1

Practical Considerations for Source Area Treatment: Interim Measures

Dean Williamson, P.E.
CH2M HILL Constructors, Inc.
December 11, 2002

CH2MHILL

Presentation Outline

- Advantages of In-situ Groundwater Source Area IMs Conducted at the Charleston Naval Complex (CNC)
  - Within the overall project environment (BRAC, Federal property transfer, RIP/OPS, GFP Contract)
  - Within RCRA Corrective Action Context
- Practical Considerations for In-situ Source Area Treatment Projects

CH2MHILL

What is the Charleston Naval Complex (CNC) and the CNC Insured Environmental Contract?

3

Navy's First Performance-Based Insured Fixed-Price Remediation Contract:

- investigations, remedial planning, and remedial action to close out over 170 RCRA and over 70 UST sites, plus Pb-based paint abatement, other work
- preparing property transfer documentation (FOST/EBS)
- O&M for remedial systems for 20 years
- investigation and remediation of newly discovered Navy-related sites for 20 years
- $65MM of combined Remediation Stop Loss and Environmental Impairment Liability insurance
- two year target schedule for property transfer

CH2MHILL

4

CNC Insured Fixed Price Project Progress to Date

- Over half the RCRA and most UST sites have received NFA status; on track to have NFA or RIP/OPS for remaining sites in 2003
- ~65 percent of property already transferred to RDA or ready for transfer in 2002; remainder to transfer in 2003
- Nominated by SCDHEC/EPA as RCRA Showcase Pilot
  - viewed by regulators and Navy as a highly successful project and a model for innovative streamlining for RCRA Corrective Action programs
  - significant credit for project success goes to the regulators

CH2MHILL

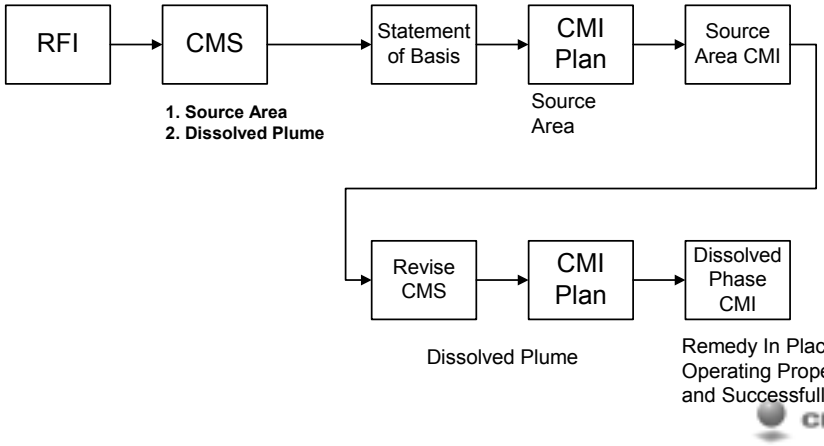
To date, 23 RCRA IMs Completed Including 6 For In-situ Groundwater Source Area Treatment

- **Electrical Resistance Heating (ERH) at a Dry Cleaner (AOC 607)**
- **In-situ Chemical Oxidation (ISCO) at three sites - dichlorobenzenes (AOC 561,SWMU 196); DDD (SWMU 38)**
- **In-situ Chemical Reduction (ISCR) ZVI - hexavalent chromium (SWMU 25/70) and TCE (SWMU 166)**

H2MHILL

6

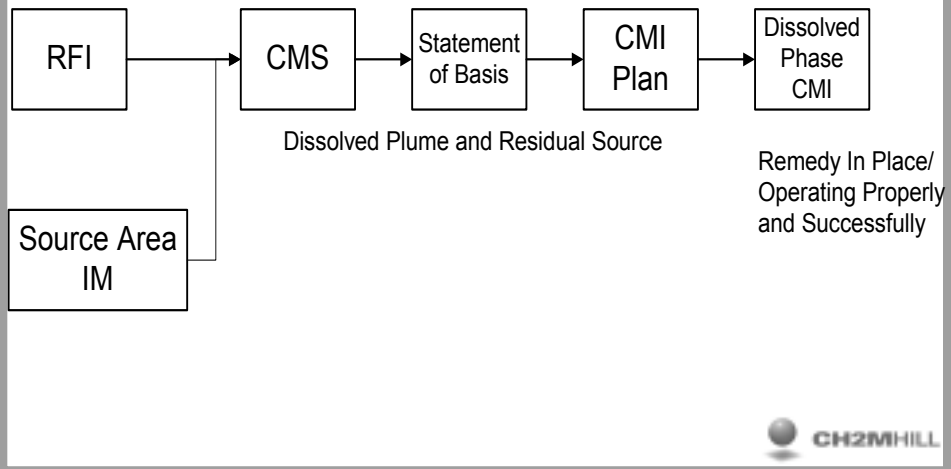
Why Interim Measures at the CNC?
Without an IM step, Source Area Treatment and Property Transfer are Delayed



