

Technology Developments for Accelerating Revitalization

RevTech

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**Marriott City Center
Pittsburgh, Pennsylvania**

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Brownfields to “Land Revitalization”

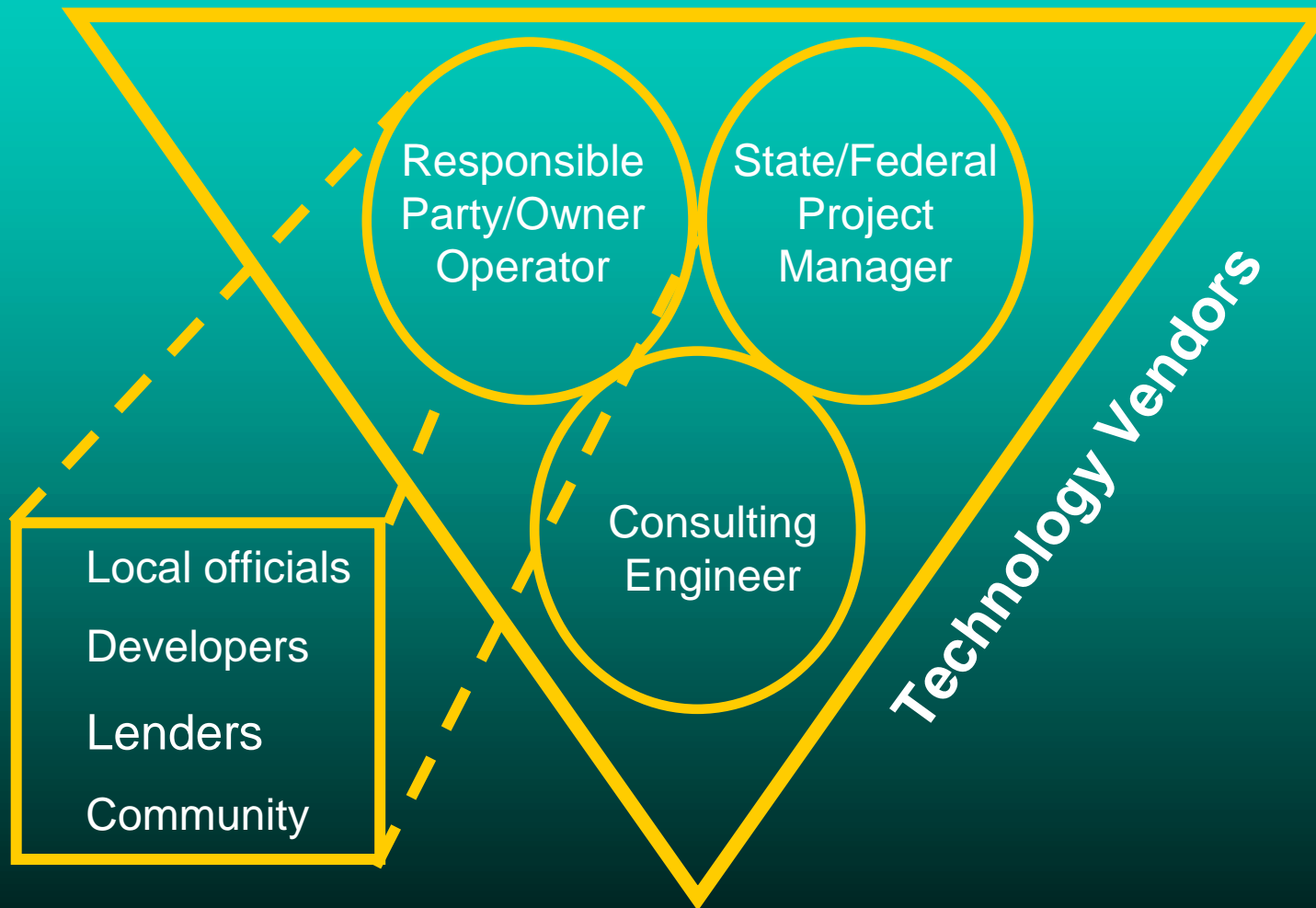
- Multiple reuse initiatives, efforts, programs, etc.
 - Brownfields (National)
 - Superfund site recycling
 - USTFields
 - RCRA Brownfields
 - Base Realignment and Closure (“Federal Brownfields Sites”)
 - State programs
 - Voluntary Clean-Up Programs
 - Brownfields
 - State clean-up/State “Superfund”
 - 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 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)



