



ITRC Summary of DNAPL Activities and Future Plans

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ITRC BioDNAPL Team and EACO Team
September 12, 2007

Presentation Outline

- ▶ What is ITRC?
- ▶ Outline of teams relevant to chlorinated solvents
- ▶ Discussion of ITRC resources
- ▶ BioDNAPL team activities
- ▶ EACO team activities

ITRC – Shaping the Future of Regulatory Acceptance



► Network

- State regulators
- Federal government
- Industry
- Consultants
- Academia
- Community stakeholders

► Documents

- Technical and regulatory guidance documents
- Technology overviews
- Case studies

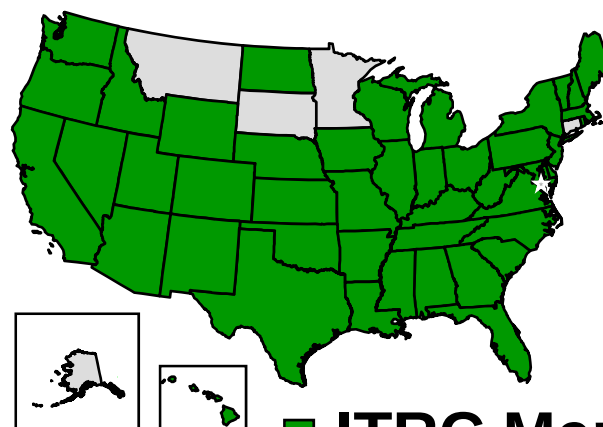
► Training

- Internet-based
- Classroom

Host Organization



ITRC State Members



■ ITRC Member State

Federal
Partners



DOE



EPA



DOD

4 Chlorinated Solvent/DNAPL Focused ITRC Teams



Inactive teams with resources still available

- ▶ DNAPLs Team
- ▶ ISCO Team
- ▶ PRB Team

Active teams with current/future resources available

- ▶ Bioremediation of DNAPLs Team
- ▶ Enhanced Attenuation of Chlorinated Organics Team
- ▶ Sampling, Characterization, and Monitoring Team

Chlorinated Solvent/DNAPL Focused ITRC Teams



► DNAPLs Team Documents

- DNAPL-1: “Review of Emerging Characterization and Remediation Technologies”
- DNAPL-2: “DNAPL Source Reduction: Facing the Challenge”
- DNAPL-3: “Technical and Regulatory Guidance for Surfactant/Cosolvent Flushing of DNAPL Source Zones”
- DNAPL-4: “An Introduction to Characterizing Sites Contaminated with DNAPLs”
- DNAPL-5: “Strategies for Monitoring the Performance of DNAPL Source Zone Remedies”

Chlorinated Solvent/DNAPL Focused ITRC Teams



► ISCO Team

- Primary resource is “Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater: 2nd Edition”

► PRB Team

- “Permeable Reactive Barriers: Lessons Learned/New Directions”

Chlorinated Solvent/DNAPL Focused ITRC Teams



- ▶ Sampling, Characterization, and Monitoring team
 - SCM-1 “Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management” (December 2003)
 - SCM-2 “The Use of Direct Push Well Technology for Long-term Environmental Monitoring in Groundwater Investigations” (March 2006)
 - SCM-3 “Triad Implementation Guide” (May 2007)

BioDNAPL Team

- ▶ Formed in 2004 with a focus primarily on chlorinated ethenes
- ▶ Resources currently available
 - “Overview of In Situ Bioremediation of Chlorinated Ethene DNAPL Source Zones” (October 2005)
 - Resource Guide (April 2007)
 - “In Situ Bioremediation of Chlorinated Ethene DNAPL Source Zones: Case Studies” (April 2007)
- ▶ Products currently in development
 - “Technical and Regulatory Guidance for In Situ Bioremediation of Chlorinated Ethene DNAPL Source Zones” (June 2008)
 - Internet training seminars based on Tech/Reg document (mid-late 2008)

Overview of In Situ Bioremediation of Chlorinated Ethene DNAPL Source Zones



<http://www.itrcweb.org/Documents/BioDNAPL-1.pdf>

October 2005

Prepared by
The Interstate Technology & Regulatory Council
Bioremediation of DNAPLs Team

10 *In Situ* Bioremediation of DNAPL Technology Background



- ▶ Innovative technology – rapidly evolving
- ▶ Based on stimulating reductive dechlorination in source areas by enhancing mass transfer
- ▶ Ability to degrade near-solubility concentrations recently realized
- ▶ Increasing number of laboratory and field applications

Advantages

- ▶ Complete destruction to innocuous products
- ▶ Likely faster than baseline pump-and-treat
- ▶ Less expensive than other remediation options
- ▶ Can treat dissolved and sorbed contaminants
- ▶ Very flexible technology