CH2MHILL

7

With Interim Measures Source Area Treatment, Remediation and Property Transfer are Accelerated



CH2MHILL

8

A Few Practical Considerations for Implementing Successful Source Area Treatment IMs

- Safety First
- Importance of Effective Source Area Delineation and Valid Site Conceptual Model
- Understanding Project Delivery Process for Source Area Treatment IMs
- Effective Risk/Uncertainty Management

CH2MHILL

9

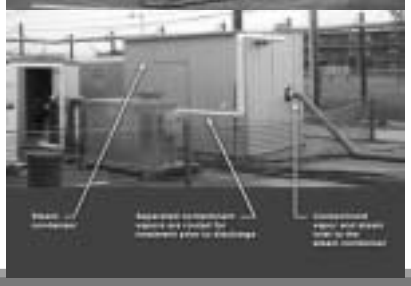
Consideration No 1.- Safety is *always* *the first and most important consideration*

- **Protect site workers, community members, and the local environment**
- **Many of the potential hazards from in-situ technology delivery systems may be unfamiliar to stakeholders (energetic materials and conditions)**
- **Think about what could happen, anticipate impacts and how to prevent incidents, and design safety into your IM**

CH2MHILL

Safety Considerations at ERH IM for AOC 607 Included Physical, Chemical, and Mechanical Issues

10



Tenant Relocation

Safety by Design (e.g., equipment interlocks)

Security Fencing

Air Emission controls and monitoring

Electrical potential measurements (equipment and fence)

Soil Vapor Monitoring

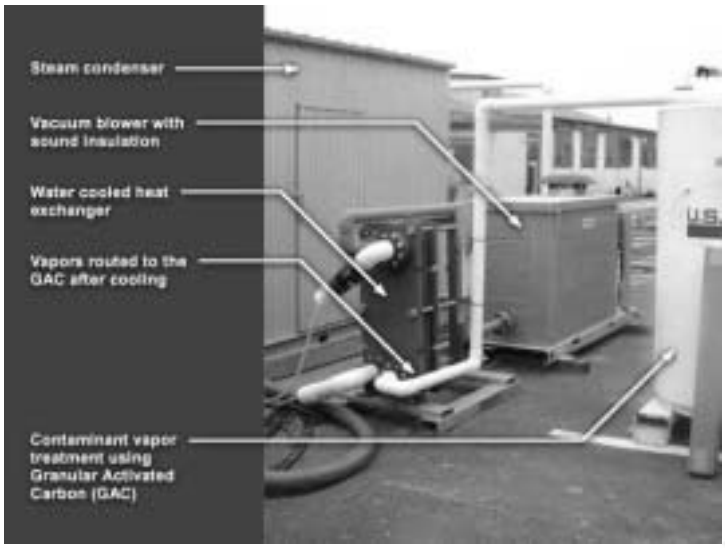
(Hot) Groundwater Monitoring

Daily inspections

CH2MHILL

At AOC 607 - ERH Vapor Phase Equipment Performed Perfectly - no vapor emissions or subsurface vapor migration

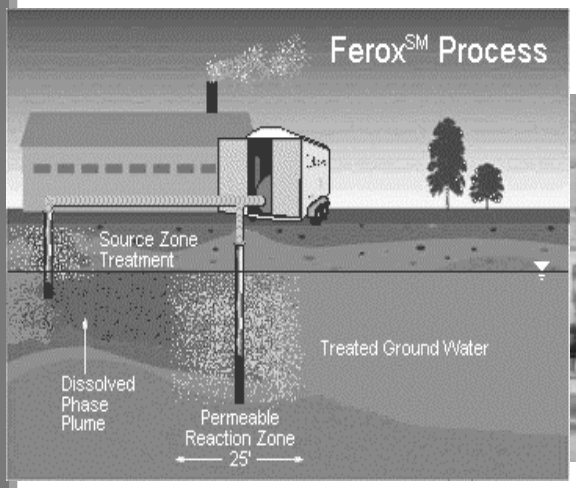
11



CH2MHILL

12

Safety Concerns For In-situ Chemical Reduction (Fer-Ox) Differed from ERH Safety Concerns



CH2MHILL

13

Fer-Ox Process Uses Pneumatic Fracturing to Deliver Various Chemicals Into the Subsurface