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

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 = Un~~pro~~ven, un~~us~~ed, un~~re~~liable

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

Drive

Decisions:

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

Determine

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



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*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



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- 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



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- 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



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- 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

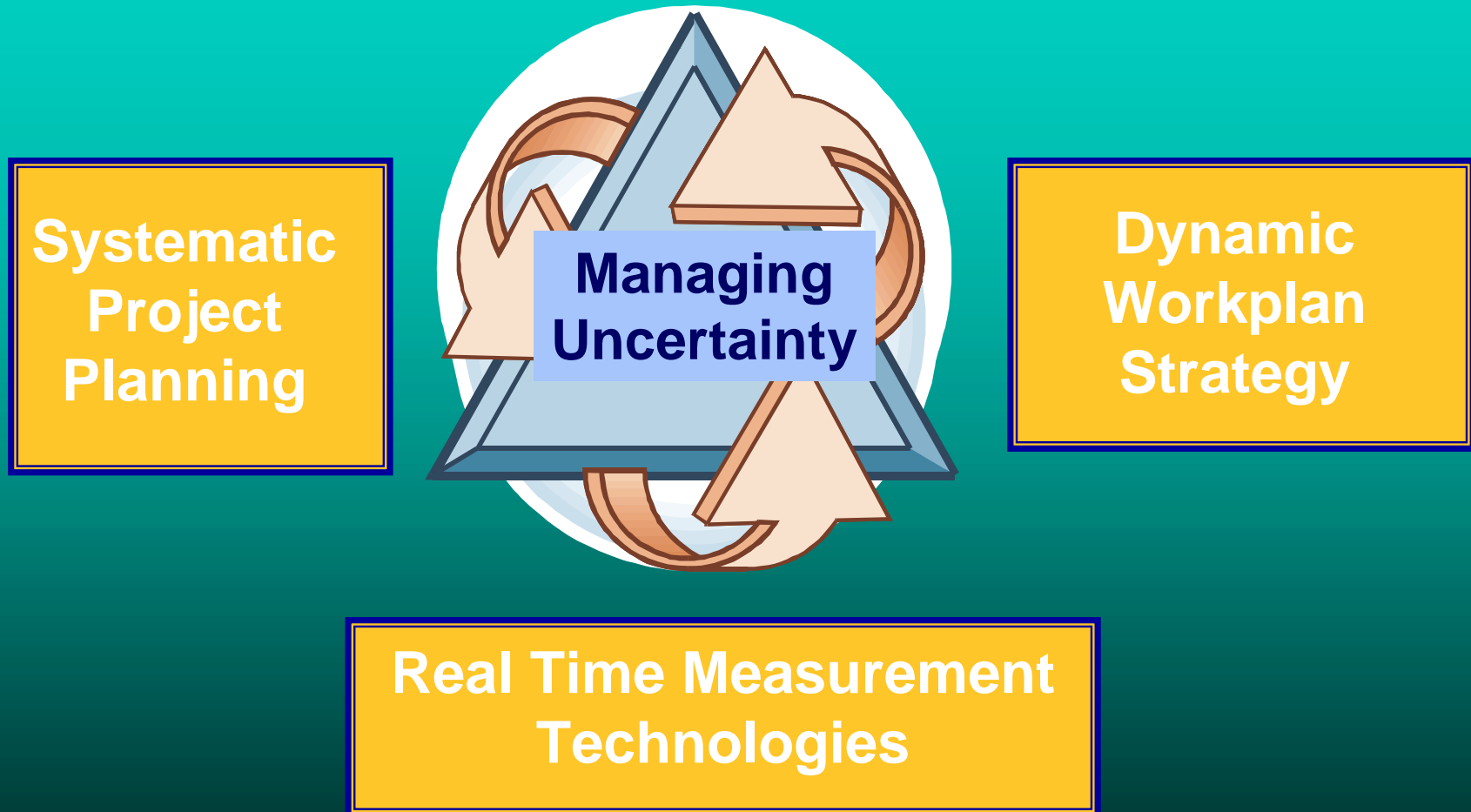
Working with Localities

- 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

