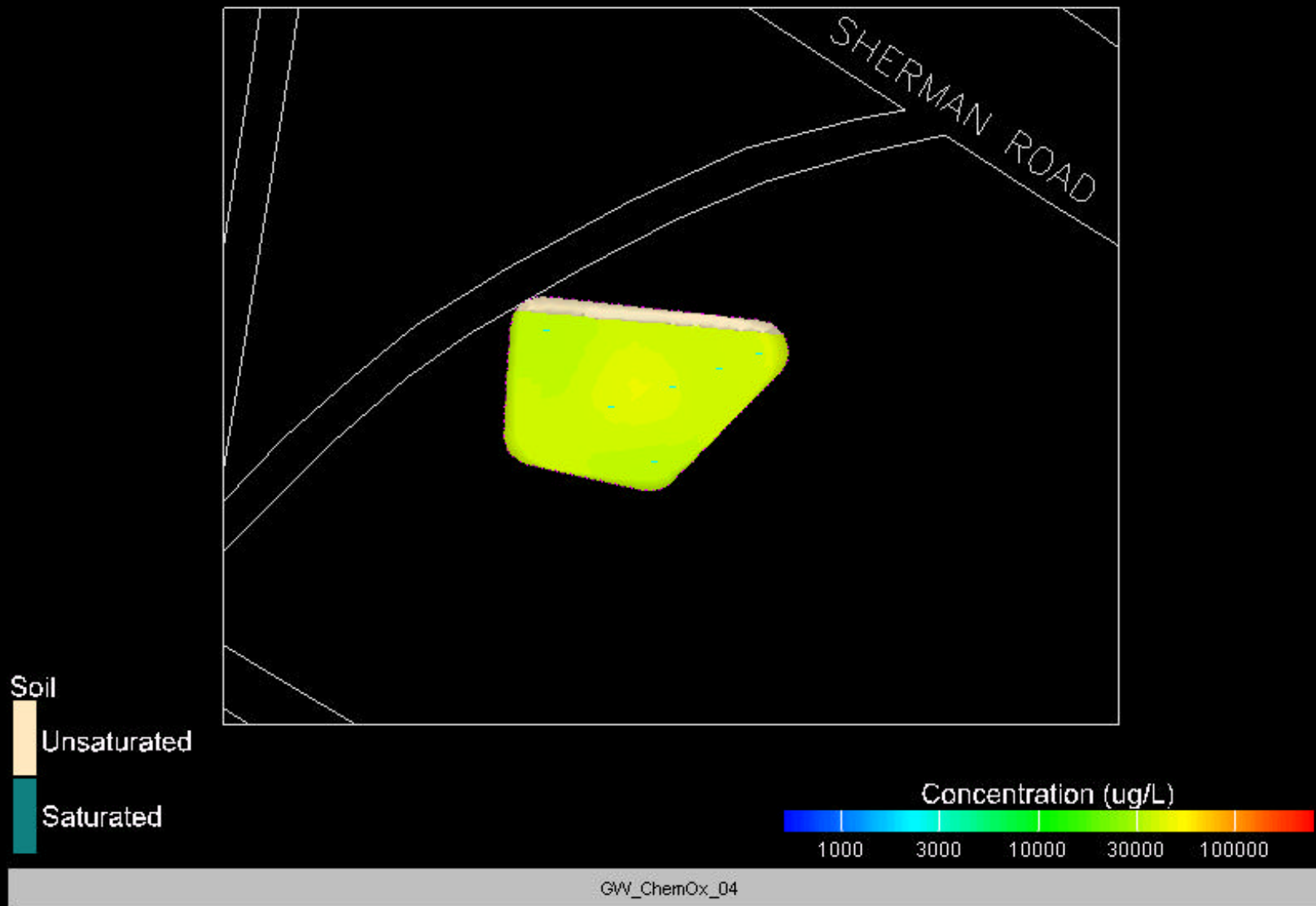
Mass Reduction by Phase

Mass Reduction in Grams VOCs



Pilot Test Groundwater Results

Total VOCs in Groundwater
Concentration exceeding 500 ug/L
Baseline



Summary Pilot Test

- **Mass reduction**
- **Technology effective for source removal**
 - May not be applicable to obtain water quality objectives
- **Evidence of Fenton's type reaction noted**
 - Contaminant reduction not due dilution and mass transfer
- **Aquifers were not adversely affected**
- **Reduced soil contamination at and below the water table**



Current Status & Future Plans

- **Regulatory review process**
- **Initiate full-scale remediation in Summer 2001**



Contacts for More Information

- **Mark Bonsavage, SWDIV Remedial Project Manager**
bonsavagemj@efdsw.navfac.navy.mil
ph: 619-556-7315
- **Bill Collins, SWDIV Remedial Project Manager**
collinswe@efdsw.navfac.navy.mil
ph: 619-556-9901
- **Rich Wong, IT Project Manager**
rwong@theitgroup.com
ph: 619-437-6326 x 314
- **Merry Coons, IT Project Manager**
macoons@theitgroup.com
ph: 619-437-6326 x 318

