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)**

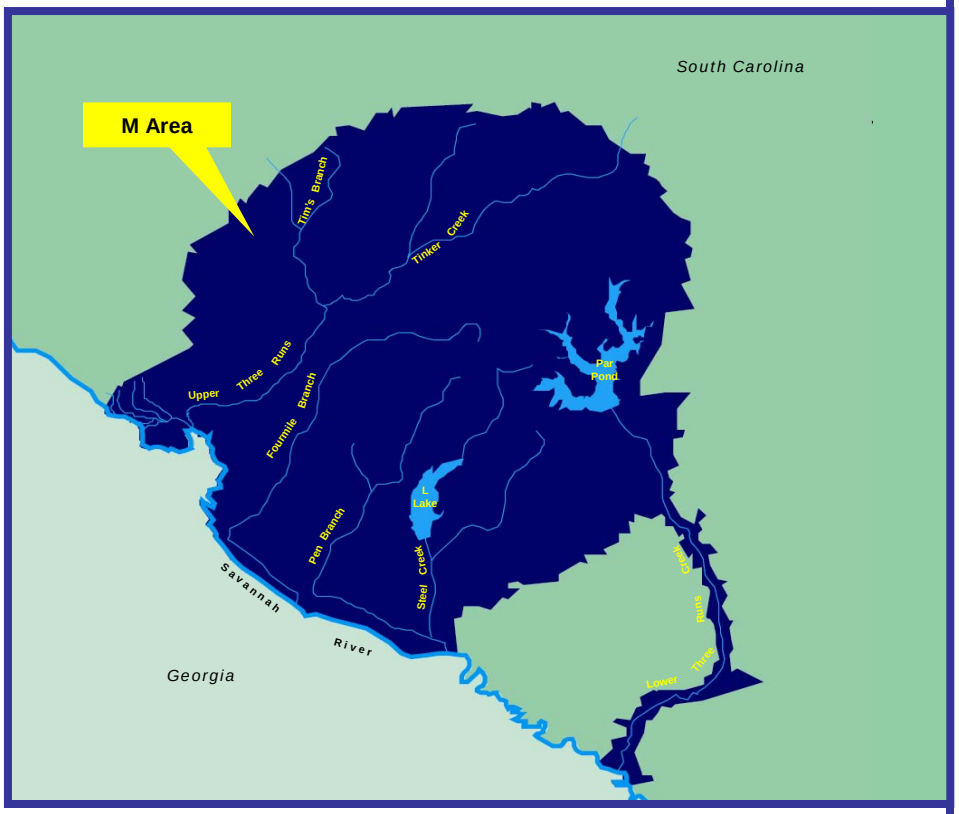
Acronyms

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
$Na_2S_2O_8$	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

