



RTDF Update



A Progress Report on the Remediation Technologies Development Forum (RTDF)

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In Situ FLUSHING TEAM

Focus:

- NAPLs
- Solubilization/mobilization
- In ground water

In Situ Flushing Team Establishes Subgroups

The RTDF's *In Situ* Flushing Action Team has established four new subgroups to accomplish the work involved in a year-long project to encourage the use of *in situ* flushing technologies for remediating non-aqueous phase liquids (NAPLs). The project's four primary goals reflected in the subgroups are to conduct an economic assessment, develop performance criteria, prepare a guide on best technical practices, and develop a full-scale design model.

Economics and Recovery/Reuse

The Economic Assessment and Remedial Agent Recovery/Reuse Subgroup is chaired by Dr. Jeff Harwell (University of Oklahoma). This subgroup focuses on:

- Identifying how to recover and reuse surfactants for different NAPLs (*e.g.*, chlorohydrocarbons) and summarizing the technological status and cost of these methodologies;
- Examining the pros and cons of using various "bottom-line" flushing cost measures and determining which measures are the most useful;
- Reviewing and comparing existing economic analyses, identifying the assumptions used to generate them, and presenting this information in a "user-friendly" form; and
- Surveying state regulators to determine their attitudes toward surfactant injection and reinjection and using this information to produce "best-practice" guidelines.

Endpoint Assessment

Dr. George Losonsky (IT Corporation) and Randy Parker (U.S. EPA) chair the Endpoint Assessment/Technical Performance Criteria Subgroup. The subgroup's objectives are to:

- Develop guidelines for establishing acceptable target endpoints for contaminant concentrations and surfactant concentrations that remain in the soil after flushing is completed;
- Develop guidelines for predicting the ability to reach target endpoints and any potential negative outcomes; and
- Develop a framework for performance assessment.

Technical Practices

Dr. Gary Pope (University of Texas) chairs the Technical Practices/Protocol Subgroup. This group's objectives are to:

- Create a "living," up-to-date technical guide on both best practices and technology needs; and
- Design the technical guide for the Internet so that the document can be updated by the group and linked to relevant source documents.

About the RTDF

The Remediation Technologies Development Forum (RTDF), which was established in 1992, is a consortium of partners from industry, government, and academia who are working together to develop safer, more effective, and less costly characterization and treatment technologies for remediation. For information on RTDF and Action Teams visit the RTDF Home Page at <http://www.rtdf.org>

The Subgroup already has developed a draft outline for the two-volume technical guide, using the *Technology Practices Manual* written by the Advanced Applied Technology Demonstration Facility (AATDF) as a resource and "point of departure." Volume I will address "What We Know Now" and will be targeted for regulators and contractors. Volume II will address "What We Still Need To Do" and will be targeted for researchers.

Full-Scale Design

The Full-Scale Design Subgroup is chaired by Dr. Michael Annable (University of Florida). The Subgroup's objectives are to:

- Develop a hypothetical full-scale *in situ* flushing design that will serve as a model for others; and
- Identify a full-scale design project in which this Subgroup might serve in an advisory role.

The Subgroup expects to produce a document outlining steps involved in the full-scale design process and significant issues, and to share additional site designs through the *In Situ* Flushing Action Team's home page on the RTDF site on the World Wide Web. The Subgroup is looking for sites that might qualify as one of the first full-scale remediation studies and intends to make frequent reports on the RTDF Web site on the progress of the search and details of the design development at the selected site or sites.

More details about the plans of these Subgroups, including information on how to participate, is available on the *In Situ* Flushing Action Team's home page on the RTDF Web site. The *In Situ* Flushing Action Team is planning its next meeting for Summer 1998, and the agenda will include updates on the Subgroup's work. For more information, contact Action Team Co-chairs, Dr. Lynn Wood (U.S. EPA/National Risk Management Research Laboratory [NRMRL]), 405-436-8552 or (e-mail) wood.lynn@epa.gov, or Mr. Steve Shoemaker (DuPont Engineering), 281-586-2513 or (e-mail) stephen.h.shoemaker@usa.dupont.com.

BIOREMEDIATION CONSORTIUM

Focus:

- Chlorinated solvents
- Degradation
 - In soil and ground water

USAF To Use Accelerated Anaerobic Biodegradation for Dover AFB Cleanup

Based on the RTDF Bioremediation of Chlorinated Solvents Consortium's successful demonstration of the effectiveness of accelerated anaerobic biodegradation, the U.S. Air Force has elected to use the process in full-scale cleanup of a plume at the Dover Air Force Base (DE) site. Full-scale implementation currently is scheduled for 1999.

