FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE ANNUAL SUMMARY OF ACTIVITIES: SEPTEMBER 2009

FRTR HIGHLIGHTS

- Twenty-three new cost and performance case studies
- EPA's OSWER releases Green Remediation Principles *(www.epa.gov/oswer/greencleanups)*
- Summary and presentations from the FRTR meeting on Green Remediation posted on the FRTR Web site
- New on-line resources dedicated to green remediation, (*www.clu-in.org/greenremediation*) and ecological revitalization (*www.cluin.org/ecotools*)
- Development of a Sustainable Remediation Tool by the Air Force Center for Environmental Excellence (AFCEE) to aid remediation professionals in incorporating sustainability concepts into the remedy decision-making process
- FRTR "What's New" Web Site Feature contains recent publications
  - Green Remediation Primer
  - Ecological Revitalization Document
  - Phytotechnology Document
  - Nanotechnology for Site Remediation

GREEN REMEDIATION:

Green remediation is the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of cleanup actions *(www.epa.gov/superfund/greenremediation).*

This fact sheet summarizes activities of the Federal Remediation Technologies Roundtable (FRTR or Roundtable) over the last year. The FRTR is an interagency working group that promotes cooperation among member agencies to further development and use of new technologies for improved remediation of hazardous waste sites. Primary members of the FRTR include the U.S. Department of Defense (DoD), the U.S. Department of Energy (DOE), the U.S. Department of the Interior (DOI), the National Aeronautics and Space Administration (NASA), and the U.S. Environmental Protection Agency (EPA).

The Roundtable meets twice each year to share information on topics of interest and has done so continuously since it was established in May 1990. The 37th FRTR meeting, held in December 2008, focused on green remediation; the objectives of the meeting were as follows:

- Improve communication, share experiences and lessons learned in advancing green remediation best practices
- Outline key issues, identify baseline, and benchmark green remediation efforts as a basis for future metrics

The recent focus on green remediation is a result of policy actions taken by the federal government, including the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, and Executive Order 13423 on Strengthening Federal Environmental, Energy, and Transportation Management. EPA's strategic plan also emphasizes the importance of green remediation. In addition, FRTR member agencies are currently supporting several green remediation efforts and activities, and the FRTR has formed a Green Remediation Subgroup. Examples of ongoing green remediation efforts within each FRTR member agency are provided below.

EPA'S GREEN REMEDIATION WEB SITES

EPA's OSWER has developed a Web site (http://www.clu-in.org/greenremediation) that serves as a repository of technical information related to green remediation. Through case studies and fact sheets the site documents the state of best management practices (BMPs) for green remediation at contaminated sites throughout the United States.

The Web site includes various resources for users, including

1. Case studies on sites where green cleanup strategies are being practiced
2. Technical information on sustainability; guidance and policy; renewable energy; design, construction and operations; and system optimization
3. A Green Remediation Toolbox that includes information on BMPs, contracting and administrative tools, decision tools, and partnering opportunities

A key feature of this Web site is the technical assistance provided to site managers and other stakeholders, who may directly submit a general inquiry about green remediation strategies through the Web site.

EPA's cross-program policy statement on green cleanups can be found at (*www.epa.gov/oswer/greencleanups*) as described in the adjoining article.

Green Remediation Efforts within DoD

Green remediation efforts under way within DoD include development of a policy memorandum by the Deputy Under Secretary of Defense for Installations and Environment (DUSD[I&E]/EM) that commits to consider green remediation in current and future remedial activities. Likewise, the U.S. Army Corps of Engineers (USACE) is developing a guidance document on incorporating sustainability into environmental remediation. Furthermore, the Air Force Center for Engineering and the Environment (AFCEE) is developing a Sustainable Remediation Tool (SRT) to aid remediation professionals in incorporating sustainability concepts into the decision-making process. The tool uses a tiered approach to estimate sustainability metrics for four technologies, including Excavation, Soil Vapor Extraction, Pump and Treat, and Enhanced *In Situ* Biodegradation. The tool considers the following sustainability metrics for each tier and technology: carbon dioxide emissions to air, total energy consumed, technology cost, safety and accident risk, and natural resource service. Additional information about AFCEE's sustainable remediation is available on line at *www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremeditation/index.asp.*

