Phytotechnology: Current Trends and Prospects

Presented at U.S. EPA International Applied Phytotechnologies Conference
March 3, 2003
Chicago, IL

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Clients for Information on Technology Innovations

Technology Vendor

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

International Markets

Investor Community

Technology Vendors
Outline

• Status of phytotechnology and alternative cover design concepts in Superfund program
• Available information on locations, performance, and cost
• U.S. partnerships to support phytotechnology
• Outstanding issues and data needs to increase acceptance
Superfund Remedial Actions: In Situ Technologies for Source Control (FY 1985 - FY 1999)

Selection of Phytotechnologies at Superfund Sites

• Selected 12 times in last 6 years
• Applications
  – 3 projects for soil only
  – 5 projects for groundwater only
  – 4 projects for both soil and groundwater
• Projects address chlorinated VOCs, metals, pesticides, and hydrocarbons
• Many use trees
• Represent small portion of Superfund soil and groundwater remedies
EPA REACH IT System

- Free information service, searchable on-line
- Information on over 600 treatment and 125 characterization technology vendors
- Site information on 934 EPA Superfund projects
- Flexible search options include by technology, contaminant, media, and sites
- Easier-to-use website
- Comprehensive update underway in 2003
  - Includes 7 newly entered phytoremediation vendors for a total of 9

http://www.epareachit.org
Federal Remediation Technologies Roundtable
Number of Phytoremediation Case Studies
(Total = 8 Sites*)

Types of Contamination

- Some sites address more than one type of contaminant.
Phytotechnology Resources

**www.cluin.org**
- Introduction to Phytoremediation, Feb 00, EPA
- Phytoremediation of Contaminated Soil and Groundwater at Hazardous Waste Sites, Feb 01, EPA
- Citizen’s Guide to Phytoremediation, April 01, EPA
- Phytoremediation Resource Guide, Jun 99, EPA
- Phytotechnologies Internet Seminar, May 01, ITRC
- Phytoremediation of VOCs in Groundwater, Feb 03

**www.rtdf.org**
- Phytoremediation of Organics Action Team Information
- RTDF Phytoremediation Bibliography (~1,400 citations)

**www.gwrtac.org**
- Technology Overview Report: Phytoremediation, Oct 96, GWRTAC
- Technology Evaluation Report: Phytoremediation of Soil and Ground Water, Mar 02, GWRTAC
Phytotechnology Resources (Cont’d)

www.itrcweb.org
• Phytoremediation Decision Tree, Dec 99, ITRC
• Phytotechnology Technical and Regulatory Guidance Document, Apr 01, ITRC

www.unep.or.jp/ietc
• Phytoremediation: An Environmentally Sound Technology for Pollution Prevention, Control and Remediation
Report on Phytoremediation for Plume Control

- Prepared by graduate student under EPA fellowship
- Documented 50 ongoing and 5 planned projects
  - Site name, contact, tree species, contaminants, year planted, objectives, performance
- Found lack of published information on performance and lessons learned
  - Lack of historical and current contamination data needed to determine trend

http://cluin.org/studentpapers
Remediation Technologies Development Forum

- Partnerships between private industry, universities, and government (EPA, DOE, DOD) — each party provides resources and expertise
- Mutual priorities/user needs are identified
- Action Teams formed to further technology development
- Phytoremediation of Organics Action Team
  - TPH in Soil
  - Alternative Cover Assessment Program (ACAP)
  - Chlorinated Solvents

http://www.rtdf.org
RTDF TPH Project

- Goal to assess efficacy of vegetation to enhance degradation of aged petroleum hydrocarbons in soil
- Uses standardized protocol
- Plants include grasses, legumes, and trees
- 13 sites evaluated under different climatic conditions for 3 growing seasons
- 9 sites completed; 4 in progress
- Regulators participating

http://www.rtdf.org
Preliminary Findings of TPH Project

- Less expensive than bioremediation (no tilling, and less fertilizer).
- Deeper treatment than unplanted.
- Works best on widespread, low to medium contamination, light hydrocarbons.
- Aesthetically appealing
INCREASING AESTHETICS
(Texas City)

Barren Landscape
Before Planting

Lush Vegetation
After Planting
RTDF Alternative Covers Assessment Program

- RTDF demonstrating effectiveness of 21 cover designs at 12 sites
- Includes side-by-side evaluations of conventional and alternative covers in different climates
- Performance assessment via large drainage lysimeters that provide direct water drainage measurements
- All sites have at least 2 years of data of a planned 5-year data collection program

Interim results at [http://www.acap.dri.edu](http://www.acap.dri.edu)
Alternative Landfill Cover (ALC) Design Applications: Project Profiles

- On-line project profiles on proposed, tested, or installed cover design alternatives
- 56 landfills and waste sites as of Feb. 2003
- Contains data on site background, cover design, performance & cost, and contacts
- Search by cover type, project name, scale, status, and location
- Allows users to submit new profiles or update existing projects

http://cluin.org/products/altcovers
Phytotechnology: Good News (Part 1)

- Applicable to a broad range of contaminants and media types
- Can be cost-effective
  - Low maintenance, passive, in situ, self regulating
  - Remote operation, large areas
- Green technology
  - Aesthetics, public acceptance
  - Solar-powered, energy efficient
  - Habitat friendly, habitat creation, promotes biodiversity
- Protective
  - Minimizes emissions & effluent, may have low secondary waste volume
  - Controls erosion, runoff, rain infiltration, and dust emissions
Phytotechnology-Alternative Covers
Good News (Part 2)

- Generally less expensive to construct than conventional cover designs
- Lower operation & maintenance costs possible
- Potential to provide equal or superior infiltration performance
  - Less prone to dessication/cracking, especially in arid/semi-arid environments
  - May increase side slope stability
Phytotechnology Issues

- Does it reduce concentrations sufficiently?
- How can treatment be accelerated?
- Is it cost-effective, considering all factors (e.g., time to achieve goals, disposal of plant mass)?
- Under what conditions does it work (contaminants, concentrations, climate, soil types)?
- Are ecological concerns (genetically engineered & non-native plants) being addressed?
- Are effects on wildlife understood?
Conclusions

- U.S. moving toward more in situ, natural processes
- Phytotechnology: many potential roles in site cleanup and management
- Applied research stage for phytotechnology means little real-time data sharing, e.g., time for peer review
- Applications for plume control on increase
- Demonstration programs addressing issues, but scale of effort means issues remain
- Coordinated national data sharing for field applications needed
- Practitioners may be getting ahead of science; need to minimize false starts
RevTech Conference
Pittsburgh, PA (July 22-24, 2003)

- Cleaning Up Contaminated Properties for Reuse and Revitalization: Effective Technical Approaches and Tools
- Focuses on assessment and cleanup activities at reuse, revitalization, and Brownfield types of properties
- Will demonstrate how approaches and technologies support redevelopment
- Technical, financial and regulatory sessions
- Exhibits, posters, and “Technology Fair”
- Training opportunities

http://cluin.org/brownfieldstsc.org