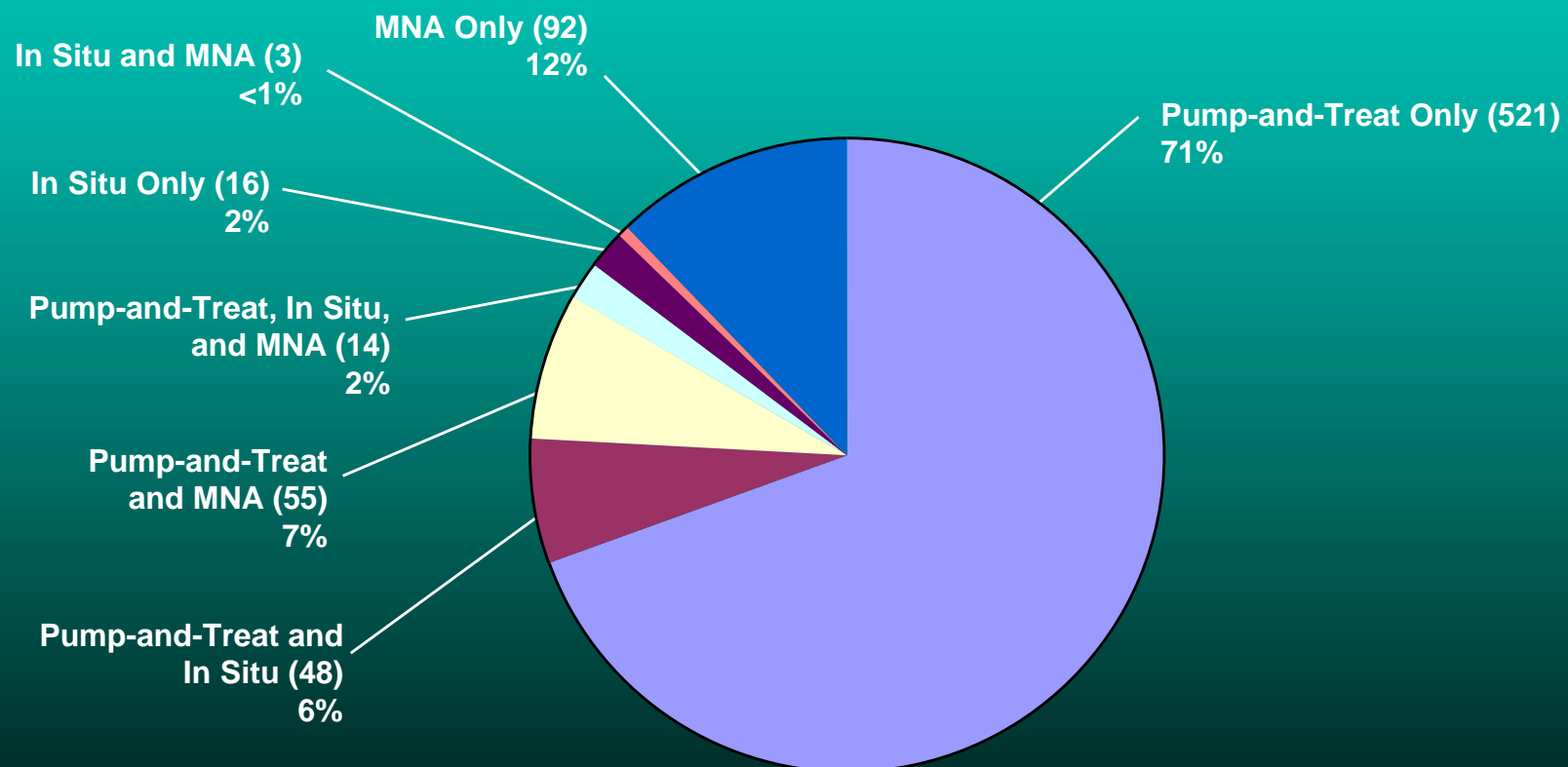
<http://clu-in.org/tsp>

Types of Sites Likely to Have Significant NAPL

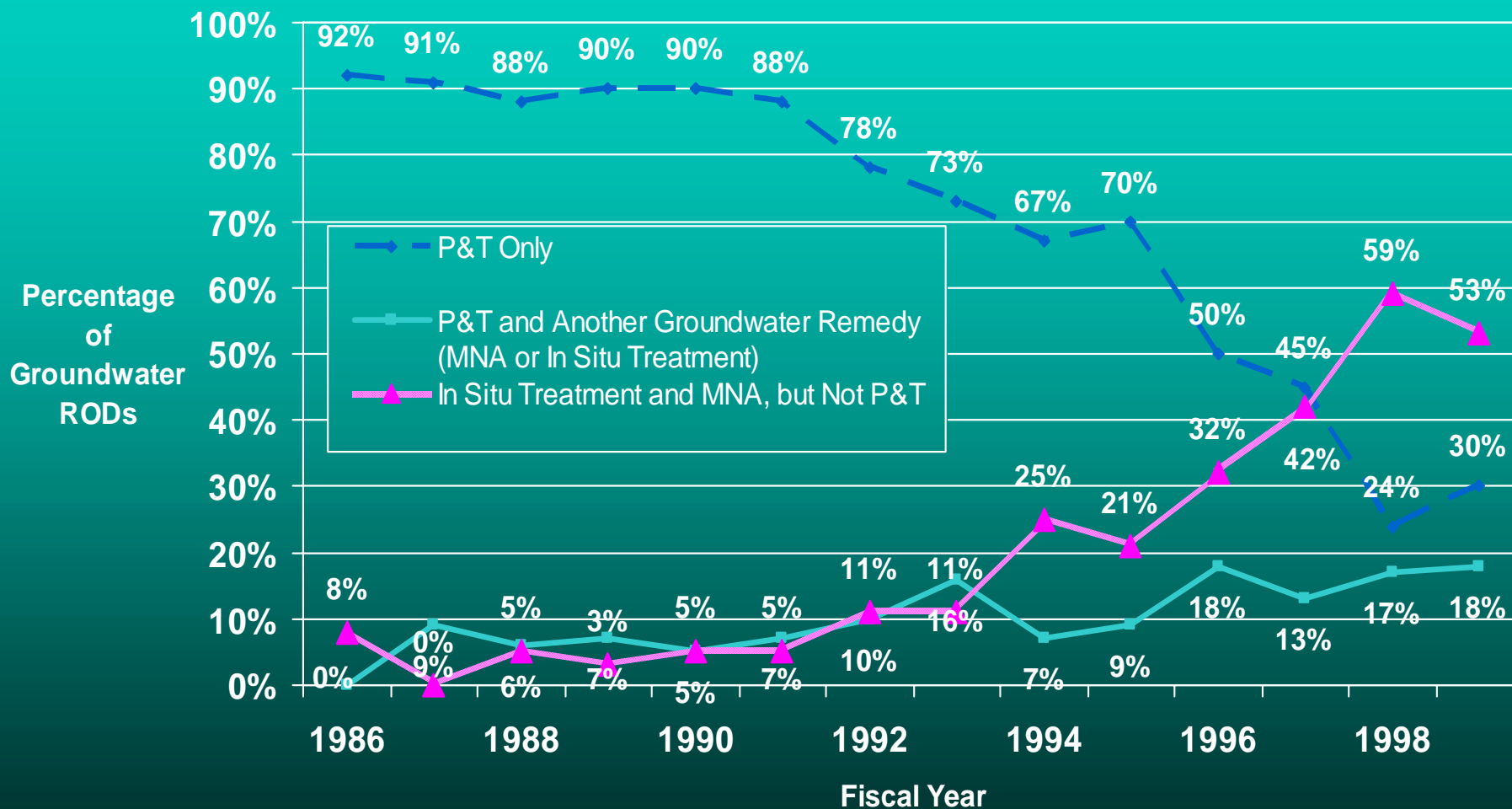
- Chlorinated Solvents - TCE most common contaminant at NPL sites
- Wood Treaters - > 80 sites on NPL
- Former Manufactured Gas Plants (MGP) - Estimated 3,500-35,000 sites
- Petroleum Refineries - Large quantities of LNAPL
- Dry Cleaners - Very prevalent class for state cleanup programs