Green Remediation Efforts within DOE

In March 2009, DOE published a final rule to promote federal procurement of energy-efficient products (Federal Register: Volume 74, Number 48, Page 10830-10836). The final rule establishes guidelines for federal agencies on implementing amendments to the National Energy Conservation Policy Act (NECPA) that require federal agencies to procure Energy Star-qualified and Federal Energy Management Program (FEMP)-designated products when they purchase energy-consuming products and systems. Additional information about DOE's Office of Energy Efficiency and Renewable Energy (EERE) is available on line at *www.eere.energy.gov.*

Green Remediation Efforts within EPA

A goal of the U.S. EPA is to preserve and restore land by assessing and cleaning up contaminated sites. Cleaning up sites can be viewed as "green" as a cleanup improves environmental and public health conditions. The process of cleanup, however, creates an environmental footprint of its own. Over time, we have learned that we can implement protective cleanups that are greener by increasing our understanding of the associated environmental footprint and taking steps to minimize it.

EPA's contaminated site cleanup programs have released the Principles for Greener Cleanups, to improve the decision-making process for cleanup activities in a way that ensures protection of human health and the environment and reduces adverse environmental impacts on communities (*www.epa.gov/oswer/greencleanups*). In consideration of these Principles, EPA's Superfund Program, one of five major EPA cleanup programs, has released a green remediation strategy outlining major activities to

GREEN REMEDIATION CASE STUDIES

EPA's Green Remediation Web site provides several site-specific examples where best management practices are in place and core elements of green remediation have been addressed using state-of-the-art technologies, novel field methods, and "tried and true" design and engineering techniques. Below are some examples of case studies available on the Web site.

- At the **Crozet Orchard Superfund Site in Crozet, Virginia**, the cleanup objective included removal of metals and pesticides such as lead arsenates from soil at a former apple orchard. The green remediation strategy involved phytoremediation supported by gravity-fed and renewable energy-powered irrigation techniques. Nearly 20,000 Chinese brake ferns were planted for hyperaccumulation of arsenic in the top 9 inches of soil at the site. The plants were watered using a 4,000-gallon tank used to transfer stored spring water by gravity to 17 of 24 fern plots when needed. Solar-powered, low-flow pumps transfer water from a hill-bottom spring to a second storage tank; water from the second tank is delivered to other (sloped) plots using gravity-fed drip methods. Arsenic concentrations have been reduced in seven plots to below the 58 parts per million (ppm) action level after two growing seasons and in five plots to levels within 10 ppm of cleanup goals. This approach also avoided the costs and greenhouse gas emissions associated with consumption of grid electricity during the treatment process.
- At the **Former Nebraska Ordnance Plant in Mead, Nebraska**, the cleanup objective consisted of removing trichloroethene (TCE) and explosives in groundwater. A 10 kilowatt (kW) wind turbine was used to power groundwater circulation wells (GCWs) for air stripping and ultraviolet treatment. This site is a formerly-owned DoD facility, and being addressed under the Formerly Used Defense Sites (FUDS) program, managed by USACE. This approach has provided sufficient renewable energy for continued TCE removal and explosives destruction by the aboveground treatment system during grid inter-tie operation. It has also reduced the consumption of utility-provided electricity by 26 percent during grid inter-tie operation and has decreased carbon dioxide emissions by 24 to 32 percent during off-grid operation of the system's 230-volt submersible pump. Surplus electricity was returned to the grid for other consumer use. This green approach is expected to realize a cost savings of more than $40,000 over the next 15 years of treatment, based on an electricity cost of $0.0546 per kWH at the time the wind turbine was started up.

reduce the environmental footprint of its cleanups (*www.epa.gov/superfund/greenremediation*).

Green remediation relies on greater conservation and/or protection of water, air, land, ecosystems, fuel, and other natural resources, as well as reduction of waste. Greener cleanups do not depend on additional regulatory requirements; and climate change or other environmental externalities are not a basis for less aggressive remedies. Opportunities exist to reduce the environmental footprint of cleanups using the remediation technologies commonly applied today, such as soil vapor extraction, bioremediation, or even groundwater pump and treat. Opportunities for greening a remedy are found mostly in the implementation of any selected remedy. Feedback on the strategy and examples of best practices and experiences are welcome through the above mentioned Web Site.