The goal of the Consortium's work related to accelerated anaerobic biodegradation is to understand thoroughly the operation, cost, and performance of the process to degrade chlorinated solvents in ground water and to work out microbial parameters (see Figure 1). *In situ* anaerobic dechlorination is typically limited by the availability of food and nutrients for microbial growth. The Consortium's initial

work on accelerated anaerobic biodegradation focused on determining what these nutritional limitations are and how to deliver additional nutrients to the aquifer effectively. In addition, the early studies determined which electron donors and acceptors best support anaerobic bioremediation; optimized the chlorocarbon destruction rate; and determined what factors control the degradation kinetics.

The Consortium installed a pilot accelerated anaerobic biodegradation system at Dover AFB in 1996. The Consortium installed three injection wells to deliver additives and constructed three recovery wells downgradient to provide the ground water to be augmented. Together, the wells created a hydraulically contained cell for the test. In October 1996, the Consortium injected additives. They included sodium lactate as the substrate, or electron donor, ammonium phosphate as the nutrient, and a small amount of yeast extract.

By March 1997, TCE in the cell was completely degraded to *cis*-DCE by native bacteria, but was not fully degrading to non-toxic by-products. As a result of this development, the Consortium elected to augment a portion of the pilot with

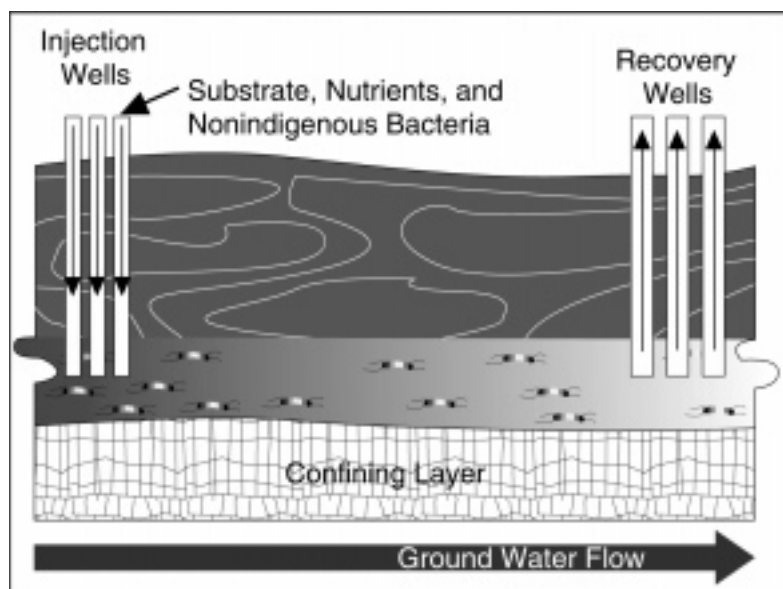


Figure 1. Schematic diagram of accelerated anaerobic biodegradation.

microorganisms that have the ability to further degrade DCE and vinyl chloride. In June 1997, cultures from the U.S. Department of Energy's Pinellas (FL) Plant were introduced into one of the three injection wells. In this area of the plume, *cis*-DCE degraded to ethene, and good mass balance was observed. The culture took 90 days to become active, and three more months to achieve full degradation. Initial concentrations were approximately 4,000 - 5,000 ppb of TCE and DCE combined.

Operation and evaluation of the Phase I pilot is scheduled to continue through Spring 1998. The Consortium also plans to assist in the scale-up of the technology at Dover AFB. For more information, contact Consortium Co-chair Dr. David Ellis (DuPont Speciality Chemicals) at 302-892-7445 or (e-mail) ellisde@csoc.dnet.dupont.com.

Information about other Consortium projects is available on the Bioremediation Consortium home page of the RTDF site on the World Wide Web.

RTDF Cometabolic Bioventing Field Test Begins at Dover AFB

The first known field test of propane-stimulated cometabolic bioventing began in December 1997 at Dover AFB. The site contains TCE, 1,2-DCE and 1,1,1-TCA in the range of 1-50 mg/kg. The initial phase of operation is acclimation of the test plot to propane. Propane (0.1-1% v/v in air) is periodically injected into the vadose zone over a 1-3-month period. Eventually, the soil microbes will begin to use propane as a food source. The commencement of propane use indicates that the chlorinated solvents are being destroyed simultaneously. After acclimation, the system will be operated for approximately nine months using constant slow injection of propane and air.

For more information, contact Greg Sayles (U.S. EPA/NRMRL) at 513-569-7607 or (e-mail) sayles.gregory@epa.gov.