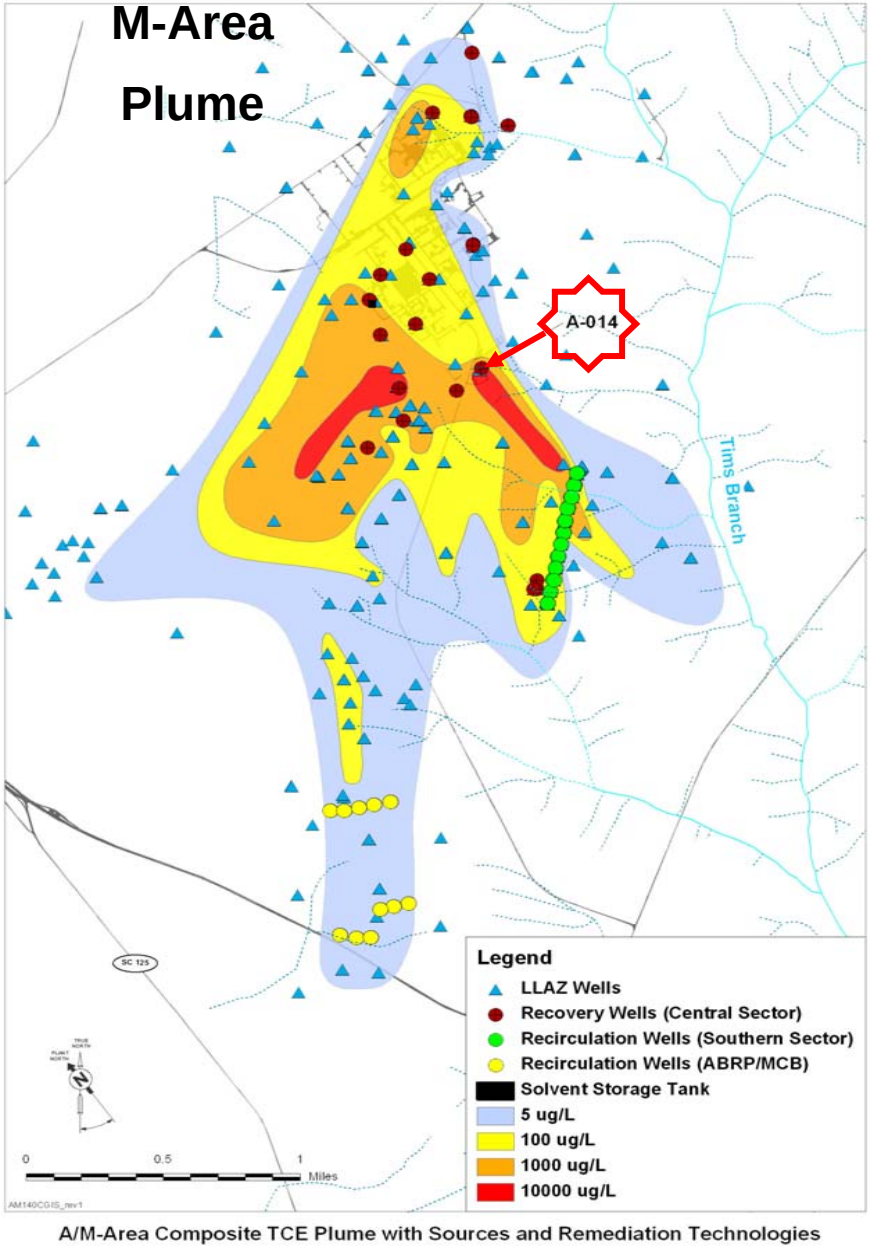
MACO Demo Project

- **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

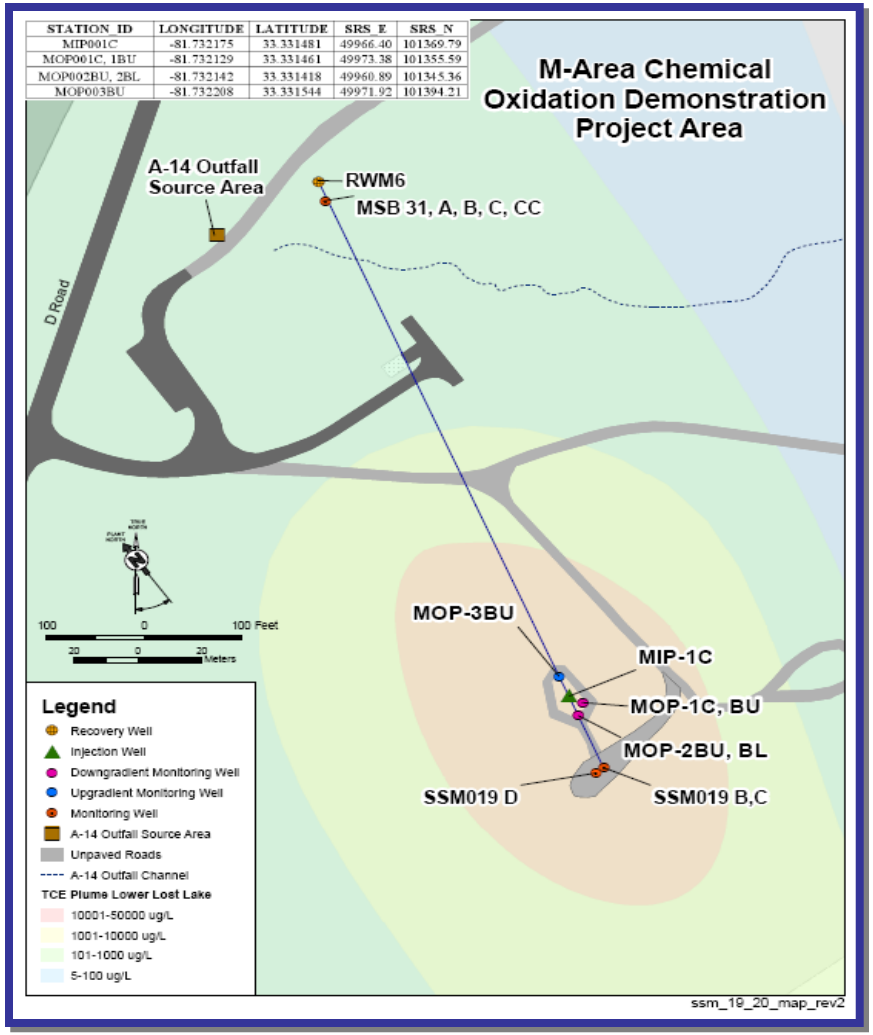


Site Location

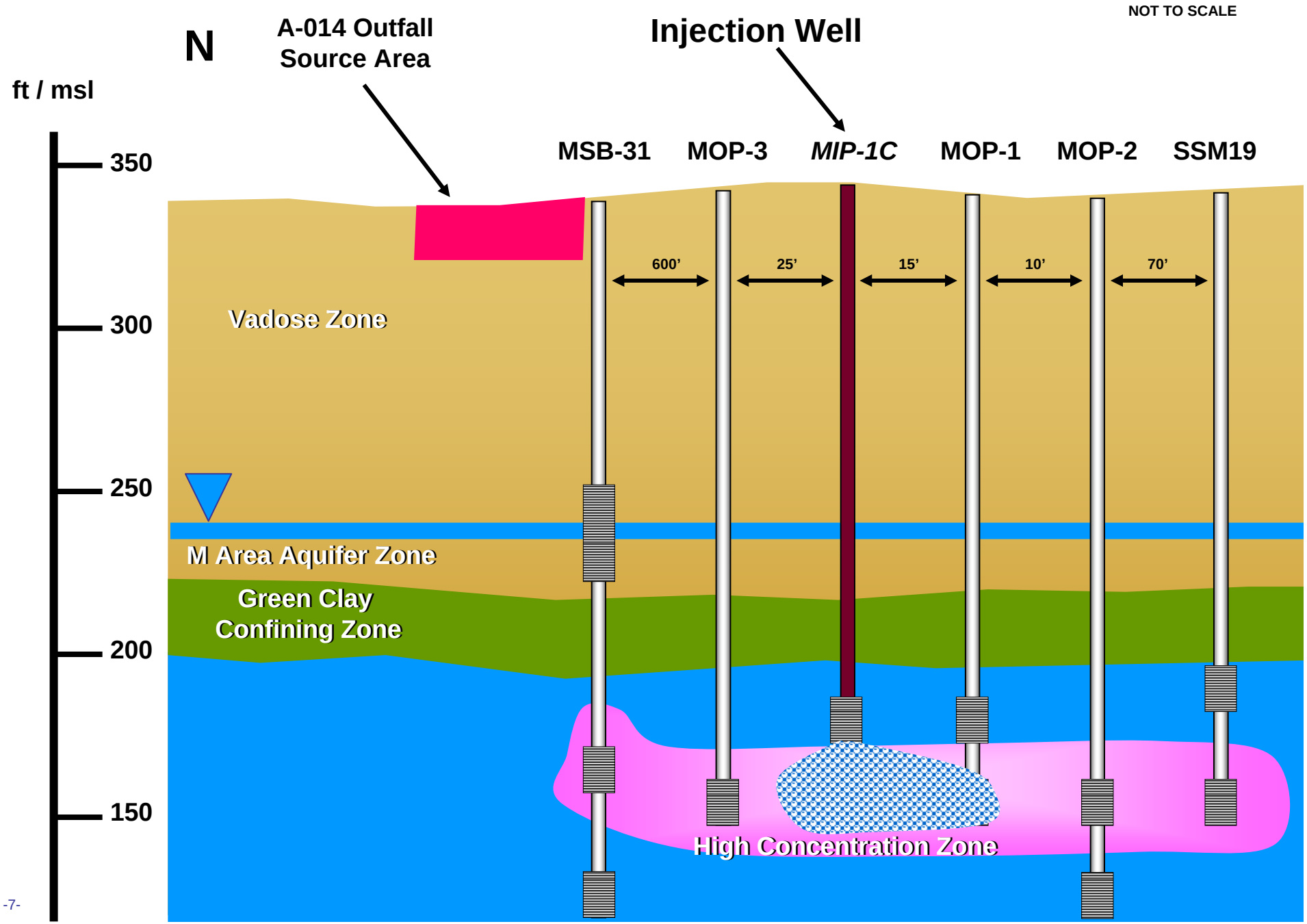