Limitations

- ▶ Residual toxic intermediates may accumulate
- ▶ Some contaminants (or co-contaminants) are toxic and/or resistant to biodegradation
- ▶ May cause biofouling of wells or clog the subsurface
- ▶ Hydrogeology of a site may not be favorable
- ▶ Ability to treat high-strength sources debatable



BioDNAPL Case Study Forum

Field Work
Test Cell #1

12.7.1999

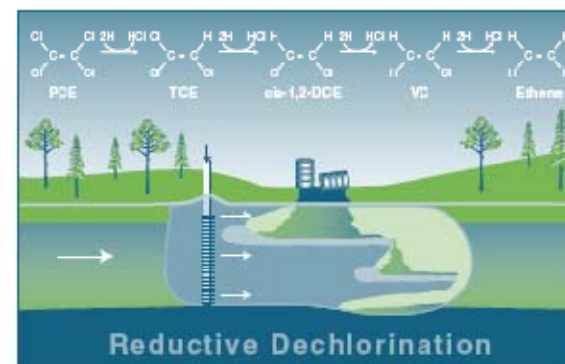
Test Cell #1 at Dover National Test Site (DNTS) 100L PCE released

16 *Dover ITRC Case Study / March 06*



Case Study

In Situ Bioremediation of Chlorinated Ethene DNAPL Source Zones: Case Studies



April 2007

Prepared by
 The Interstate Technology & Regulatory Council
 Bioremediation of DNAPLs Team

Broad Range of Conditions

- ▶ Location: East Coast to West Coast
- ▶ Donor: HRC, EOS, lactate, molasses, whey, ethanol
- ▶ Scale: Small test plot to huge full-scale
- ▶ Monitoring: Highly monitored demos – dry cleaner
- ▶ Depths: 5-300 feet
- ▶ Goal: Enhance Flushing, Contain Source, Reduce Flux, Reduce Longevity
- ▶ Geology: Sands, Silts, Fractured Bedrock
- ▶ Flow: Slow to Very Fast
- ▶ DNAPL: TCE sludge, Aged TCE / PCE, Fresh PCE
- ▶ Conc: ca. 2,000 – ca. 350,000 ug/L

Case Studies Presented at the Forum



Test Area North Case Study

Bioremediation of DNAPLs Team
ITRC Case Study Forum
March 28, 2006

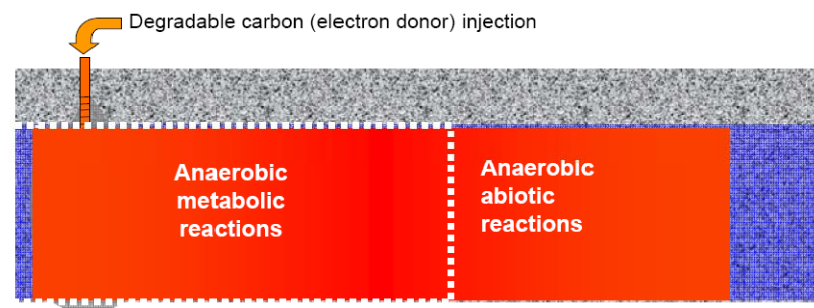


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Manufacturing Facility - PCE DNAPL Case Study

ITRC BioDNAPL Team
October, 2005



Fred C. Payne, Ph.D.
ARCADIS, Southfield, MI



Case Studies Presented at the Forum



Biodegradation of Dense Non-Aqueous Phase Liquids (DNAPLs) through Bioaugmentation of Source Areas

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Tel. (805) 982-1616
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NETTS Manager

Dr. David Major
Michaye McMaster
GeoSyntec Consultants
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Launch Complex 34 Kennedy Space Centre

Application of Enhanced Bioremediation in A DNAPL Source Zone

Eric Hood, David Major – GeoSyntec
Jacqueline Quinn – NASA
Sam Yoon, Arun Gavaskar – Battelle

March 28, 2006



Case Studies Presented at the Forum



Enhanced Anaerobic Bioremediation of a TCE Source Area using EOS®

Robert C. Borden, P.E., Ph.D.
Christie Zawtock, P.E.
Walt Beckwith, P.G.
Solutions-IES
919-873-1060
www.solutions-ies.com



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tCOB® is a registered trademark of COB Remediation, Inc.

Portland, Oregon Dry Cleaners: Bioremediation of a PCE Source Area

Anna Willett
Haley and Aldrich, Inc.