LASAGNA™ PARTNERSHIP

Focus:

- TCE
 - Degradation
 - In low-permeability soils

RCI Verification Statement To Be Signed for Lasagna™ Process

Signing of a Rapid Commercialization Initiative (RCI) Verification Statement for the Lasagna™ process developed by RTDF's Lasagna™ Partnership is expected to be completed this month. The RCI is a federal-state-private cooperative effort to facilitate regulatory acceptance and expedite the application of new environmental technologies.

The Verification Statement indicates the acceptance by the signatories of cost and performance data from the Lasagna™ Partnership's Phase IIA-Vertical demonstration at the U.S. Department of Energy's (DOE's) Paducah Gaseous Diffusion Plant, completed last year. The Statement is being signed by representatives of DOE, U.S. Department of Commerce, U.S. EPA, Southern States Energy Board, MSE-Technology Applications, Inc., the California Environmental Protection Agency, DOE's Oak Ridge Operations Office, Enviro-Chem Systems, Inc., and Monsanto Company. Letters of concurrence to this Verification Statement are being provided by the appropriate environmental organizations in South Carolina, Kentucky, Ohio, Florida, Tennessee, and Massachusetts.

Based on the results of the Phase I and II demonstrations, which began in 1995, DOE decided to seek regulatory approval to use the Lasagna™ process and cited it as the preferred remedy in the proposed Record of Decision (ROD) for a Solid Waste Management Unit at the Paducah site.



A copy of the Verification Statement and the final report of the Lasagna™ RCI participants will be available on the Lasagna™ Partnership home page of the RTDF site on the World Wide Web in May 1998. For more information about the vertical Lasagna™ process, contact Action Team Co-chair Dr. B. Mason Hughes (Monsanto) at 314-694-1466 or (e-mail) b.mason.hughes@monsanto.com.

New Reports on Phase IIA Lasagna™ Demonstration on Web

The RTDF's Lasagna™ Partnership has posted two new documents on the Partnership's home page on the RTDF site on the World Wide Web. These documents, "Modeling and Iron Dechlorination Studies" and "Iron Dechlorination Studies," report on work completed during the Phase IIA-Vertical Lasagna™ demonstration, completed in 1995, at DOE's Paducah (KY) Gaseous Diffusion Plant. The new documents and eight Phase I topical reports can be viewed or downloaded from the RTDF web site. Information on how to obtain printed copies also is available.

IINERT SOIL-METALS TEAM

Focus:

- Lead
 - Immobilization/inactivation
 - In soil

IINERT Team Producing Soil/Site Survey

The In-Place Inactivation and Natural Ecological Restoration Technologies (IINERT) Soil-Metals Action Team is circulating a survey to help identify potential research field sites and to collect sufficient quantities and types of soils for research purposes. The Team has grouped the types of sites to be included in these studies based on the source of lead (Pb) contamination, such as:

- industrial or waste sites, including tetraethyl lead and ammunition manufacturing, burning grounds, and battery breaking
- mining and smelting operations

- orchard sites on which PbAsO₄ pesticides have been applied
- soils contaminated mainly from paint or leaded gasoline emissions
- firing ranges

The IINERT Team wants to study soils and sites with total Pb concentrations from 0.2 to 1 percent, although concentrations above and below this range also may be desirable. Other inorganic and organic contaminants also may be present. The plan is to collect surface soil samples in bulk (55 gal.) from each of the Pb-contamination source groups. The samples will include soils of various textures and pH. All soils will be characterized by standard methods for relevant soil properties and made available to IINERT Team members for additional study.

As of March 16, 1998, information had been collected on four types of sites (see Figure 2). The IINERT Team is looking for additional sites. If you can help, please complete a survey form and send it to the Team. The blank survey form is available on the RTDF World Wide Web site. Just click on the IINERT Soil-Metals Action Team page, and click again on the "Technical Documents" button. Send completed survey forms to Team Co-chair Dr. Bill Berti at DuPont Central Research and Development, Glasgow Site 301, P.O. Box 6101, Newark, DE 19714-6101 or (e-mail) bill.ber ti@usa.dupont.com. For questions, contact Dr. Berti at 302-451-9224.

Type of site	Number
Smelting/Mining sites	12
Industrial or waste sites	
Battery Cracking	2
Acid sludge disposal	1
Metal	
Disposal sites	3
Lead paint	1
Total	19

Figure 2. Preliminary results from soil/site survey.