CH2MHILL

14

In-situ Chemical Reduction at SWMU 25/70 Was Safely Implemented

Site access restrictions, structural integrity of buildings/foundations,

Compressed gas and ZVI handling and use, underground utilities, pneumatic injection equipment, drilling

CH2MHILL

15

Safety Considerations for ISCO using Fenton's Reagent Include Several Additional Issues

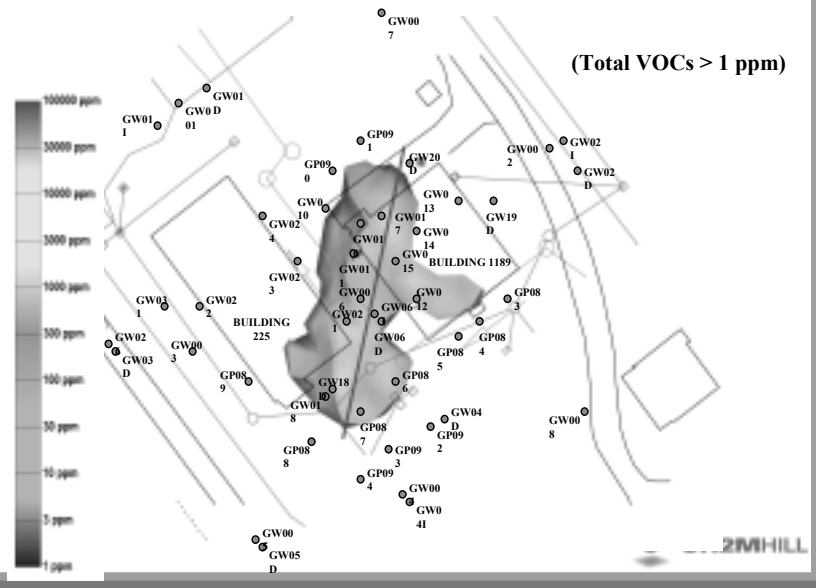
Bulk chemical transport, storage, and handling, reagent injection, sampling, underground utilities, building foundation integrity

CH2MHILL

Consideration No 2. - Complete Source Area Characterization and Valid Site Conceptual Model

- High quantity of adequate data often more useful than a few high quality data points - ***different objects than for an RI or RFI***
- Design-related investigations at IM sites led to significant changes in Site Conceptual Model and IM Design

Visualization Software Helpful in Understanding Source Area Morphology



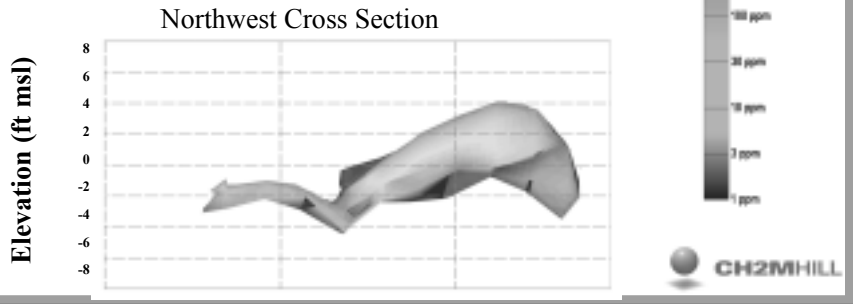
Valid Site Conceptual Model critical for determining best treatment approach

18

Consider release attributes, hydrogeology, source area topology, spatial distribution (vertical and horizontal), potential migration pathways

Example - AOC 607 PCE Concentrations Greatest Along Clay/Overlying Sediment Interface Near 11 ft bls

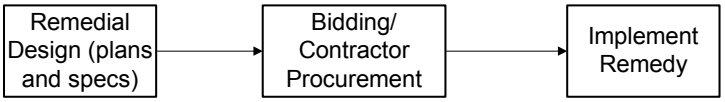
Northwest Cross Section



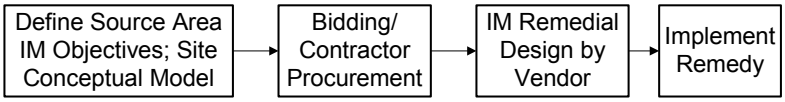
CH2MHILL

19

Consideration No 3. - Project Delivery Process is different than for conventional remediation projects



Project Delivery Process for Conventional Remediation



Typical Project Delivery Process for In-situ Source Area Interim Measure

CH2MHILL

20

Considerations for Vendor Procurement for In-Situ Source Area Treatment Projects

- Typically not “constructing” something conventional, but procuring specialty (not “commodity”) services
- Potential Considerations for vendor procurement - experience, safety record, capabilities, interview/presentation
- Procurement Document quality and effective procurement process critical to overall project success