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



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



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)
- Best Practices for Evaluating Ground Water Capture Zones (draft December 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
(clu.in.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.)

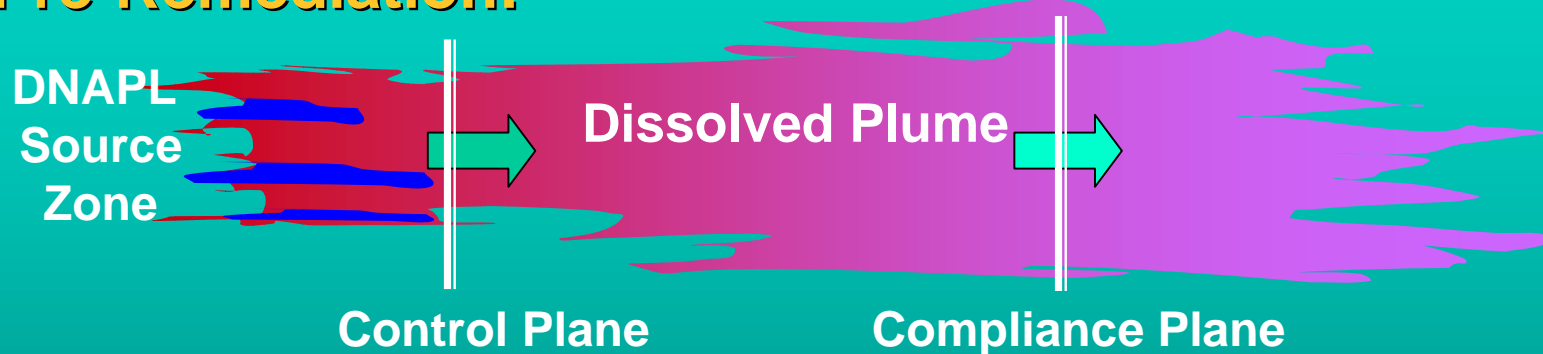
- **Site Characterization Technologies for DNAPL Investigations (~100 pp), upcoming (August 03), TIO report (clu.in.org/techpubs.htm)**
- **Strategies for Characterizing DNAPL Contamination, upcoming (Summer 03), ITRC report (www.itrcweb.org)**

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

- Technology Evaluation Report: Technologies for Dense Nonaqueous Phase Liquid Source Zone Remediation – Dec 98
(<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>)
- In Situ Chemical Oxidation-- 200+ projects
(<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 ground water from leaks, spills and drainfields
- States that are drafting legislation also attend (GA, LA, NM)
- Driving force in many states is deed transfers

SCRD- Resources (cont.)

- 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>

EPA United States Environmental Protection Agency

Technology Innovation Office

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Hazardous Waste Clean-Up Information [Jump to a CLU-IN Section](#)

- 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

TechDirect

Highlights

- 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

1. <http://clu-in.org> (or <http://www.epa.gov/tio>)
2. <http://www.epareachit.org>
3. <http://www.frtr.gov>
4. <http://www.gwrtac.org>
5. <http://www.rtdf.org>
6. <http://www.epa.gov/ord/SITE>
7. <http://em-50.em.doe.gov>
8. <http://www.itrcweb.org/>
9. <http://www.serdp.org/research/research.html>
10. <http://www.epa.gov/etv/>