Joplin Site Shows Pb Reduction

Analysis of grass collected from the Joplin (MO) field research site six months after treatment application indicates that in-place Pb inactivation technologies are able to reduce plant Pb concentrations over control levels by up to 90 percent. The field study has been a cooperative effort of the IINERT Soil-Metals Action Team, U.S. EPA, Missouri Department of Natural Resources, University of Missouri, U.S. Department of Agriculture-Agriculture Research Service, the Doe Run Company, and DuPont Company.

An animal dosing study, using weaning rats as a human surrogate, has begun. This study is using the same soils collected from the Joplin plots that have been used in the University of Missouri pig dosing study. Results from these studies will help determine the next step to translate in-place inactivation into a practical and accepted remediation technology.

For more information about the Joplin field study, contact Action Team Co-Chair Dr. Bill Berti at 302-451-9224 or (e-mail) bill.ber ti@usa.dupont.com.

PERMEABLE REACTIVE BARRIERS TEAM

Focus:

- Chlorinated solvents, metals
- Degradation/immobilization
- In ground water

Agencies To Coordinate PRB Long-Term Performance Research

The U.S. EPA, DOE, and Department of Defense (DoD) recently agreed to adopt a coordinated approach for addressing long-term performance issues for permeable reactive barrier (PRB) projects. The RTDF's Permeable Reactive Barriers Action Team will serve as advisor to facilitate coordination of the different agency efforts and will establish uniform testing protocols to be applied by all cooperating groups.

A January 1998 meeting at the Oak Ridge National Laboratory brought together researchers and research program managers from the three agencies to discuss interagency collaboration on research

focused on PRB long-term performance. Participants agreed that funding requests from each agency will be much less than would be required for a single, comprehensive program. During the meeting, participants discussed specific measurement and research tasks and listed scientific issues related to geochemistry, microbiology, hydrology, sampling, analysis, and modeling. They also identified topics of mutual concern and expertise and requirements unique to each organization.

Participants set the following objectives for the proposed work: 1) to develop *a priori* testing requirements that predict the longevity of a PRB, 2) to develop monitoring methods that will provide an early warning of incipient barrier failure, and 3) to develop long-term monitoring protocols that minimize operation and maintenance costs. They agreed that it would be necessary to select sampling and analytical methods that will ensure direct comparability for all data to be obtained. In addition, they agreed that each agency would be chiefly responsible for obtaining data at its own sites. Participants recognized, however, that each agency has unique monitoring expertise and will need to be involved, in some cases, in making specific measurements at all of the walls being studied.

The DOE portion of the project will focus on the installations at the Oak Ridge Y-12 Plant and Kansas City Plant. DOE's Portsmouth X625 long-term pilot study facility also may be addressed depending upon the status of that project. DOE and EPA will collaborate on work at DOE's Rocky Flats Environmental Technology Site. EPA's portion of the project will focus on the U.S. Coast Guard Elizabeth City (NC) site and the Denver Federal Center site. DoD's portion includes the Moffett Field site and may include others. Data will be shared through regular conference calls and sharing of routine project reports. Final reports for specific milestones will be peer-reviewed by the principal investigators and their designees from the other participating agencies.

Each agency is preparing proposals for research on the long-term performance of PRBs. These proposals will be shared

among the participating agencies through each agency's principal investigator to ensure maximum synergism among the proposed projects.

For more information, contact Action Team Co-chair Dr. Robert Puls (U.S. EPA/NRMRL) at 580-436-8543 or (e-mail) puls.robert@epa.gov.

PRB Team Focus of International Interest

Interest about the Permeable Reactive Barriers (PRB) Action Team and its activities is high among several countries including Germany, the Netherlands, and the United Kingdom. Dr. Robert Puls (U.S. EPA/NRMRL), Co-Chair of the Action Team, met in February with researchers and environmental program managers from a number of European countries during a "Special Topics Technical Session on Permeable Reactive Barriers" in Vienna, Austria. The session was part of the NATO Committee on the Challenges to Modern Society (CCMS) Phase III Pilot Study Meeting, involving 14 countries engaged in the transfer of technological and scientific solutions among countries with similar environmental issues and problems.

As a result of the technical session and subsequent discussions, several European countries proposed formation of an European PRB Action Team, including possibly establishing some linkage with the RTDF Team in the United States.

Dr. Puls is continuing discussions with country representatives and providing additional information in support of this initiative. A summary of proceedings from the Technical Session is expected to be available this Summer on the RTDF World Wide Web site. For more information, contact Dr. Puls at 580-436-8543 or (e-mail) puls.robert@epa.gov.



