



U.S. DEPARTMENT OF
ENERGY

Savannah River Site

A Presentation to the
Facilities Disposition and Site Remediation Committee
Savannah River Site
Citizens Advisory Board

M-Area Chemical Oxidation (MACO) Demonstration Project

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Purpose

- **To provide the Facilities Disposition and Site Remediation Committee a description and preliminary results of the M-Area Chemical Oxidation Project**
- **This is an ARRA funded demonstration - through the first Quarter of Fiscal Year 2010, \$750,000 has been spent (includes site preparation through deployment and initial monitoring)**





Acronyms

- **ARRA** American Recovery and Reinvestment Act
- **BU** Upper Screen Zone for demonstration wells
- **BL** Lower Screen Zone for demonstration wells
- **HAZMAT** Hazardous materials
- **IDW** Investigation Derived Waste
- **ISCO** In-Situ Chemical Oxidation
- **LLC** Limited Liability Corporation
- **MACO** M-Area Chemical Oxidation
- **mg/L** Milligrams per liter
- **msl** Mean sea level
- **NaOH** Sodium hydroxide
- **Na₂S₂O₈** Sodium persulfate
- **PCE** Tetrachloroethylene
- **RCRA** Resource Conservation and Recovery Act
- **SREL** Savannah River Ecology Lab
- **SRS** Savannah River Site
- **SRSOC** Savannah River Site Operations Center
- **TCE** Trichloroethylene
- **ug/L** Micrograms per liter



