

Phytotechnology: Current Trends and Prospects

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Phytotechnologies Conference

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Technology Innovation Office

Clients for Information on Technology Innovations

Technology Vendor

**Responsible
Party/
Owner
Operator**

**Federal/
State
Project
Manager**

**Consulting
Engineer**

International Markets

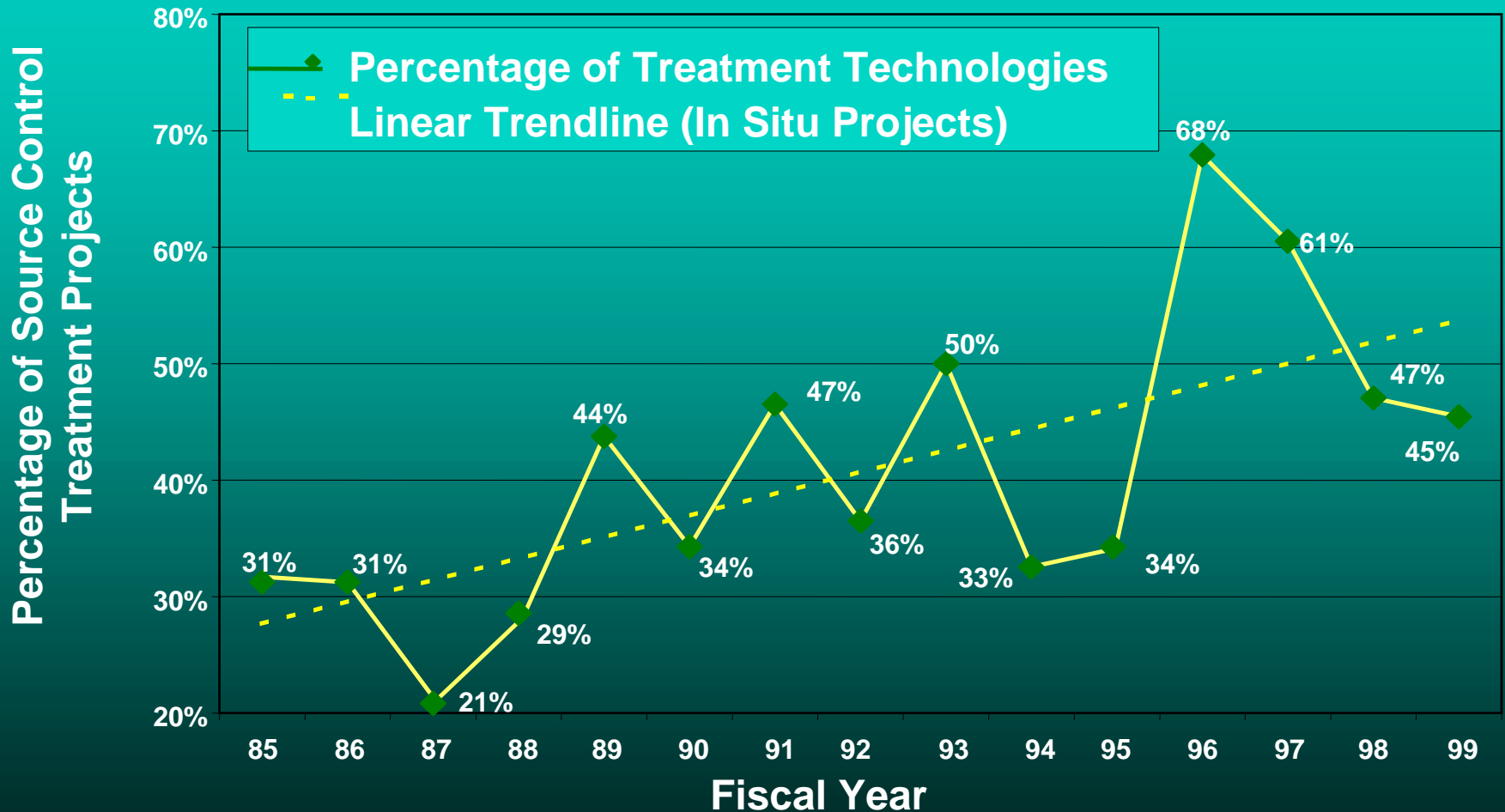
Investor Community

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)



Source: *Treatment Technologies for Site Cleanup: Annual Status Report (Tenth Edition)*, EPA 542-R-01-004, February 2001, <http://clu.in.org>

