Federal Remediation Technologies Roundtable

Review of EPA-ORD Remediation Technology Programs

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ORD Technology Programs that address Remediation

- Superfund Innovative Technology Evaluation (SITE)
- Small Business Innovation Research (SBIR)
- Nanotechnology Research Program
- Groundwater and Ecosystems Restoration Research, Ada, Oklahoma

Risk Management Research SITE Program

- Purpose: evaluation of innovative technology performance and cost
- *Why is it Important ?*
  - provides relevant innovative technology performance data to regions and other decision makers
  - provides cost data for evaluation of remediation and monitoring options

Risk Management Research SITE Program

- Why Important (cont.)
  - SITE focuses on in-situ treatment and hard-to-treat wastes

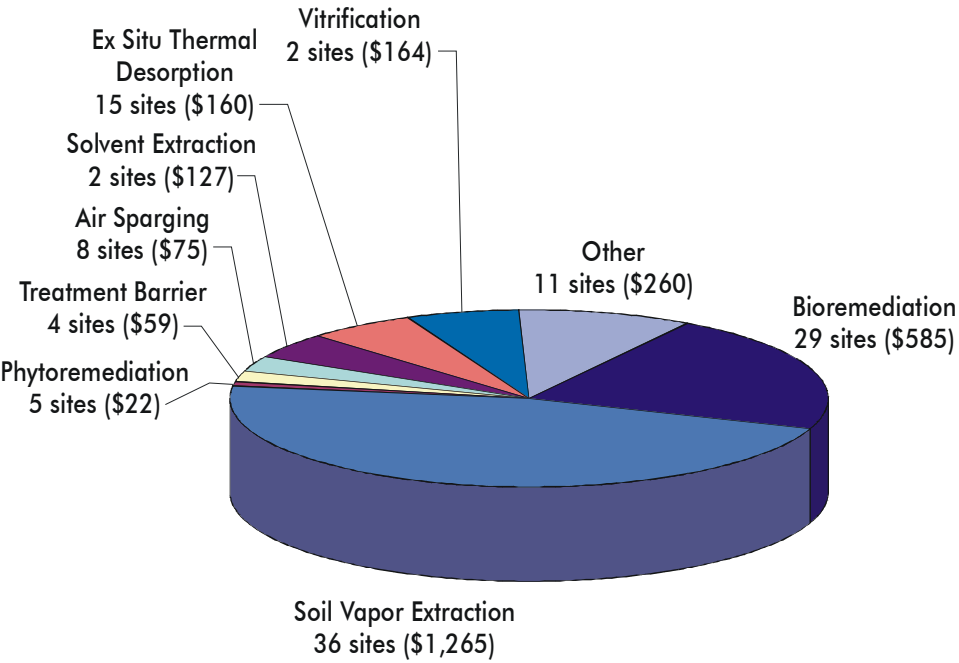
    58% of all Superfund site source control treatment is in-situ
  - Twice as much Superfund site contaminated soil (28M yd^3) is being treated in-situ than ex-situ(14M yd^3)
  - Demonstrated need for on site, real time characterization and monitoring technologies

Loring Air Force Base, Maine

- Remediation of in-situ DNAPL in Fractured Rock

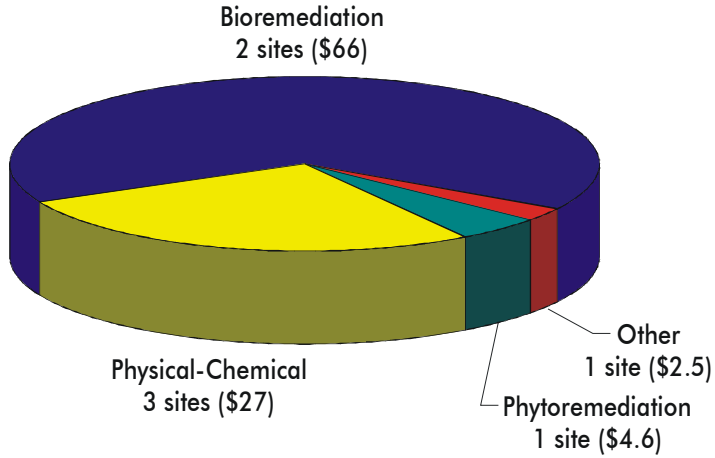
- Based on SITE Program performance and cost data, the technology was implemented by the Army Corps at a site in Rhode Island

- Two additional implementations are planned for Maine



Cumulative Cost Savings

Savings estimates based on comparison of innovative and conventional technologies for FY 93-00 RODs. Savings shared equally among technologies when multiple technologies were used and technology-specific costs were not available.



Incremental Cost Savings

Savings estimates based on comparison of innovative and conventional technologies for FY-00 RODs.