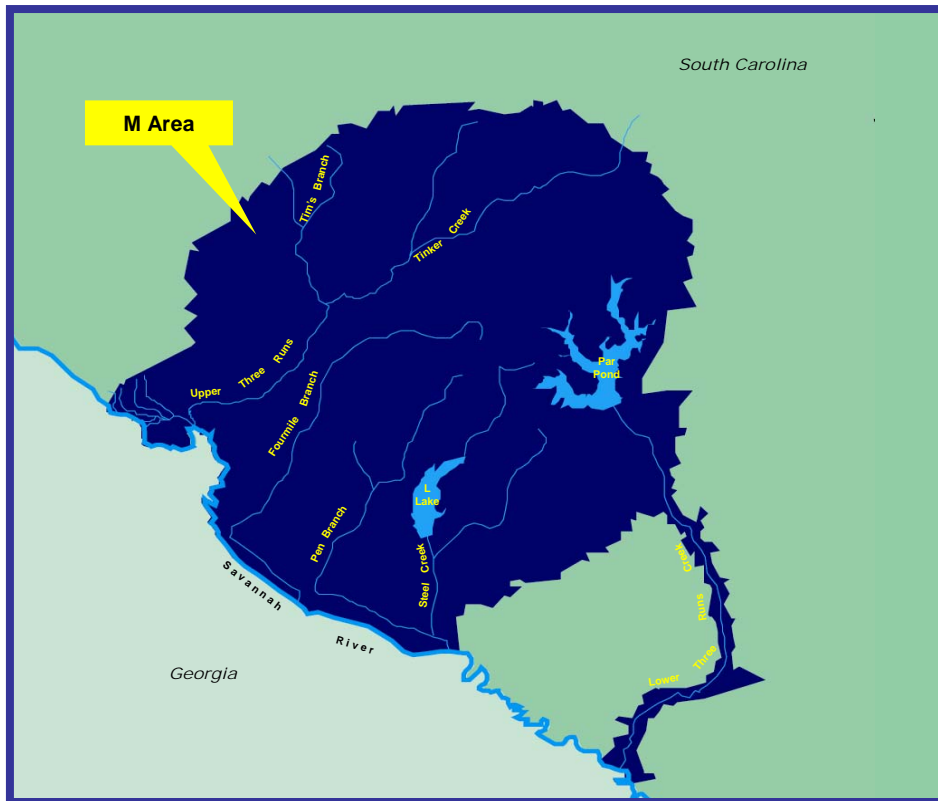


MACO Demo Project

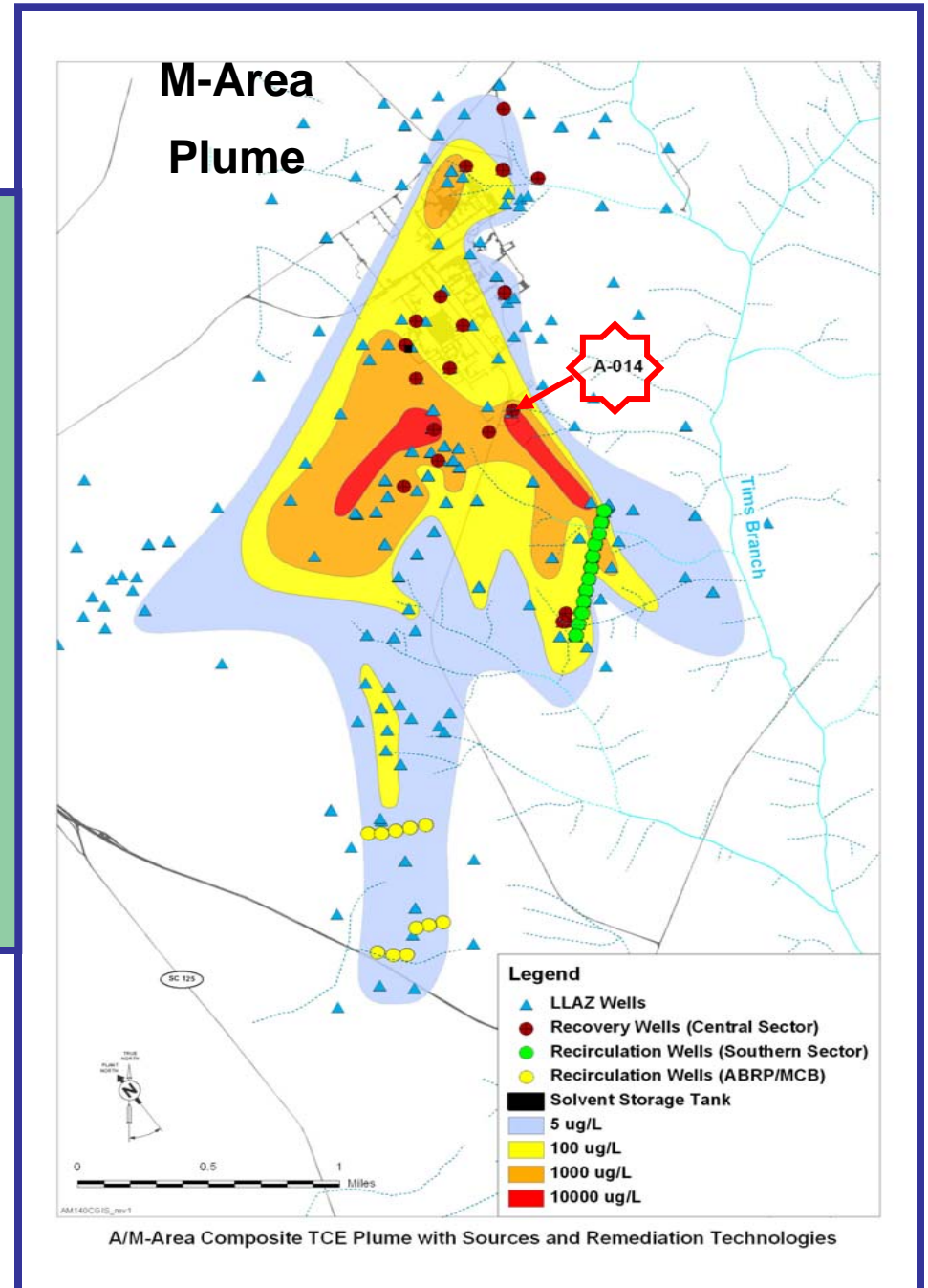
- **M-Area Groundwater Operable Unit Resource Conservation and Recovery Act (RCRA) Source Area**
- **Demonstration of In-situ Chemical Oxidation Technology**
- **Catalyzed sodium persulfate – chemical oxidant**
 - Known for its effectiveness for dissolved phase solvents such as Tetrachloroethylene (PCE) and Trichloroethylene (TCE)
 - The oxidant provides electrons to convert toxic solvents into non-toxic compounds (i.e., carbon dioxide, hydrogen chloride, etc.)