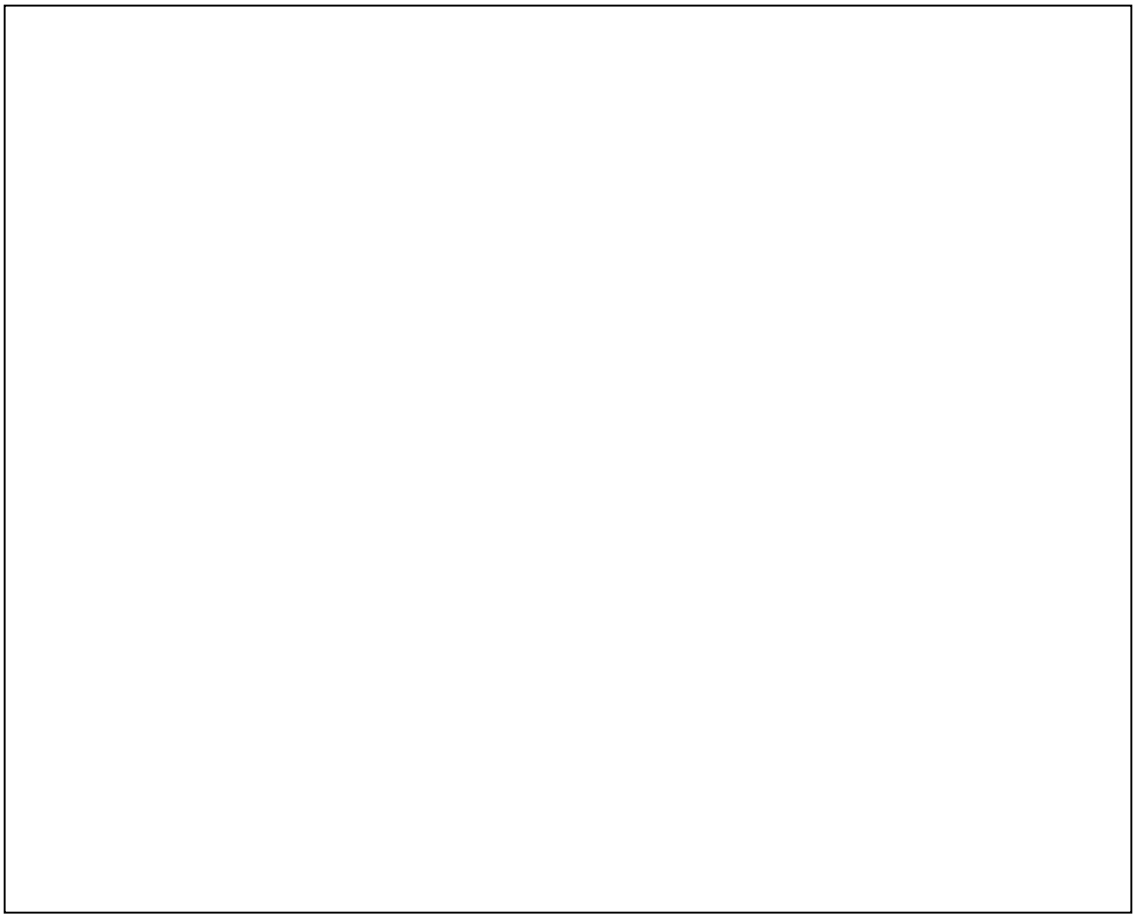
CH2MHILL

21

Questions to Consider Before Entering Into Performance Based Contracting For Source Area Treatment

- How is performance to be measured - mass removal, dissolved phase concentrations, other metrics (temperatures achieved, reagents delivered)?
- How complete is site characterization? How will "changed subsurface conditions" impact performance warranty?
- What is the cost premium for obtaining a performance warranty from contractor? Is it worth it?
- Is performance warranty "enforceable" in the event of remedy failure?

