Technology Developments for Accelerating Revitalization

RevTech
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Brownfields to “Land Revitalization”

- Multiple reuse initiatives, efforts, programs, etc.
  - Brownfields (National)
  - Superfund site recycling
  - USTFields
  - RCRA Brownfields
  - Base Realignment and Closure (“Federal Brownfields Sites”)
  - State programs
    - Voluntary Clean-Up Programs
    - Brownfields
    - State clean-up/State “Superfund”
  - Private sector (reusing property, real assets)
- Start with reuse as the basic premise
The Land Revitalization Initiative

- Emphasizes that cleanup and reuse are mutually supportive
- Reflects EPA belief that property reuse should be an integral part of the way EPA does business
- Applies regardless of whether a property is a Superfund site, an operating waste disposal site, a petroleum facility, a former gas station, or an abandoned industrial facility

Under this new initiative, revitalization and reuse will be a formal part of our planning at every single site we clean up under every single program we manage—it's not discretionary, and it's not a pilot program." - Marianne Lamont Horinko, April 2003
Affecting Site Decisions (TIP Clients)

- Responsible Party/Owner Operator
- State/Federal Project Manager
- Consulting Engineer

Local officials, Developers, Lenders, Community
TIO’s Mission

- Advocates “smarter” technologies for the characterization and cleanup of contaminated sites
- Works with clients to identify and understand better, faster, and cheaper options
- Seeks to identify and reduce barriers to the use of innovative technologies
Rev Tech Goals and Audience #1

• Land Redevelopment Decisionmakers (e.g., local officials, property owners, financial community, etc.)
  – Emphasize the need to understand the “black box” of assessment and cleanup
  – Understand that:
    • There are many alternatives to cleanup based not only on technical issues (contaminants, media), but also on very specific decisions and reuse scenarios
    • Picking the right approach can have significant impact on development potential of a site
    • EDUCATED CONSUMER
RevTech Goals and Audience #2

- Hazardous waste site cleanup professionals (e.g., regulators, cleanup service providers, technology vendors)
  - Revitalization/redevelopment focus requires flexibility
    - Decreased emphasis on “one-size-fits-all” approaches
    - Increased investment in planning
  - Industry must adjust practices to ensure cleanup of more sites (i.e., more business, more reuse)
  - Traditional approaches less viable as market moves away from “low-hanging fruit”
The Land Reuse Equation

Purchase Costs + Redevelopment Costs vs. Clean Value

- Transaction costs
- Site prep
- Construction
- Development
- Taxes/admin.
- Marketing
- Etc., etc., etc.

+ Assessment
- Cleanup
- Liability issues

- Revenues
- Resale/asset value
- Social/political

07/22/03
Site Redevelopment: The Role of Cleanup Technology

- Technologies can support successful redevelopment at Brownfields:
  - By changing standard assumptions of what is possible:
    - Cost
    - Time
    - Site conditions, issues, etc.
  - By affecting decisions:
    - Purchase price + site prep < “clean” value
    - Site prep includes investigation and clean-up (risk management)
    - Lower costs can significantly affect equations
      - More “positively positioned” properties
      - More “public” redevelopment
Technology Opportunities

• Investigation, characterization, monitoring (*If only we could quickly but reliably determine if the site is (still) contaminated*)
  – Field analytics
  – Innovative sampling
  – Long-term monitoring/compliance
  – Dynamic decision making, expedited characterization

• Treatment technologies (*Standard options just won’t work with the proposed reuse*)
  – *In-situ* treatment
  – Volume reduction
  – Contaminant destruction
  – Groundwater (?)
What Are Innovative Technologies?

Innovative technologies, or innovative applications, are those for which performance or cost information is inadequate.