MACO Demo Project

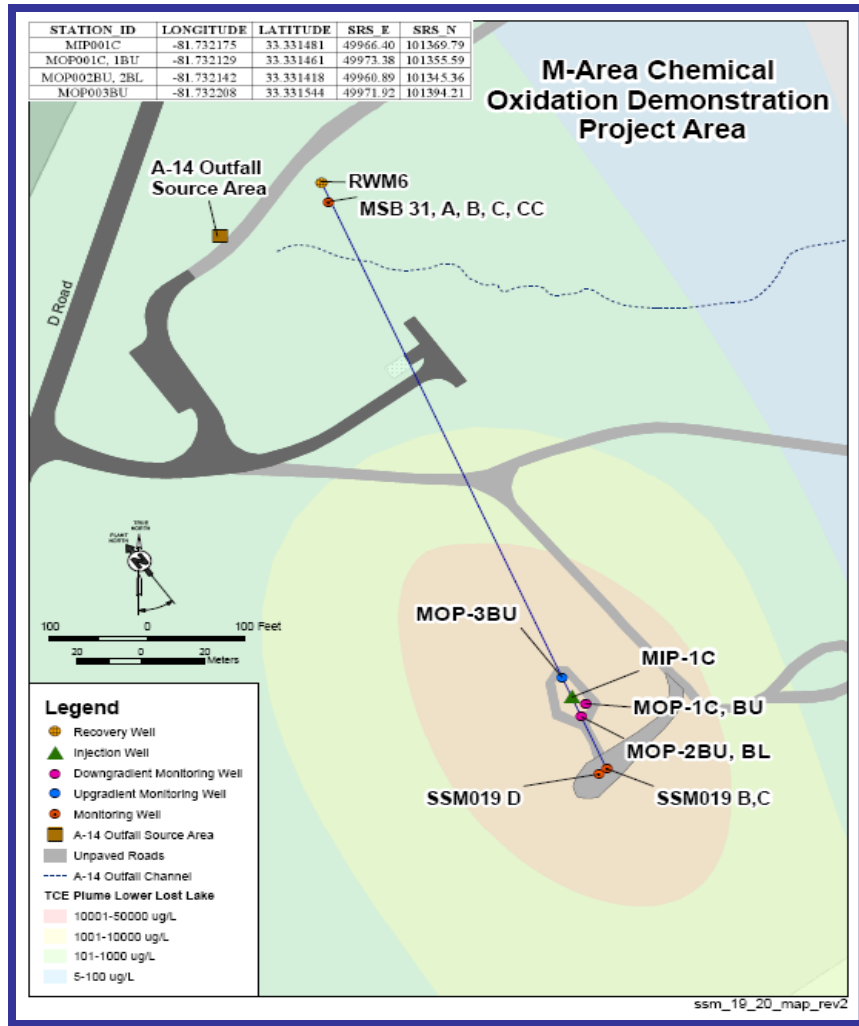


Site Location



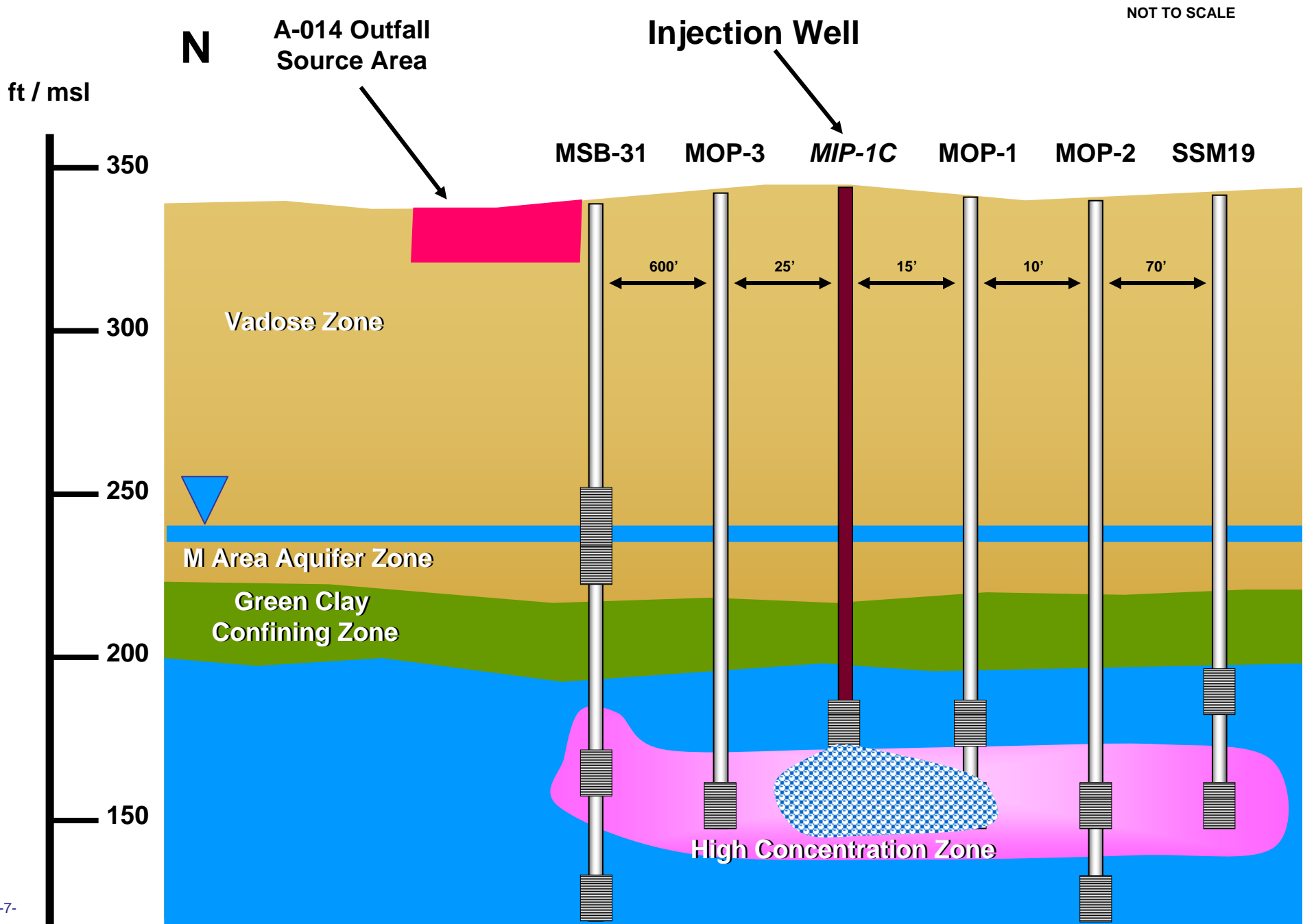


MACO Demo Project



- **Project Site**
- **M-Area PCE / TCE contamination plume**
- **Southeast of A-14 Outfall Source Area**







MACO Demo Project

- **Installation of three monitoring wells and one injection well**
- **Contract between Savannah River Ecology Lab (SREL) and Redox-Tech, LLC**
- **Redox-Tech, LLC - vendor selected based on previous expertise and experience**
 - **In-Situ Chemical Oxidation (ISCO) a primary scope of services offered by vendor**
 - **Catalyzed sodium persulfate – many successful deployments of this ISCO technique in the commercial arena**
 - **Offices in Cary, North Carolina and Aiken, South Carolina**