A/M-Area Composite TCE Plume with Sources and Remediation Technologies

MACO Demo Project



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

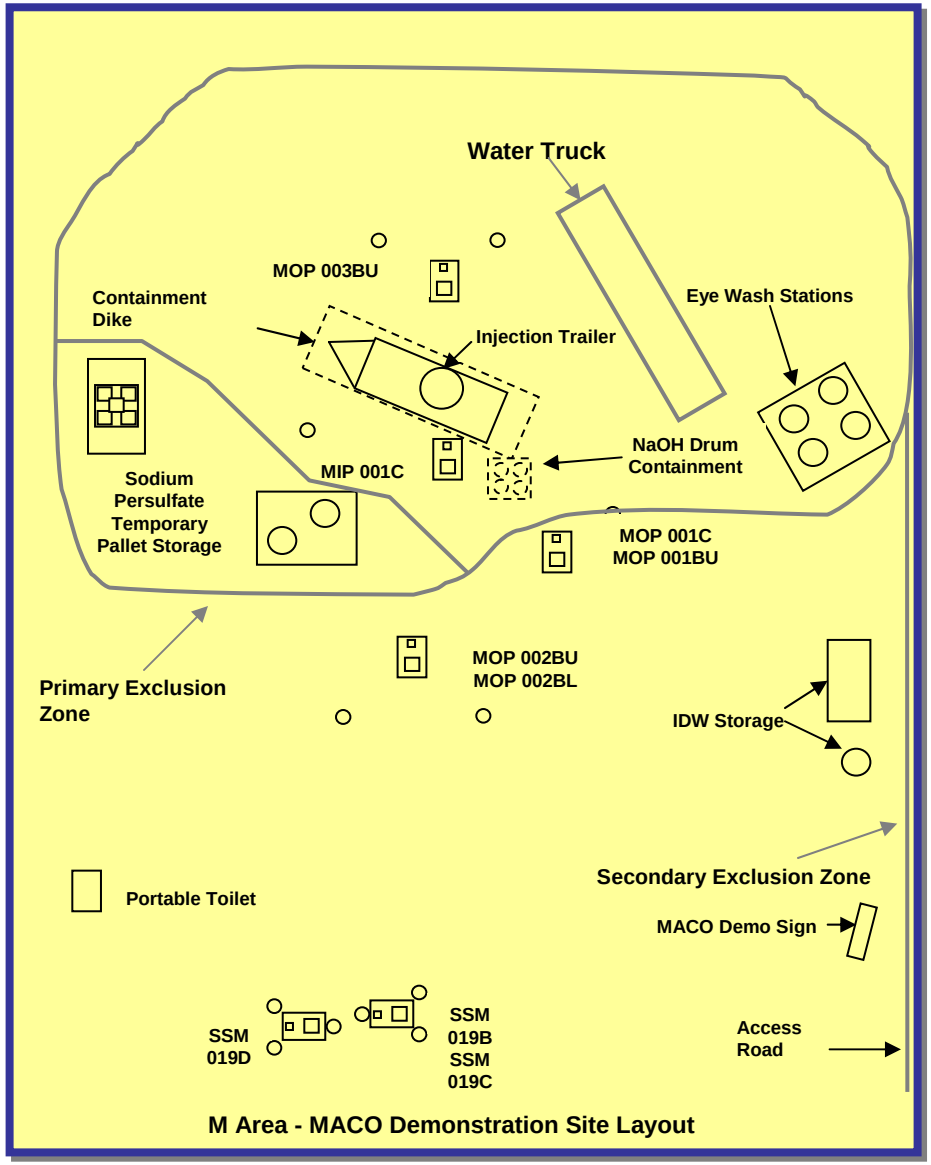

NOT TO SCALE
N
A-014 Outfall
Source Area
Injection Well
ft / msl
350
300
250
200
150
MSB-31
MOP-3
MIP-1C
MOP-1
MOP-2
SSM19
600’
25’
15’
10’
70’
Vadose Zone
M Area Aquifer Zone
Green Clay
Confining Zone
High Concentration Zone