Innovative = Unproven, unused, unreliable
Planning is the Key to a Rational Cleanup Process

- Identify key decisionmakers, decisions and data needs of each
- Include their upfront input on goals, decisions from decisionmakers THOROUGH planning process
  - Consensus
  - Commitment
- Actively address uncertainty and all sources of uncertainty (tolerable to decisionmakers)
- Site-specific approaches to all activities
- Focus on goals of reuse and site activities build and advance towards goals
Understanding the Context of Cleanup

Reuse Plans, Goals

Decisions:
- Cleanup goals
- Data (type, quality)
- Tolerable uncertainty

Approaches to:
- Assessment
- Investigation
- Cleanup Design, Implementation
- Closeout, Long-Term Operations and Maintenance

Tools for:
- Sampling and Analysis
- Cleanup/Remediation
  - Containment
  - Cleanup
  - Controls
- Monitoring, maintenance
Redevelopment Focus

Supporting Redevelopment with Technology Resources
Resources - Brownfields/Reuse

Brownfields Technology Support Center
http://www.brownfieldstsc.org

- Publications
- Request site specific support (Local, State, Regional staff)
- Reports on past projects
- Events
  - Training
  - Workshops
Brownfields TSC Partners

• EPA
  – Office of Research and Development
    • NRMRL-Cincinnati
    • NRMRL-Ada
    • NERL-LV
  – Environmental Response Team (Edison, NJ)
• U.S. Army Corps of Engineers
• Department of Energy- Argonne National Laboratory
• Hazardous Substances Research Center -Technical Assistance to Brownfields (NJIT)
Brownfields TSC Publications

- Road Map to Understanding Innovative Technology Options for Brownfields Investigation and Cleanup, Third Edition
  - Resources Tool Kit CD-ROM
  - Spotlights on Triad, Uncertainty
- Assessing Contractor Capabilities for Streamlined Site Investigations
- Brownfields Technology Primers:
  - Requesting and Evaluating Proposals That Encourage Innovative Technologies for Investigation and Cleanup
  - Selecting and Using Phytoremediation for Site Cleanup
Brownfields TSC Publications

- Recently completed (printing underway)
  - Updated Directory of Services
  - Technology Primer: Triad Approach

- Planned, Under Development
  - Lessons in Procurement
  - Vendor Guide
  - Coal Mining Sites
  - Technology application profiles (online)
Brownfields TSC- Direct Support

- Who? Government users
  - Local
  - State
  - EPA Regions
  - No consultants, NGOs (can work through localities)

- Normal support services
  - Technology scoping
  - Technology review, literature, descriptions
  - Procurement issues
  - Education/training
  - Plan review - technology focus
  - Help identify “non-technology” support, expertise
Brownfields Technology Support Center

Working with Localities

- Milwaukee, WI
- St. Louis, MO
- Utica, NY
- Des Moines, IA
- Ft. Myers, FL
- Puerto Rico
- Hoopa Valley and Navajo Tribes
- Camden, NJ
- Santa Fe, NM
- State of Montana
- Clinton, IA
- Glen Cove, NY
- Bluffton, SC
- Danbury, CT
- Buffalo, NY
- Rochester, PA
- Central City, PA
- Boston, MA
- Trenton, NJ
- Seattle, WA
- Center Hill/Cincinnati, OH
- Ft. Collins, CO
- Covington, KY
- Ambridge, PA
- Greenwich, CT
- Tohono O’odham Nation, AZ
- E. Palo Alto, CA
- Philadelphia, PA
Cleanup/Technology Focus

Supporting Cleanup with Resources to Address “Thorny” Issues
The Triad Approach

Synthesizes practitioner experience, successes, and lessons-learned into an institutional framework
Innovative Analytical and Sampling: Opportunities for Cost Savings, TODAY

- An excellent target for innovative approaches
  - New but not unproven (approaches and technologies)
  - Technology allows improvement
    - Increase sampling density…AFFORDABLY
    - Support rapid decisionmaking
  - Not all sites are candidates for treatment, but all sites require monitoring and measurement activities

- Impacts total project costs
  - Accurate characterization results in “remedy” savings (e.g. removal, treatment) by reducing uncertainty about cleanup goals and which remedy is most appropriate and cost effective
  - Monitoring and measurement activities occur from site assessment through site closeout, reuse
Arsenic Treatment Technologies for Soil, Waste, and Water

- Report on available/innovative treatment technologies for remediation, industrial/hazardous waste, and drinking water
- Some technologies included: solidification/stabilization, soil washing and flushing, precipitation, filtration, adsorption, ion exchange, PRBs, and phytoremediation
- Tabulates and summarizes performance and cost data based on literature search and use of technologies at Superfund sites

http://clu-in.org/arsenic
Proven Alternatives for Above-Ground Treatment of Arsenic in Groundwater

