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

Legend:
- LLAZ Wells
- Recovery Wells (Central Sector)
- Recirculation Wells (Southern Sector)
- Recirculation Wells (ARBP/MCB)
- Solvent Storage Tank
- 5 ug/L
- 100 ug/L
- 1000 ug/L
- 10000 ug/L

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
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$_2$S$_2$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
550-Gallon Mixing Tank
MACO Demo Project

Fork Lift assisted addition of solid sodium persulfate to mixing tank
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

MOP 1C

Persulfate Injection Begins
12/10/2009

Persulfate Injection Ends
12/21/2009

Sample Date

TCE (mg/L)

12/08/09 12/13/09 12/18/09 12/23/09 12/28/09 01/02/10 01/07/10 01/12/10 01/17/10
Preliminary Monitoring Results

TCE (mg/L)

Persulfate Injection Begins
12/10/2009

Persulfate Injection Ends
12/21/2009
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