Figure 2. Cost savings estimated from RODs analysis by technology type (millions of 2002 dollars)

Federal SBIR Program

- 11 Federal Agencies with SBIR Programs
- Set-aside: 2.5% of Extramural R&D
- Program utilizes Small Businesses with fewer than 500 employees to Develop Technologies that Agencies Need
- Promotes Commercialization
- Over $2 Billion in 2005
- EPA Budget in 2006: $6 Million

SBIR at EPA

SBIR Phase I

- Proof of Concept
- Competitive (1 in 10 Funded)
- $70,000 over 6 Months

SBIR Phase II

- Technology Commercialization
- $225,000 up to $345,000 (with Options)
- Duration: 2 years

Nanocrystalline Zero Valent Iron for *In-Situ Remediation*

- Company: OnMaterials, Inc.
- Status: Phase II completed in 2005
- Use: Clean-up of contaminated soil and groundwater
- Application:
  - Demonstrated at TCA site in New Jersey
  - ORP reduced from +50 to nearly -400 mV
  - TCA concentrations reduced by up to 95%
  - 8000 lb injection at same site in June, 2005
- Advantages: customizable surface area (15 m^2/g) and low cost (<$20/lb)

Magnetite (Fe_3O_4) Nanoparticles for Groundwater Remediation

- Company: Luna Innovations Inc.
- Status: 2006 Phase II
- Use: Enhanced groundwater remediation
- Advantages:
  - High surface area, superparamagnetic properties, stable surface coating, reduced aggregation
  - Reductive dechlorination without forming chloroform
  - Significantly lower costs
- Commercialization partner to scale up manufacturing

Fence-line Fugitive Emissions Ambient Monitor

- Company: VOC Technologies, Inc.
- Status: Ongoing Phase II project
- Technology: Pneumatic Focusing Gas Chromatography (compress air sample to high pressure before injecting it into a GC)
- Use: Analysis of VOCs and HAPs
- Advantages:
  - GC is housed in a PC – Automated & Continuous
  - Lower cost of VOC/HAP analysis by factor of 100

Field Screening Detector for Metals in Soil

- Company: Physical Sciences, Inc.
- Status: Phase II completed 2002
- Technology: Spark-induced breakdown spectroscopy (SIBS)
- Use: Field instrument for the measurement of metals in soil
- Application: Site characterization
- Advantages:
  - Field-rugged, rapid, simple, inexpensive

Chromium (VI) Sensor

- Company: Eltron Research, Inc.
- Status: Phase II completed 2004
- Technology: self-assembled monolayer (SAM) modified microelectrode arrays
- Use: electrochemical detection of Cr(VI)
- Applications: remote groundwater monitor
- Advantages:
  - self-contained laboratory -samples, analyzes and stores results

ORD Nanotechnology Research Under the STAR Grants Program

Applications address existing environmental problems, and prevent future problems

Implications address the interactions of nanomaterials with the environment, and any possible risks that may be posed by nanotechnology

STAR Nanotechnology Research Related to Site Remediation

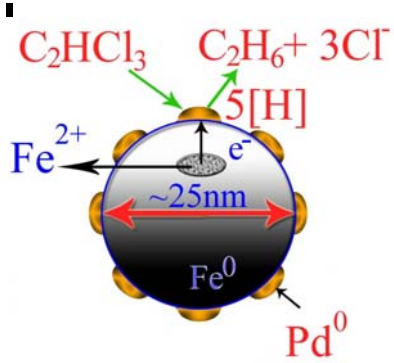
- Remediation of Soil and Groundwater – 8 grants
- Sensors – 6
- Funded in 2002-2004
- Limited new funding under STAR
- Information on STAR nanotechnology projects at epa.gov/ncer/nano

Examples of STAR Nano Remediation Projects

- Nanoscale Bimetallic Particles for In-situ Remediation
- Fe(0)-Based Nanoparticles for In Situ Degradation of DNAPL Chlorinated Organic Solvents
- Synthesis and Application of a New Class of Stabilized Nanoscale Iron Particles for Rapid Destruction of Chlorinated Hydrocarbons in Soil and Groundwater
- Transformation of Halogenated PBTs with Nanoscale Bimetallic Particles
- A Bioengineering Approach to Nanoparticle-Based Environmental Remediation
- Novel Nanostructured Catalysts for Environmental Remediation of Chlorinated Compounds

Early Application: Remediation using nanoscale Iron particles

- nanoscale zero valent iron particles are deployed in-situ to remediate soil and ground water contaminated with chlorinated compounds and heavy meta



Groundwater and Ecosystems Restoration Division, Ada, OK
Research Themes

- Ground Water
- Oil Spills
- Site Characterization/Soil Research
- Mining
- Tech Support Centers

Ground Water Research Questions

- How can Dense Non-Aqueous Phase Liquid (DNAPL) Source Zones be effectively remediated?
- Can we develop uniform and appropriate DNAPL Source Zone clean up strategies?
- Are there effective in situ bioremediation methods for DNAPL plumes?

Outcomes/Impacts of ORD DNAPL Research

- **Impacts of Source Treatment**
  - Technical guidance for assessing different technologies for DNAPL source areas – Identified as priority by Ground Water Task Force, OSWER All One Cleanup Program
  - ORD field-based research provides basis for using mass flux as performance metric
  - ORD, Army and EPA Region 10 is in process of applying mass-flux approach for site-wide performance assessment at Fort Lewis EGDY
- **Integrated Remediation Systems**

•Surfactant Enhanced Residual Biotreatment (SERB), impetus for assessment of other types of treatment trains

Additional Information

- www.epa.gov/ord/site
- www.epa.gov/ncer/sbir
- www.epa.gov/ncer/nano
- www.epa.gov/ada/