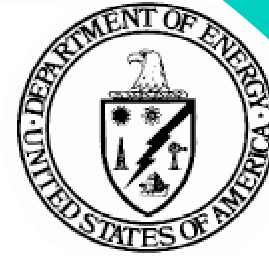
Selection of Phytotechnologies at Superfund Sites

- 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

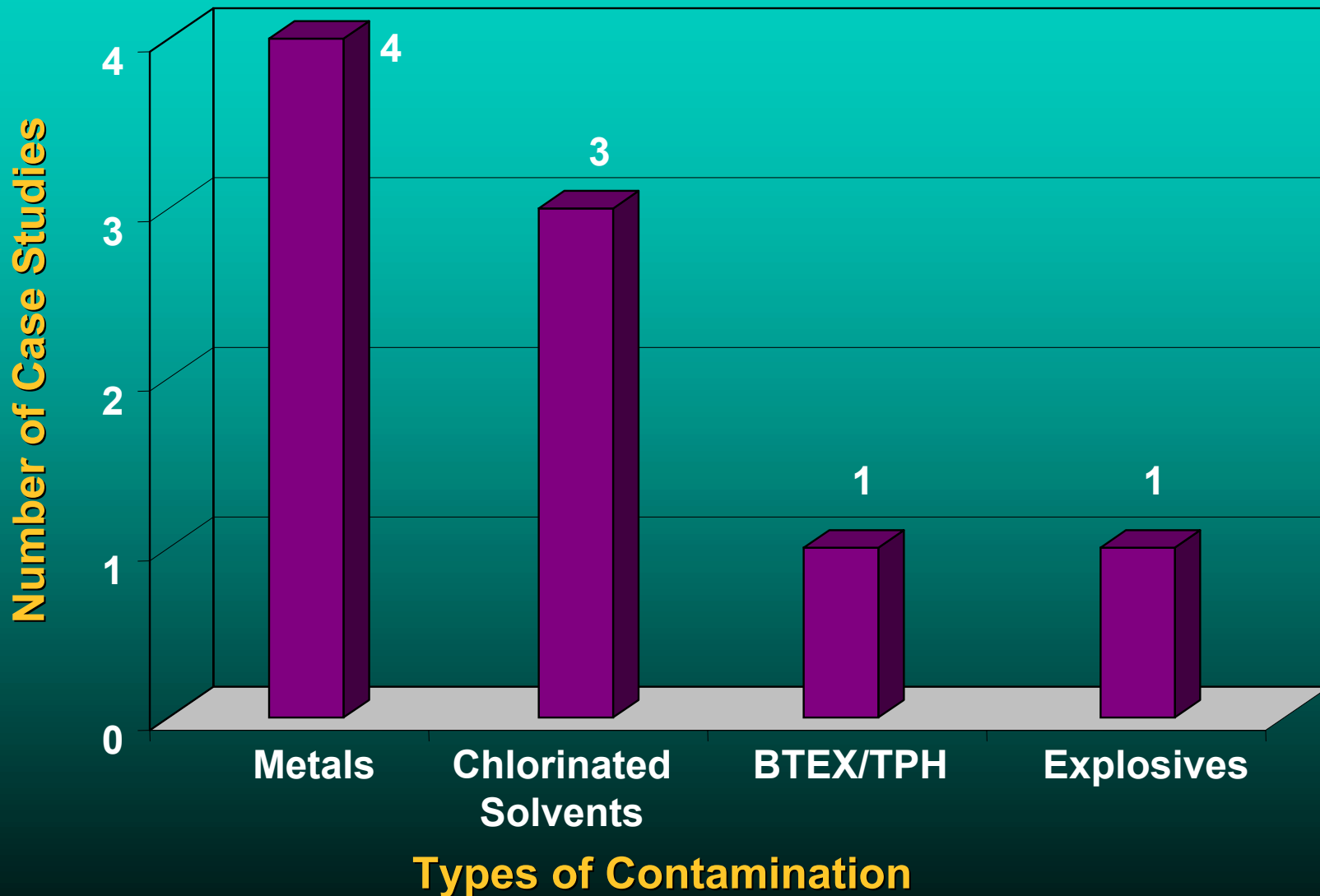
<http://www.epareachit.org>



Federal Remediation Technologies Roundtable



Number of Phytoremediation Case Studies (Total = 8 Sites*)



* 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, Oct 97, 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://clu.in.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

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>

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://clu.in.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 desiccation/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

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***Hazardous Waste
Clean-Up Information***