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**

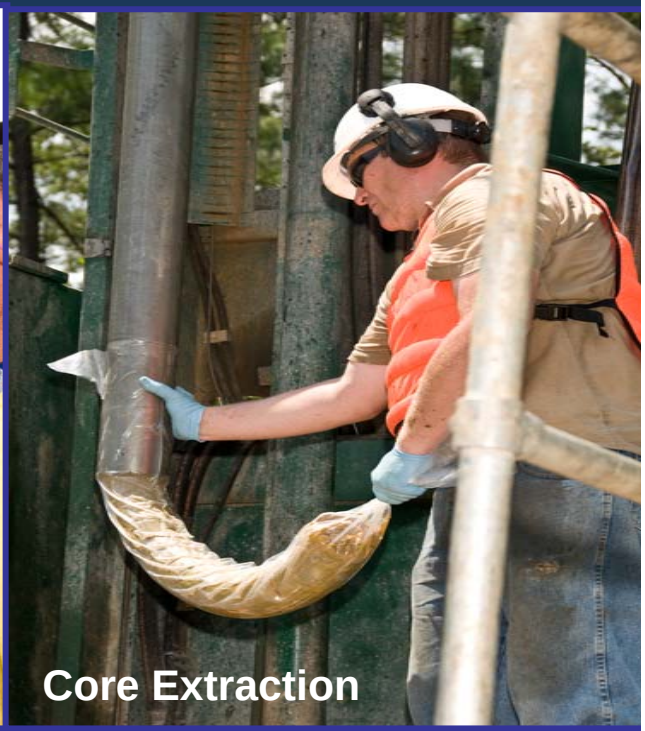
MACO Demo Project

- **Injected 4,800 gallons of catalyzed sodium persulfate solution into the subsurface**
- **Batch injections**
  - **Approximately 450 gallons of water**
  - **990 pounds of sodium persulfate ($Na_2S_2O_8$ - 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