CH2MHILL



Consideration No 4. - Managing Risk and Uncertainty - Dealing with the Unexpected

- In-situ technologies are relatively immature; implementation requires skill, science, creativity; unexpected things happen
- Good contingency planning is critical - keeping asking "what if…" and "could this…" during design/planning steps
- Review anecdotal information from other projects
- Monitoring during implementation is critical
  - AOC 607 - subsurface temperature, subsurface vapors, VOCs in GW and recovered vapors, voltages, ambient air
  - ISCO projects - VOCs and CO_2 in wells, mass of reagent delivered per well
  - ISCR projects - iron delivered, radius of influence of injection, ORP indicators, VOC and hexachrome concentrations over time

CH2MHILL

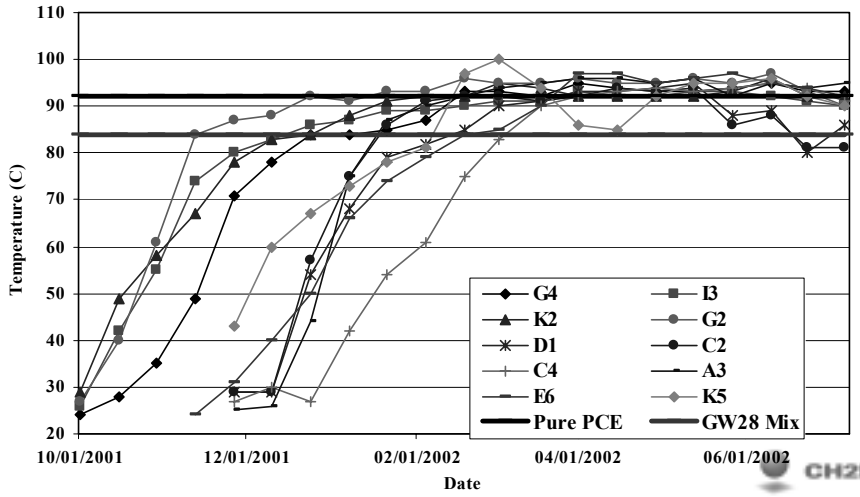
Risk/Uncertainty Management - Keep, Share or Transfer?

- **What uncertainties are you better off self-managing rather than transferring?**
  - Site characterization uncertainties? DNAPL extent? Inadvertent DNAPL mobilization? Regulatory approval? Permitting?
- **What uncertainties are appropriate for the vendor to be responsible for?**
  - Performance warranty? Schedule? Subcontracted work critical to their performance?
- **What uncertainties are better shared?**
  - You decide

CH2MHILL

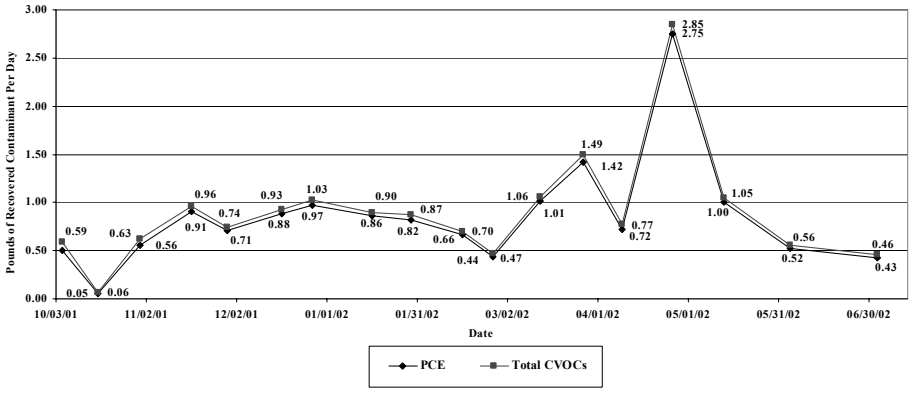
Example of Process Monitoring During ERH Implementation: Temperature Rise at 11 ft bls

24



CH2MHILL

PCE Mass Recovery Rate Peaked when Groundwater at 11 ft bls Reached Target Temperature



Total CVOCs are a concentration summation of 1,1-DCE, trans-1,2-DCE, cis-1,2-DCE, TCE, PCE, and vinyl chloride

CH2MHILL

Performance To Date and Lessons Learned Summary

- AOC 607 ERH - 79% VOC reduction (dissolved phase) versus 95% target; electrode spacing/ soil drying, acetone generation; no rebound so far
- SWMU 196 - ISCO - 82% VOC reduction (dissolved phase) versus 90% target; multiple phases of injection helped
- SWMU 25/70 - Fer-Ox - 70% hexachrome reduction, ZVI still active
- AOC 561 - ISCO - 95% VOC reduction (dissolved phase); small site

CH2MHILL

Summary: Source Area Treatment IMs May Offer Significant Benefits

- Benefits at the CNC included expediting the RCRA Corrective Action process and Property Transfer Objectives (RIP/OPS)
- Practical Considerations for In-situ Source Area IMs Include:
  - Safety First
  - Delineate Source Area and Develop Valid Site Conceptual Model
  - Understand Project Delivery Process for Source Area Treatment Projects
  - Effectively Manage Business and Technical Risks and Uncertainties

CH2MHILL