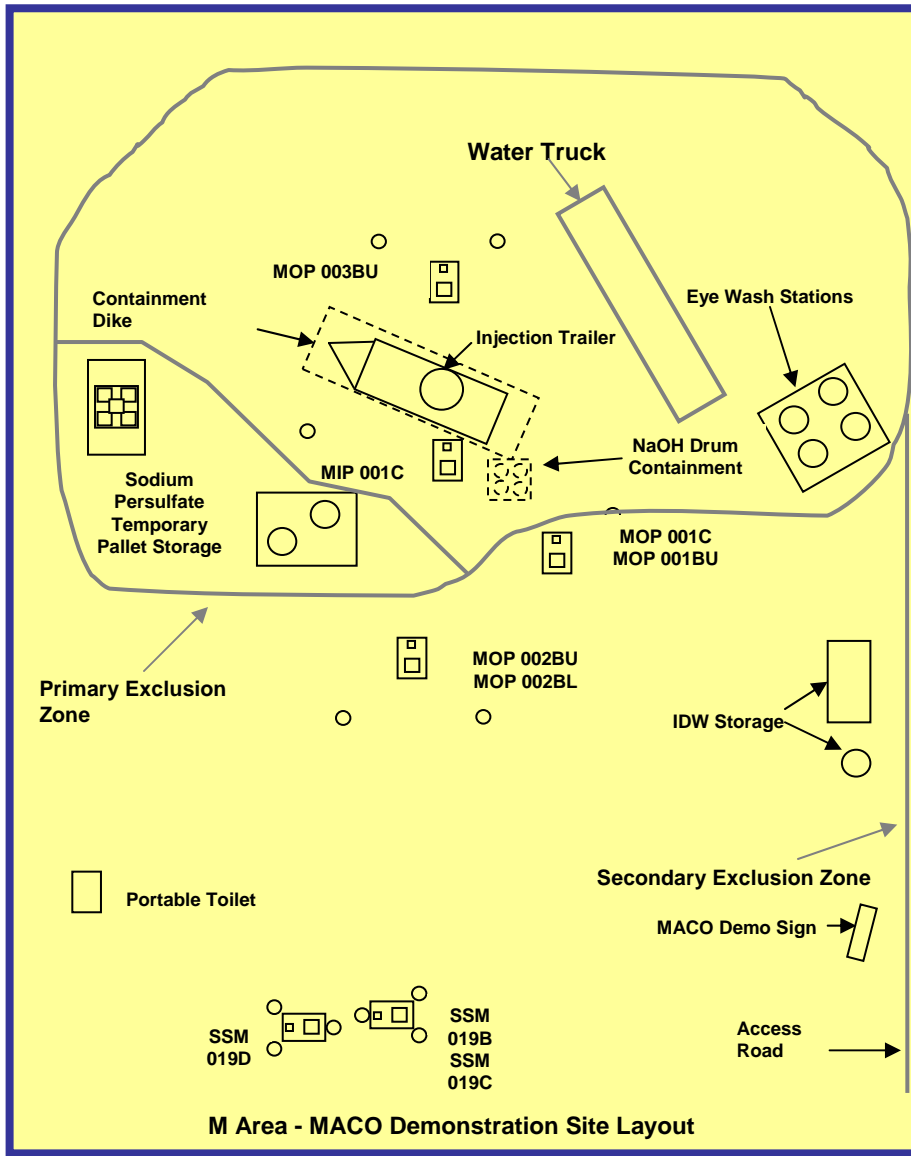




MACO Demo Project

- **Injected 4,800 gallons of catalyzed sodium persulfate solution into the subsurface**
- **Batch injections**
 - **Approximately 450 gallons of water**
 - **990 pounds of sodium persulfate ($\text{Na}_2\text{S}_2\text{O}_8$ - a solid)**
 - **Approximately 20 gallons of 25 percent sodium hydroxide (NaOH) solution-catalyst**
- **Average injection rate = 3 gallons per minute**