Steve Koenigsberg (ESC, LLC)
Kevin Parrett (ODEQ)
Rick Gillespie (Regenesis)

ITRC Bioremediation of DNAPLs Forum
Long Beach, CA
March 28-29, 2006



BioDNAPL Case Study Forum: Outcomes

- ▶ **“Credible evidence for ISB of sources”**
- ▶ **Tentative niche definition**
 - Low strength sources (no massive pools)
 - Relatively homogeneous and permeable
 - Sufficient time (slow technology) and access (for injections)
 - Hydraulic capture or sufficient downgradient buffers
 - “Where cost is a major driver”
- ▶ **Concerns**
 - Mobilizing DNAPL
 - Partial degradation – vapor risks?

ITRC Team



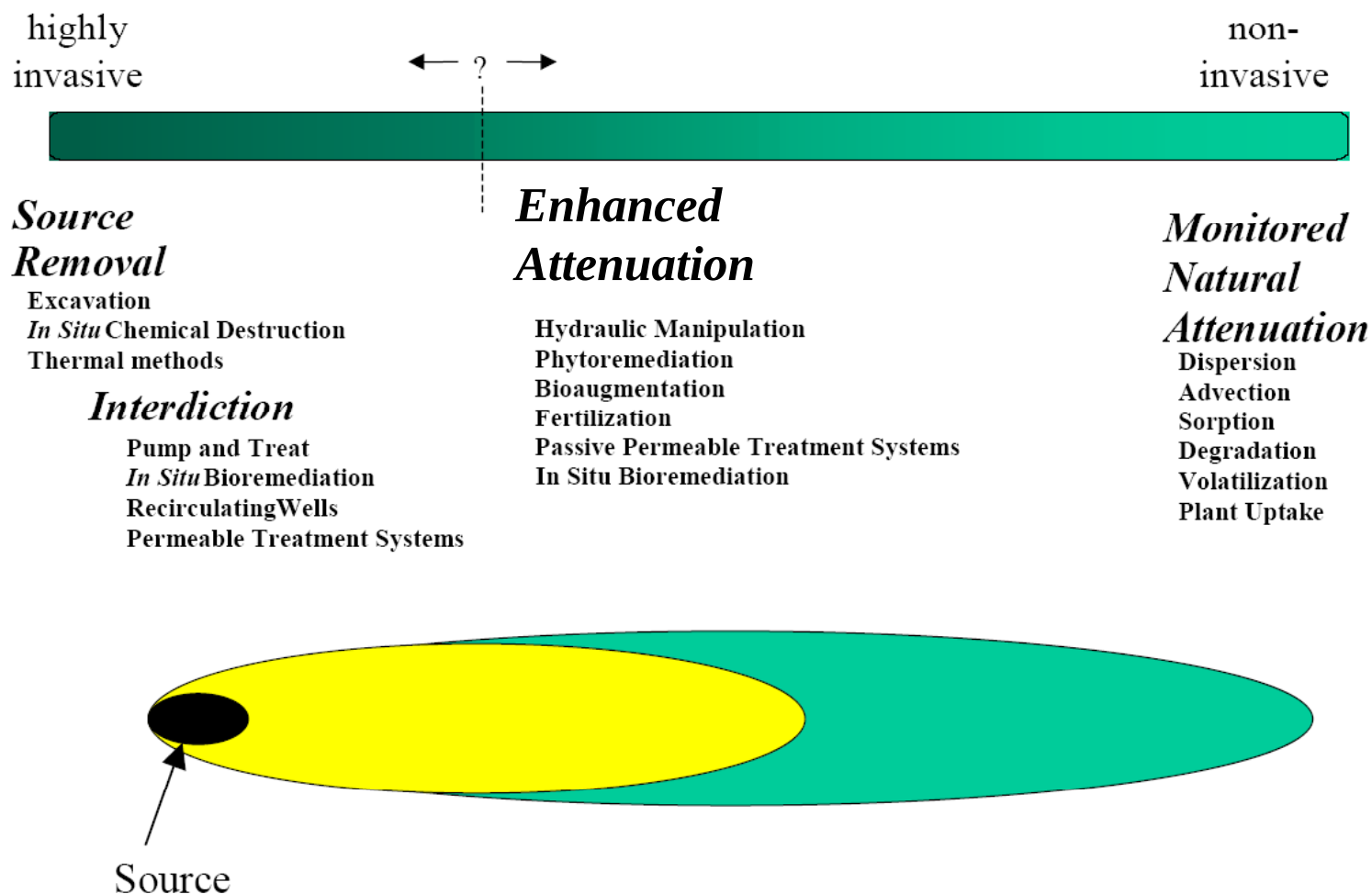
Enhanced Attenuation

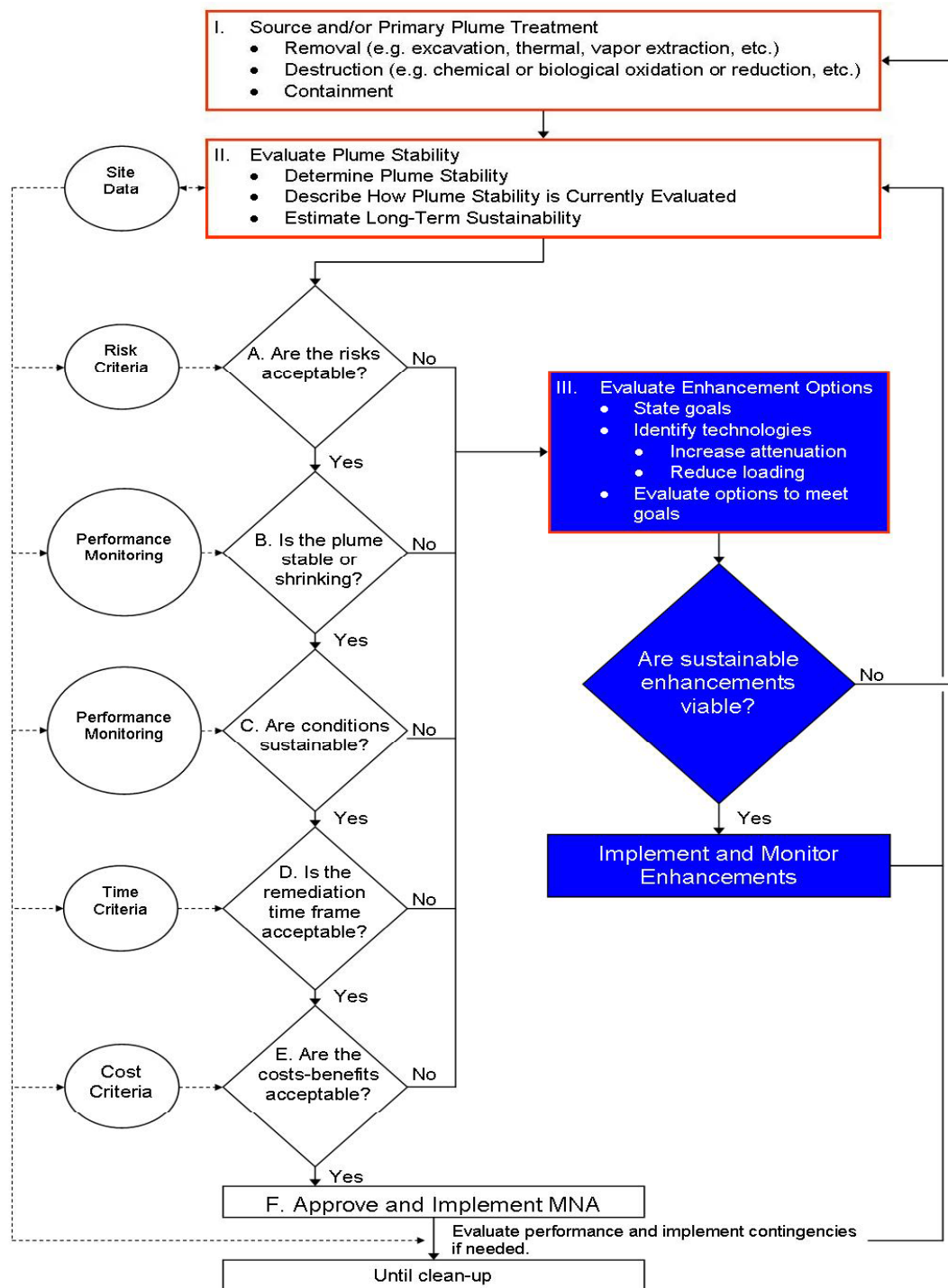
Chlorinated Organics

EACO Team

- ▶ Formed in 2004
- ▶ Focus on chlorinated solvents
- ▶ Resources available
 - EACO Resource Guide (October 2006)
 - Decision Framework (April 2007)
- ▶ Products currently in development
 - Technical and regulatory guidance for Enhanced Attenuation: Chlorinated Organics (April 2008)
 - Internet training seminars based on Tech/Reg document (mid 2008)

Integrated Remediation Philosophy





Summary

- ▶ ITRC has been very active in the area of chlorinated solvents and DNAPLS for the past 10-15 years
- ▶ Many resources produced during this time are still relevant to the environmental community
- ▶ Recently released products and those currently in development are cutting edge resources for characterization, remediation, and performance monitoring of chlorinated solvent contaminated sites.
- ▶ Downloads available at www.itrcweb.org