PHYTOREMEDIATION TEAM

Focus:

- Solvents, TPH, PAH
- Degradation/immobilization
- In soil and ground water

Phytoremediation Team TCE Subgroup Seeking Industry Participants

The TCE in Ground Water Subgroup of the RTDF Phytoremediation of Organics Action Team is looking for potential industrial partners. This includes companies or associations in the drying cleaning, aerospace, electronics, and other industries that have used halogenated solvents heavily and have had to clean metal via vapor degreasing prior to painting or plating. Such potential partners also may be potentially responsible parties for sites with environmental contamination from trichloroethylene (TCE) and/or perchloroethylene (PCE). The TCE Subgroup believes these companies and individuals would have an interest in phytoremediation because of its promise as a less expensive and more sustainable approach in dealing with halogenated solvents in soil and ground water.

The Subgroup also is interested in working with DOE's Biomass Power Program and Biofuels Feedstock Development Program to find ways to leverage their expertise in industrial scale poplar tree plantations. These groups focus on providing a sustainable option for meeting projected needs for electric generating capacity and fuels. While the DOE groups have different objectives than the RTDF, the Subgroup can benefit from lessons learned by these groups, since they have many years' experience.

For more information about the plans, activities, and partnership opportunities in

the Phytoremediation Team's TCE Subgroup, visit the RTDF World Wide Web site or contact Subgroup Co-chairs Greg Harvey (U.S. Air Force) at 737-255-7716, extension 302 or (e-mail) harveygj@emsmtp.wpafb.af.mil, or Harry Compton (U.S. EPA) at 908-321-6751 or (e-mail) compton.harry@epa.gov.

Alternative Covers Workshop Focuses on RCRA Landfills

Members of the Phytoremediation of Organics Action Team Alternative Covers Subgroup participated in a February 1998 workshop in Las Vegas, NV, focusing on issues involved in the application of alternative covers to standard RCRA landfills. The workshop, sponsored by the Desert Research Institute, served as a followup to the Action Team's meeting on alternative covers held in September 1997. Approximately 75 stakeholders participated in the workshop including U.S. EPA Headquarters, three EPA Regional Offices, eight states, DoD, DOE, U.S. Department of Interior, local city and county governments, and private industry and consultants.

The purpose of the workshop was to develop and formalize a demonstration project to assess alternative landfill covers. The Alternative Covers Assessment Program (ACAP) will establish a dispersed network of test facilities across the country. ACAP will focus on increasing the base of knowledge about alternative covers and addressing data gaps, including those related to water infiltration rates, effects of climatic changes, and long-term monitoring techniques. In conjunction with field work, the demonstration will establish and modify existing numerical computer models for the design and evaluation of alternative landfill covers. A Cooperative Research and

Development Agreement (CRADA) will be established among the demonstration participants to perform the joint effort.

In addition to discussing ACAP, attendees examined regulatory and industrial needs associated with applying nonconventional covers.

A complete summary of the meeting is available on the Phytoremediation of Organics Action Team page on the RTDF's World Wide Web site. For additional information about the ACAP demonstration, contact Action Team Co-chair Steve Rock (U.S. EPA/NRMRL), 513-569-7149 or (e-mail) rock.steven@epa.gov.

Phytoremediation Team TPH Subgroup Holds First Teleconference

The Phytoremediation of Organics Action Team has formed a subgroup to focus on degradation of petroleum hydrocarbons in near-surface soils.

The group held its first conference call on March 18. Efforts will focus on the use of plants to degrade petroleum-contaminated soils which occur at petroleum refining, storage, transfer, and disposal sites. Some of the sites that could be examined by the group already have been identified. A mission statement has been proposed for the group which is aimed at combining expertise, technologies, and resources to conduct phytoremediation field tests for degradation of petroleum hydrocarbons. The object of this work is to develop guidelines for future applications, and gain public and regulatory

acceptance. Specific topics for discussion include the development of a standardized protocol for evaluation of plant suitability for phytoremediation of TPHs, and the gathering of available information in the open and grey literature applicable to phytoremediation of TPHs. The TPH phytoremediation subgroup is likely to meet at the IBC conference in Houston this June 22-25.

A summary of the March 18 teleconference call is available on the Phytoremediation of Organics Action Team's page on the RTDF's World Wide Web site. For more details, contact Action Team Co-Chair and Subgroup Chair Lucinda Jackson (Chevron) at 510-242-1047 or (e-mail) luaj@chevron.com, Subgroup Chair Phil Sayre (U.S. EPA) at 202-260-9570 or (e-mail) sayre.phil@epa.gov, or Action Team co-chair Steve Rock at 513-569-7149 or (e-mail) rock.steven@epa.gov.

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RTDF Update



RTDF
Remediation Technologies
Development Forum

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