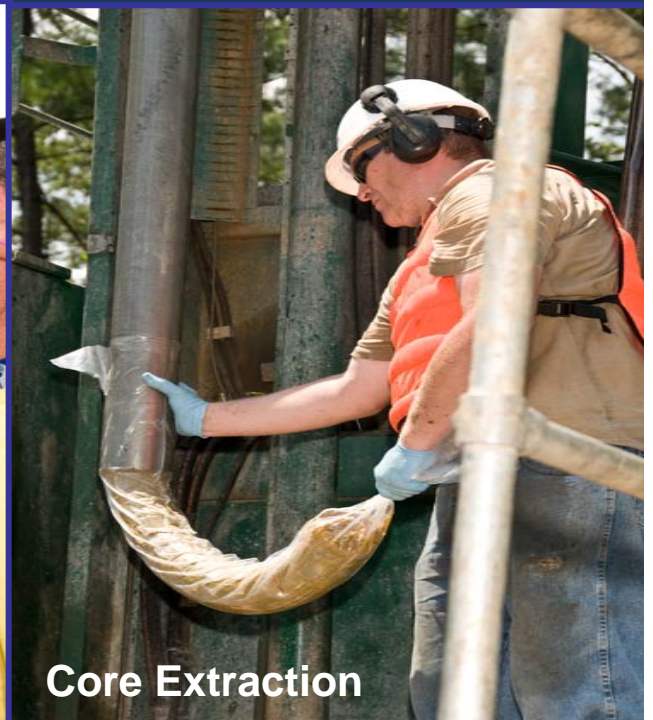
- **Site layout sketch**

- Injection Well
- Monitoring Wells
- Chemical Storage
- Injection Trailer
- Eye Wash Station
- Investigation Derived Waste (IDW) Storage
- Exclusion Zones





Core Sampling



Core Extraction



Well Drilling



Core Logging



Overall Site Layout





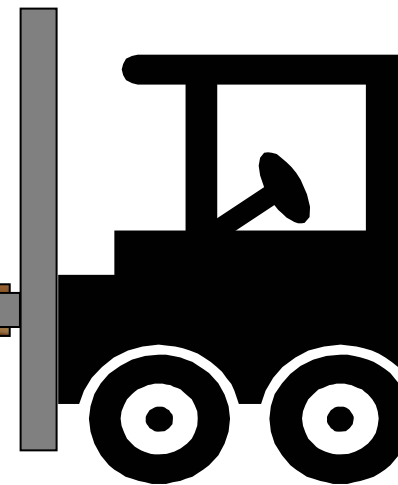
Water Truck and Injection Trailer / Crew



550-Gallon Mixing Tank



MACO Demo Project



Fork Lift assisted addition of solid sodium persulfate to mixing tank





Injection Well Head Fitting





MACO Demo Project

- **Safety precautions**
 - Containment structure (dike) with 2,300 gallons of capacity
 - Multiple Eye-Wash Stations with face dousers
 - Maintenance assistance with make-up water, fork-lift operations, air compressor, and chemical delivery to site
 - Hydrostatic pressure test of injection rig
 - In-service leak test with clean water
- **Spill protection and mitigation**
 - Containment structure
 - Drum containment – lockable clam shell
 - Spill kit (absorbent booms, pillows, and granular absorbent-compatible)
 - ER-ERP-001 – Emergency Procedures (Spill Response)
 - Prior notification of Hazardous Materials Spill Response Team (HAZMAT) and Savannah River Site Operations Center (SRSOC)
 - Freeze protection for pumps