- New issue paper prepared with Engineering Forum
- Provides current state-of-practice for treatment of water
- Purpose is to help site managers screen technologies to achieve new arsenic MCL of 10 ug/l
- Summarizes project-specific data on 4 technologies:
  - Precipitation/coprecipitation
  - Adsorption
  - Ion Exchange
  - Membrane Filtration

http://clu-in.org/tsp
Types of Sites Likely to Have Significant NAPL

- Chlorinated Solvents - TCE most common contaminant at NPL sites
- Wood Treaters - > 80 sites on NPL
- Former Manufactured Gas Plants (MGP) - Estimated 3,500-35,000 sites
- Petroleum Refineries - Large quantities of LNAPL
- Dry Cleaners - Very prevalent class for state cleanup programs
Superfund Remedial Actions: Groundwater Remedies (FY 1982 - FY 1999)

Total Sites With Pump-and-Treat, Monitored Natural Attenuation (MNA) and In Situ Groundwater Treatment Remedies = 749

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<tr>
<th>Remedial Action</th>
<th>Sites</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Pump-and-Treat Only</td>
<td>521</td>
<td>71%</td>
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<tr>
<td>In Situ Only</td>
<td>16</td>
<td>2%</td>
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<tr>
<td>Pump-and-Treat and MNA</td>
<td>55</td>
<td>7%</td>
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<tr>
<td>In Situ and MNA</td>
<td>3</td>
<td>&lt;1%</td>
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<tr>
<td>Pump-and-Treat, In Situ, and MNA</td>
<td>14</td>
<td>2%</td>
</tr>
<tr>
<td>MNA Only</td>
<td>92</td>
<td>12%</td>
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</table>

Selection of P&T for Superfund Remedial Actions 1986 - 1999

Percentage of Groundwater RODs

Fiscal Year


0% 5% 7% 7% 9% 9% 13% 17% 18%

0% 6% 7% 5% 7% 9% 11% 13% 17% 18%

0% 5% 5% 5% 11% 11% 16% 18% 24% 30%

8% 5% 3% 5% 10% 7% 9% 18% 32% 59%

5% 6% 7% 7% 9% 10% 13% 18% 42% 53%

9% 88% 90% 90% 88% 78% 73% 67% 70% 50%

92% 91% 88% 90% 90% 88% 78% 73% 67% 50%

P&T Only
P&T and Another Groundwater Remedy (MNA or In Situ Treatment)
In Situ Treatment and MNA, but Not P&T
Superfund Pump and Treat Optimization Initiative

- 2-yr nationwide study to evaluate/optimize 20 Fund-lead P&T systems

- Cost reductions identified at 17 of 20 sites
  - Total potential cost savings exceeds $5M/yr
  - Over 30 yrs this could save EPA and States $150M

- Improvements in remedy protectiveness identified at 17 of 20 sites
  - Lack of sufficient evaluation of capture zones highest priority
Key Message from Reviews

GROUNDWATER REMEDIATION SYSTEMS REQUIRE ACTIVE MANAGEMENT

- Revisit system objectives
- Evaluate subsurface performance
- Evaluate above ground performance
- Evaluate potential cost reductions
- Develop exit strategy
- Evaluate contract efficiency
Further Resources re: Optimization

- Elements for Effective Management of Operating Pump and Treat Systems (final October 2002)


- Inventory of Optimization Approaches for Remediation Systems (USACE draft June 2002)

- Special topic area for the Federal Remediation Technologies Roundtable web site --
  (http://www.frtr.gov/optimization)

All documents to be available at www.cluin.org
Further Resources re: Optimization (Cont’d)

- Inventory of Optimization Approaches for Remediation Systems (USACE draft June 2002)

- Special topic area for the Federal Remediation Technologies Roundtable web site -- (www.frtr.gov/optimization)

- June 2004 Optimization Conference
  - Target audience: Regulators, site managers, contractors & researchers
  - Focus on new tools for remedy performance evaluation, improved operation, maintenance and monitoring, and cost reduction strategies (cluin.org)
NAPL Site Characterization

- Essential component of the remedial package
- Currently tool-limited for more complex scenarios
  - Large facilities/chlorinated solvents/heavier PAHs
- Subject of future technical information transfer efforts
- EPA/Army COE/DOE--Argonne actively investing in the rollout of the “Triad” approach to site monitoring
DNAPL Investigation Technologies: Current Resources

- Field Analytic Technology Encyclopedia (FATE) (http://fate.clu-in.org)

- Technology Overview: DNAPLs – Review of Emerging Characterization and Remediation Technologies, June 00 (http://www.itrcweb.org)

- Innovations in Site Characterization: Geophysical Investigation at Hazardous Waste Sites, Aug 00 (http://clu-in.org/techpubs.htm)
DNAPL Investigation Resources (cont.)