Green Remediation Efforts within NASA

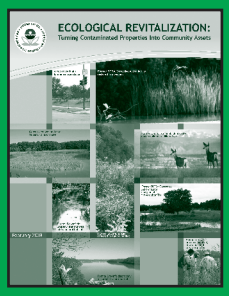
NASA has teamed with Florida Power and Light (FPL) to provide Florida residents and the space program new sources of "green" electricity. For example, NASA is exploring development of renewable energy projects at the Kennedy Space Center (KSC) in Florida. NASA provided 100 acres to FPL under Florida's Enhanced Use Lease authority to design, construct, and operate a 10-megawatt photovoltaic system tied to FPL's grid. FPL will also build another 1-megawatt photovoltaic system to support electrical needs at KSC. It is estimated that nearly 227,000 tons of greenhouse gas emissions will be prevented from entering the atmosphere during the life of this project.

FRTR WEB SITE FEATURE: "WHAT'S NEW"

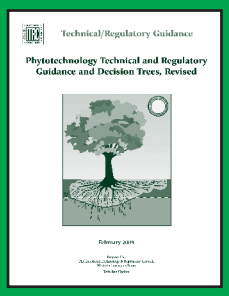
This feature allows federal agencies to showcase their notable studies or remediation projects and other FRTR agency efforts. As an example, three recent publications or achievements posted in this section are:

Green Remediation Publications

In April 2008, EPA published the Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites technology primer, which outlines the principles of green remediation and describes opportunities to reduce the footprint of cleanup activities throughout the life of a project. The document is available online at *www.clu-in.org/download/remed/Green-Remediation-Primer.pdf*.



EPA also published the document Ecological Revitalization: Turning Contaminated Properties into Community Assets in February 2009. Ecological revitalization refers to the process of returning land from a contaminated state to one that supports a functioning and sustainable habitat. This document provides technical information to assist property managers and other stakeholders to better understand, coordinate, and conduct ecological revitalization at contaminated properties during cleanup. The document is available on line at *www.clu-in.org/download/issues/ecotools/Ecological_Revitalization_Turning_Contaminated_Properties_Into_Community_Assets.pdf*.



In February 2009, ITRC revised the document Phytotechnology Technical and Regulatory Guidance and Decision Trees. This document provides guidance for regulators who evaluate and make informed decisions on phytotechnology work plans, and for practitioners who evaluate remedial alternatives at a given site. This document is an update to Phytoremediation Decision Tree (PHYTO-1, 1999) and Phytotechnology Technical and Regulatory Guidance Document (PHYTO-2, 2001) and replaces the previous documents entirely. It merges the concepts of both previous documents and includes new and practical information on the process and protocol for selecting and applying various phytotechnologies as remedial alternatives. The document is available on line at: *www.itrcweb.org/Documents/PHYTO-3.pdf.*

REMEDIATION CASE STUDIES AND TECHNOLOGY ASSESSMENT REPORTS

A major activity of the Roundtable throughout the year is to collect and distribute information from federal and state agencies on the use of new technologies at their sites. Each year, the Roundtable compiles reports and makes them available at the Web site *www.frtr.gov*. In 2008, the FRTR Web site was redesigned to make it more user-friendly. The "What's New" section provides notices about meetings, conferences, and publications of relevance to FRTR and is updated monthly.

The FRTR Web site provides case studies and reports in four categories: Remediation Technology, Site Characterization and Monitoring, Long-Term Monitoring and Optimization, and Remediation Technology Assessment. The case studies share data collected by member agencies and are based on real experiences and lessons learned in selecting and implementing site characterization and treatment technologies to delineate and remediate soil and groundwater contamination at hazardous waste sites. Remediation case study reports describe the performance and cost of technology applications at full-scale and large-scale demonstration projects.