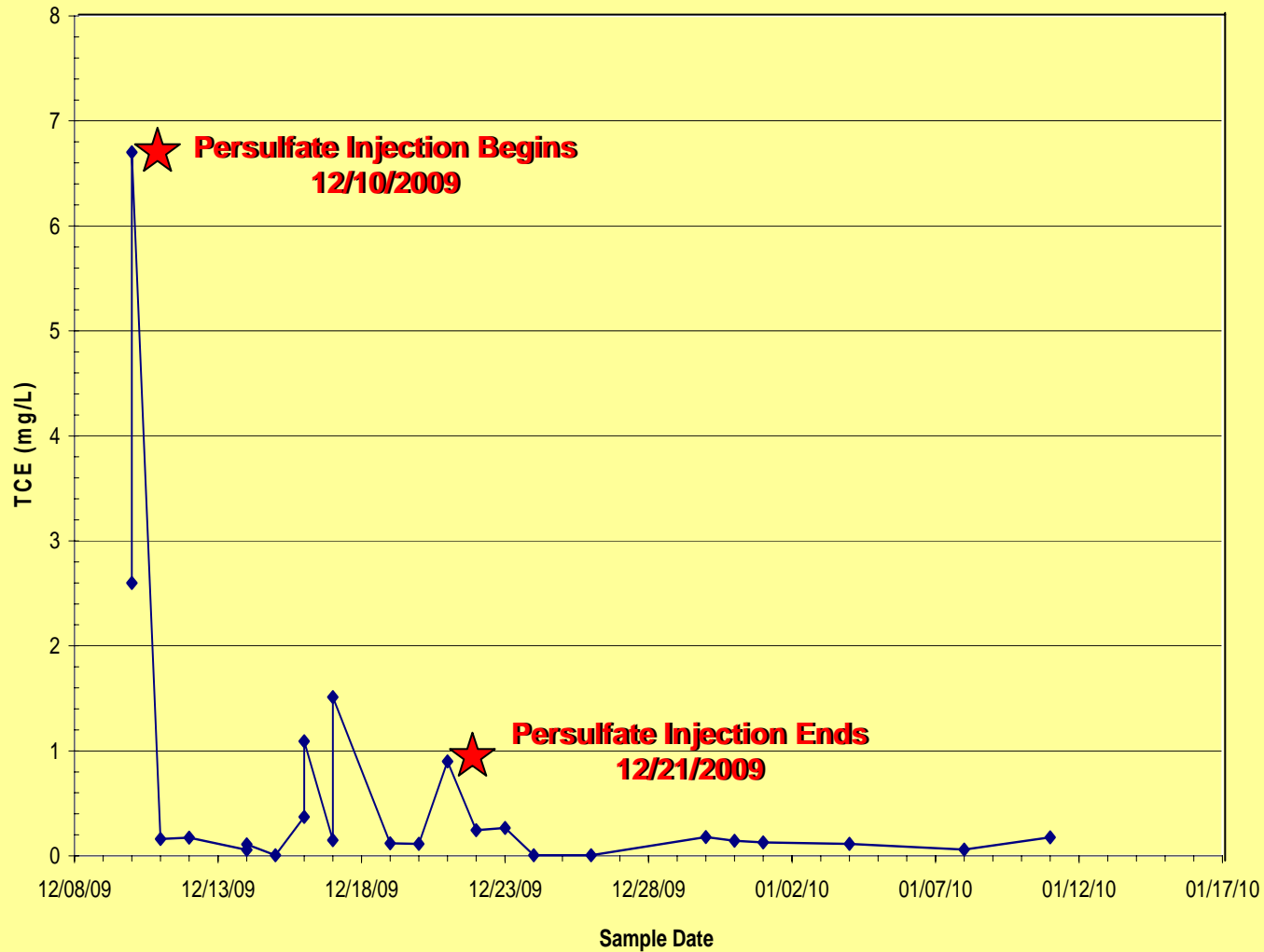




SREL Monitoring Well Sampling



MOP 1C

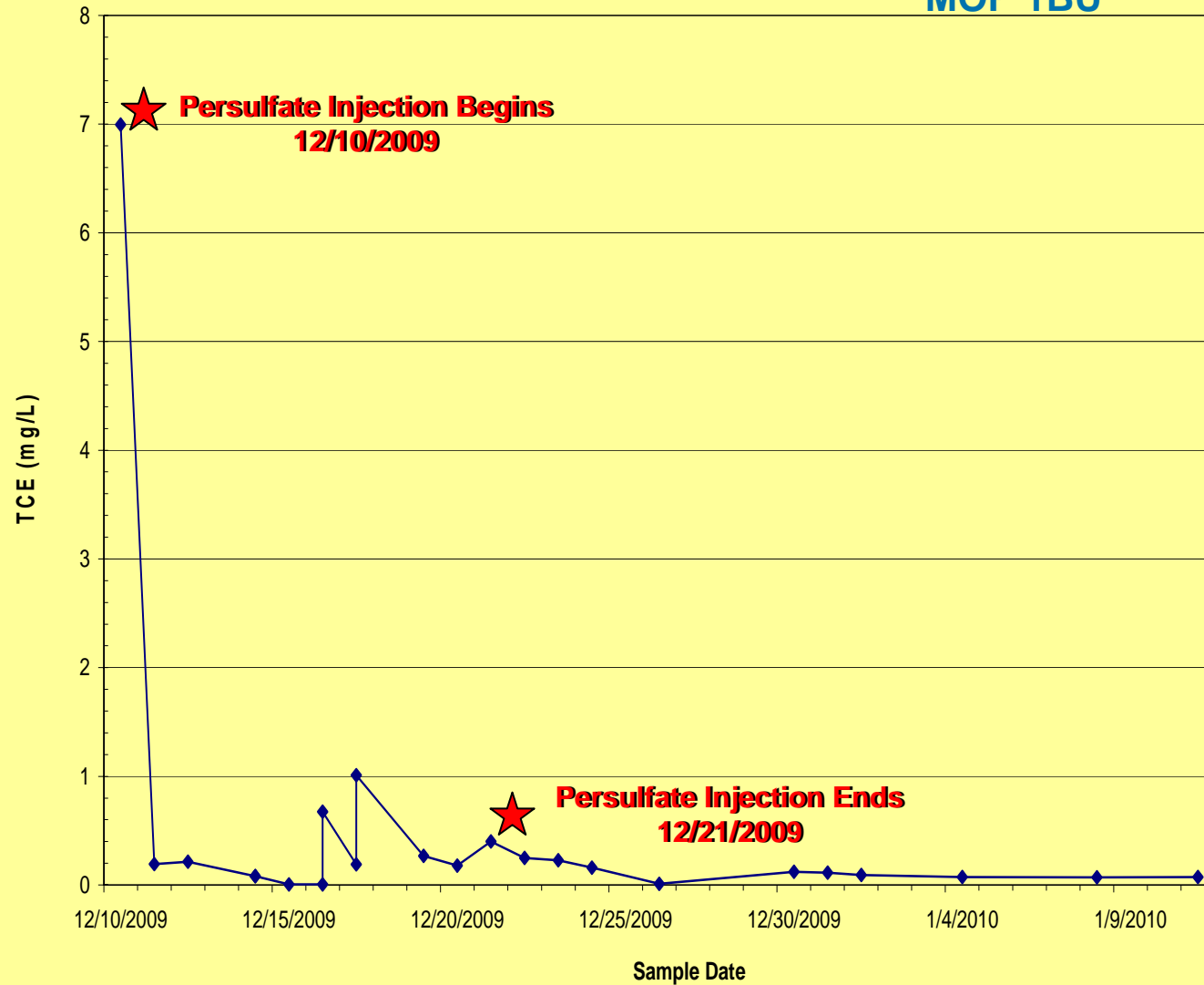


Preliminary Monitoring Results





MOP 1BU



Preliminary Monitoring Results





Summary / Path Forward

- **Attention to safety resulted in all work performed safely - no incidents**
- **Injections were completed within a two-week period**
- **Initial monitoring results show success in the destruction of PCE and TCE**
- **Groundwater monitoring will continue for several months to measure the effectiveness of the demonstration**