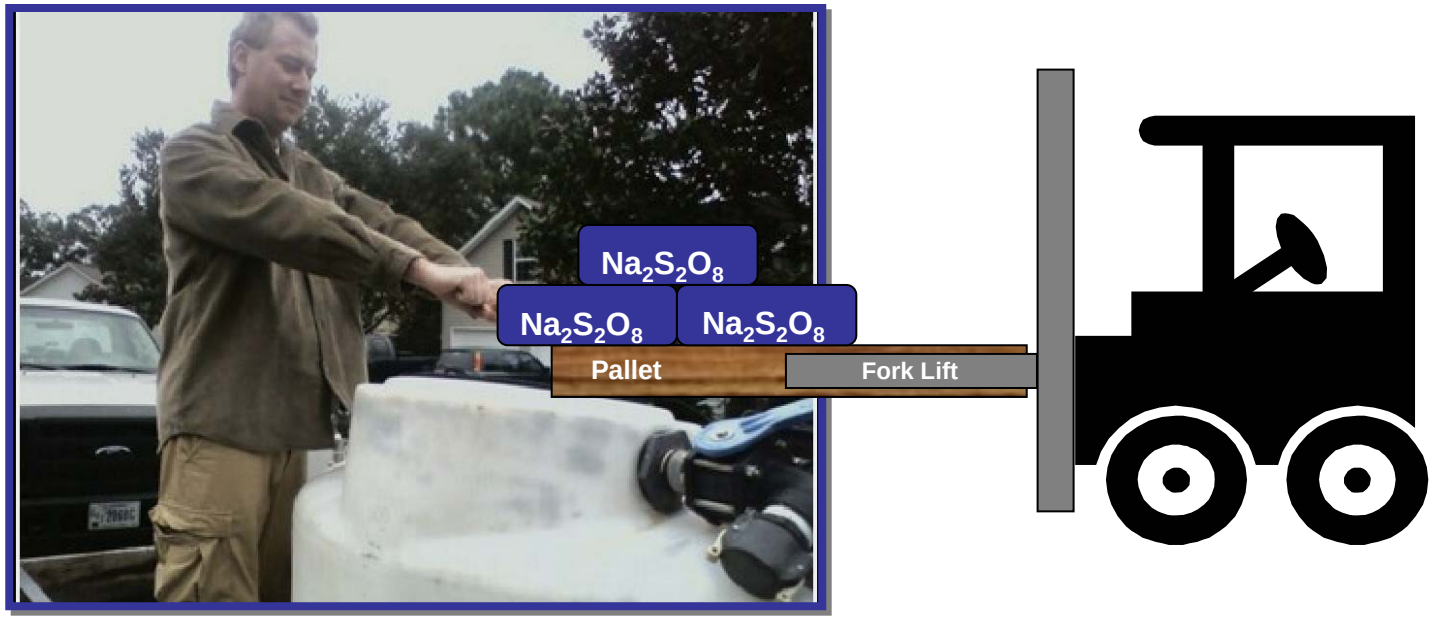
Overall Site Layout

Water Truck and Injection Trailer / Crew

550-Gallon Mixing Tank

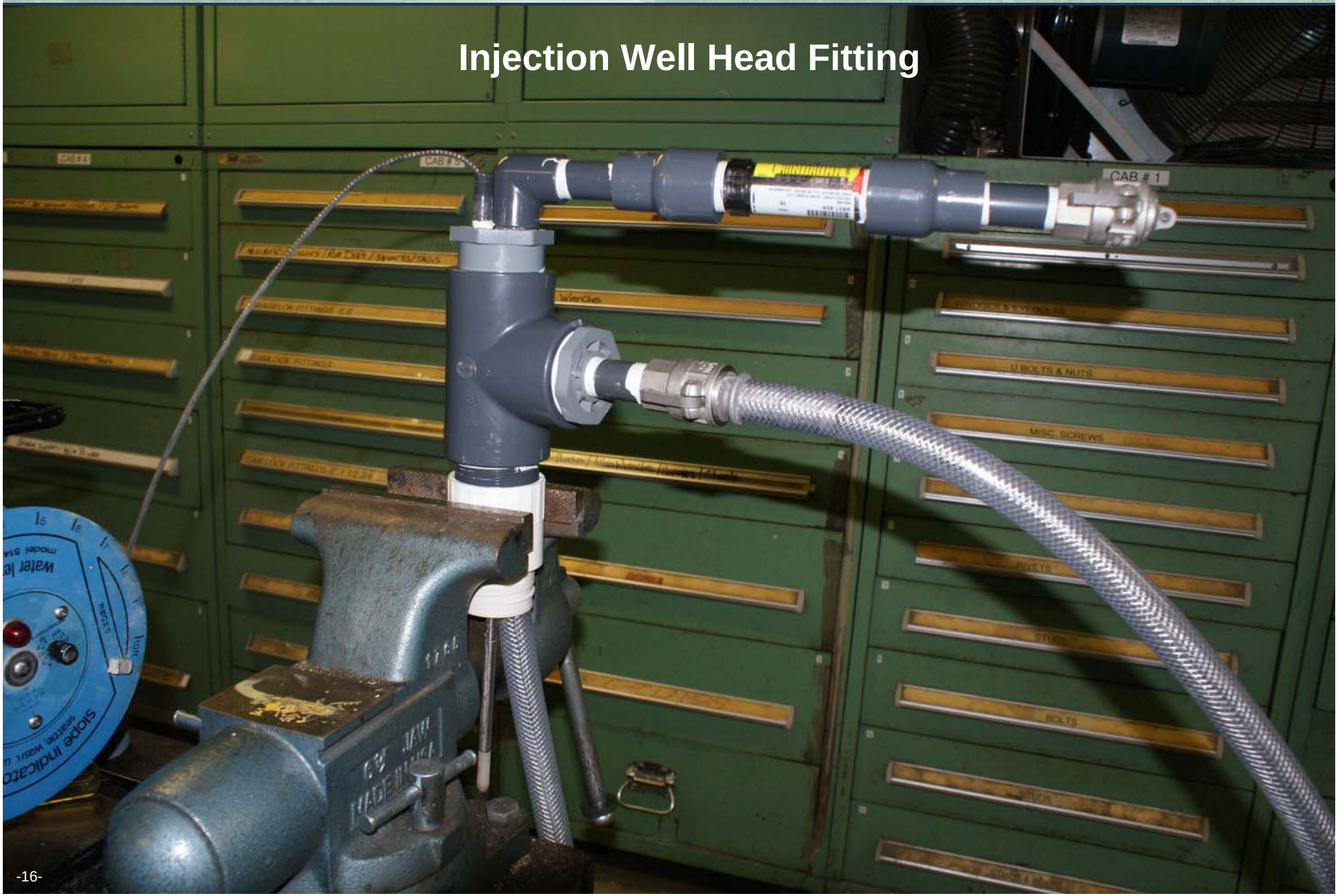
ACP-FY10-015-14