- Site Characterization Technologies for DNAPL Investigations (~100 pp), upcoming (August 03), TIO report (cluin.org/techpubs.htm)

- Strategies for Characterizing DNAPL Contamination, upcoming (Summer 03), ITRC report (www.itrcweb.org)
Rethinking Source Term vs. Plume Management

• Potential source term control solutions
  – Steam/Heat
  – Chemical oxidation
  – Surfactant-cosolvent flushing

• Outstanding issues
  – Science
  – Policy
  – Other (Economic – Public and Private sector)
Groundwater Plume Response

Pre-Remediation:

Partial Mass Removal:

Partial Mass Removal + Enhanced Natural Attenuation:
DNAPL Treatment Technologies: Current Resources

  (http://www.gwrtac.org)
- Technology Status Review: In Situ Oxidation – Nov 99
  (http://www.estcp.org/documents)
- Guidance for In Situ Oxidation at Contaminated Sites: Technology Overview with a Focus on Permanganate Systems, Siegrist et al, DOE Jan 2000
**DNAPL Treatment Resources (cont.)**

- In Situ Thermal Treatment Site Profiles – 67 projects
  ([http://clu-in.org/products/thermal](http://clu-in.org/products/thermal))
- In Situ Chemical Oxidation-- 200+ projects
  ([http://clu-in.org/products/chemox](http://clu-in.org/products/chemox))
- In Situ Surfactant/Cosolvent Flushing-- 46 projects (7 full-scale)
  Data Base under development
- In Situ Thermal Treatment Design Guide – Joint USACE/EPA effort – In preparation
Remediation Technologies Development Forum: NAPL Clean Up Alliance

- Mission: Develop technically practicable, cost-effective solutions to remediation of large sites contaminated with petroleum hydrocarbons (e.g., oil refineries)
- Formed in 2001; co-chaired by EPA Region 8 and Chevron/Texaco
- 15 members participate on the "core team" and many more "associate" members

http://www.rtdf.org/public/napl
RTDF-NAPL Alliance
Current Projects

• Evaluation of innovative technologies for LNAPL removal - 2 Region 8 sites (Texaco and Conoco)

• LNAPL decision-making framework document
  – Guide for characterization and remediation at large-scale LNAPL sites (draft 3/03)

• LNAPL Technical Training (anticipated 2003)
  – Characterization, mobility, and removal

• Pursuing additional state and EPA members
  – Recent discussions with ASTSWMO and TNRCC
State Coalition for Remediation of Dry Cleaners (SCRD)

- Public-public partnership formed by TIO with 11 states having legislation; formed in 1998
- Mission: Share information on technical solutions and other issues re: PCE in soils and groundwater from leaks, spills and drainfields
- States that are drafting legislation also attend (GA, LA, NM)
- Driving force in many states is deed transfers
1998 SCRD state survey of cleanup technologies
- 61% natural attenuation
- 60% oxidation
- 57% air sparging
- 20% bioremediation

Database of drycleaner site profiles
- 61 profiles
- Source removal technologies
- Small sites are a microcosms – technology application is quicker and more precise

http://drycleancoalition.org
CLU-IN World Wide Web Site
http://clu-in.org

- Site Remediation Technologies
- Site Characterization Technologies
- Technology Partnerships, Roundtables, and Consortia
- Updates on International Clean-Up Activities
- Vendor Support
- Publications for Downloading
- Free E-mail Updates via TechDirect
- Regulatory Information and Technology Policy
- Links to Other Internet and Online Resources
Broadcasts periodic e-mail messages to list of over 16,000 subscribers

Highlights events of interest to site remediation and site assessment professionals

Describes new products and provides instructions on how to obtain them
Top 10 Websites For Hazardous Waste Management