MACO Demo Project



Fork Lift assisted addition of solid sodium persulfate to mixing tank

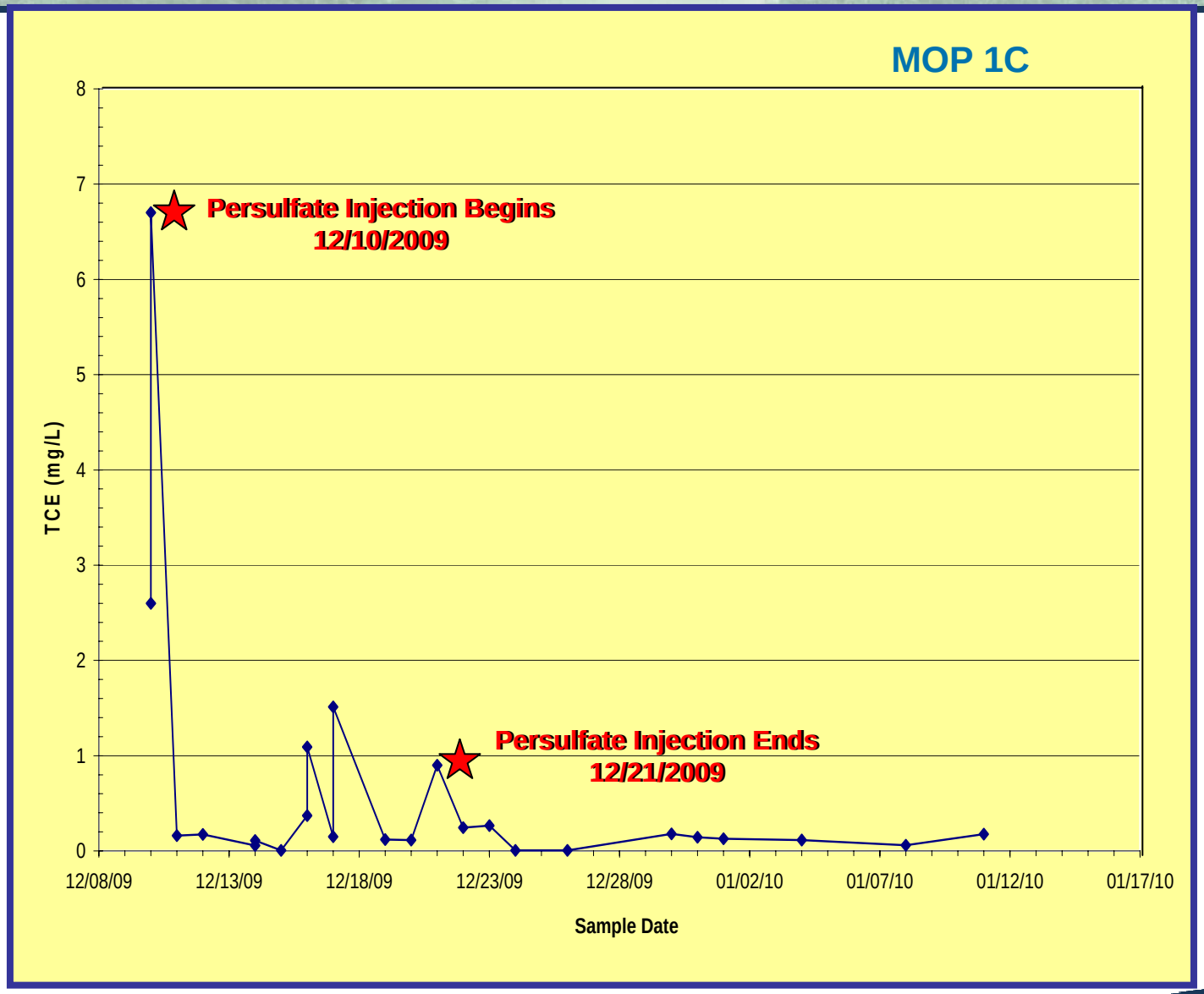
Injection Well Head Fitting



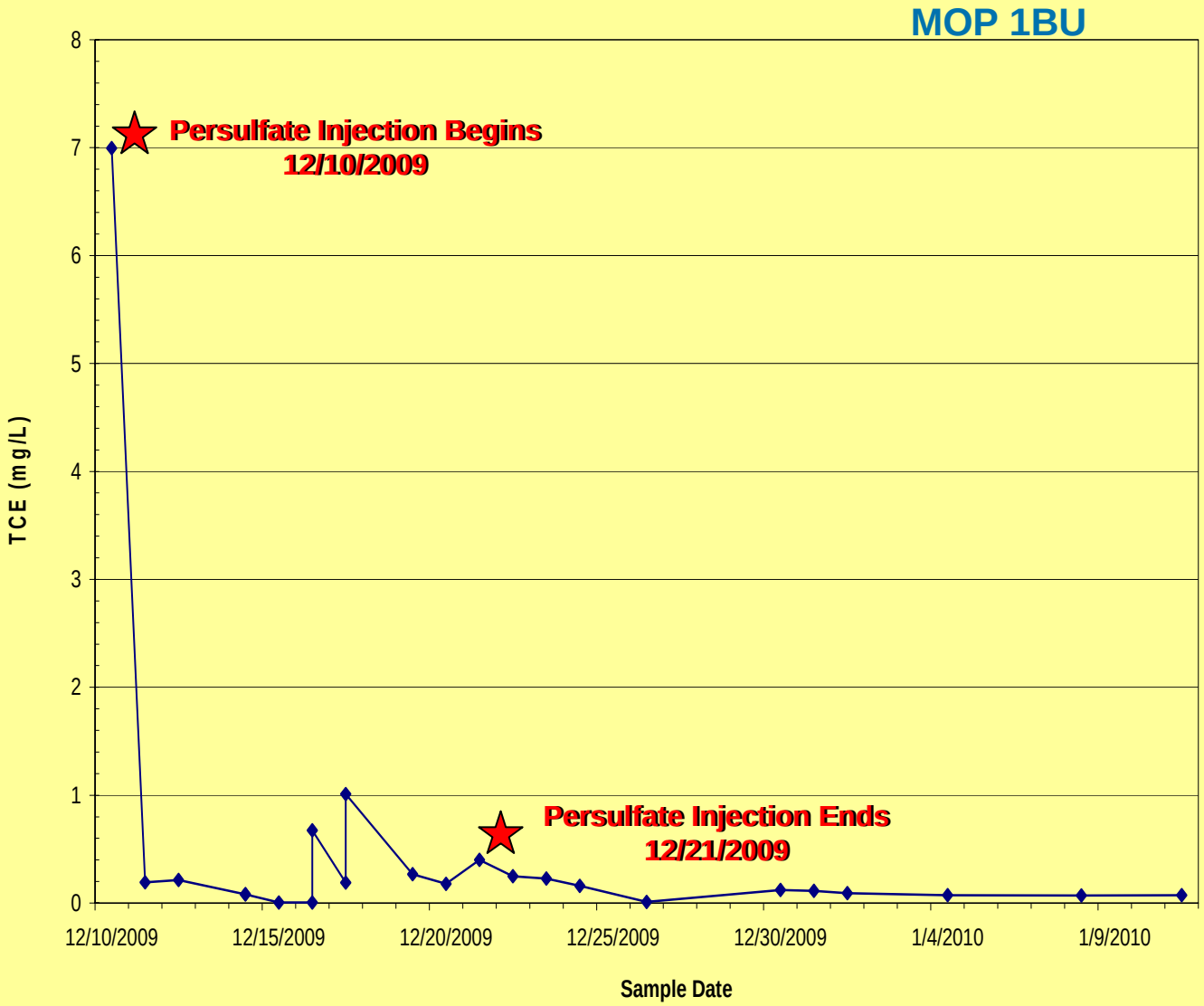
MACO Demo Project

- **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



Preliminary Monitoring Results



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**