Remediation Technology Cost and Performance Case Studies

More than 400 Remediation (treatment or containment) Technology Cost and Performance Case Studies are

available on the FRTR Web site. Recently, five new cost and performance case studies for remediation technologies have been added. These case studies address the use of *in situ* remediation technologies for contaminated sediment, perchlorate, and explosives in soil and groundwater. Three reports prepared by DoD's Environmental Security Technology Certification Program (ESTCP) provide cost and performance data for *in situ* treatment of explosives in soil and groundwater using permeable reactive barriers (zero-valent iron and mulch biowalls), and lime amendment to immobilize metals and transform explosives. In addition, one report developed by ESTCP involves the use of regenerable ion exchange technology to treat perchlorate in groundwater. One report developed by EPA describes use of capping to minimize upward migration of dense nonaqueous phase liquid at the Thea Foss Waterway Superfund Site in Washington.

Site Characterization and Monitoring Reports

This focus area includes reports on field-based site characterization and monitoring technologies; more than 185 reports are currently available. Eleven new reports have been added, including two from the U.S. Department of the Interior (DOI)/U.S. Geological Survey (USGS), nine from ESTCP, and one from EPA. The two reports from USGS describe collection and analysis of tree cores to assess the distribution of subsurface volatile organic compounds (VOCs) and use of pumped and diffusion sampling methods to monitor concentrations of perchlorate and explosives in groundwater. The eight reports from ESTCP describe various field-based strategies for detecting nonaqueous phase liquids (NAPL), VOCs, and explosives. For example, one report describes use of naturally occurring radon-222 (Rn) as a partitioning tracer for locating and quantifying NAPL contamination in the subsurface and for monitoring changes in NAPL quantities that result from remediation. The EPA report describes the experimental design, the analytical methods used, and compares the total dioxin/furan toxicity equivalents ($TEQ_{D/F}$) results.

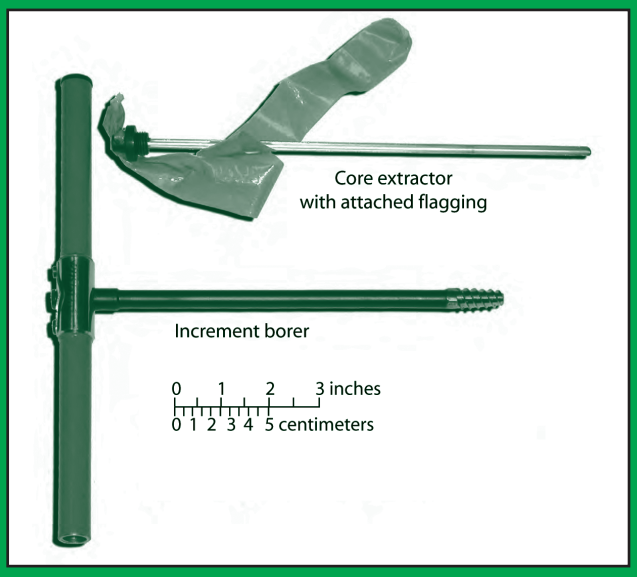
Long-Term Monitoring and Optimization Case Study Reports

This focus area includes reports that describe long-term management and optimization efforts that

HIGHLIGHT OF NEW CHARACTERIZATION REPORT

User's Guide to the Collection and Analysis of Tree Cores to Assess the Distribution of Subsurface Volatile Organic Compounds.

This report, prepared by the U.S. Department of the Interior and the U.S. Geologic Survey, provides a guide to the use of tree coring as a tool to examine subsurface volatile organic compounds (VOCs). Delineating the presence and extent of subsurface VOCs is useful for evaluating the potential risks to human health from ingestion of groundwater and the potential for respiration risks from vapor intrusion into buildings. The report is divided into two parts, with additional references and two appendices. The first part focuses on the methodology for collecting and analyzing tree cores. The second part focuses on the historical perspectives and technical considerations related to tree coring as a tool to examine subsurface contamination. The technical considerations include the rationale for various aspects of the methodology and a discussion of the factors that influence VOC concentrations in tree cores. The two appendices attached include a collection of various case studies and an air sample analysis for VOCs.



Typical Tree-Coring Tool

involve techniques such as groundwater monitoring program evaluation, plume capture evaluation, and hydraulic optimization. More than 125 reports are currently available under this focus area. New documents include two reports from EPA. These reports provide a summary of the technical assistance provided for the Burlington Northern Somers site in northwestern Montana and the Idaho Pole Site in Bozeman, Montana.

Remediation Technology Assessment Reports

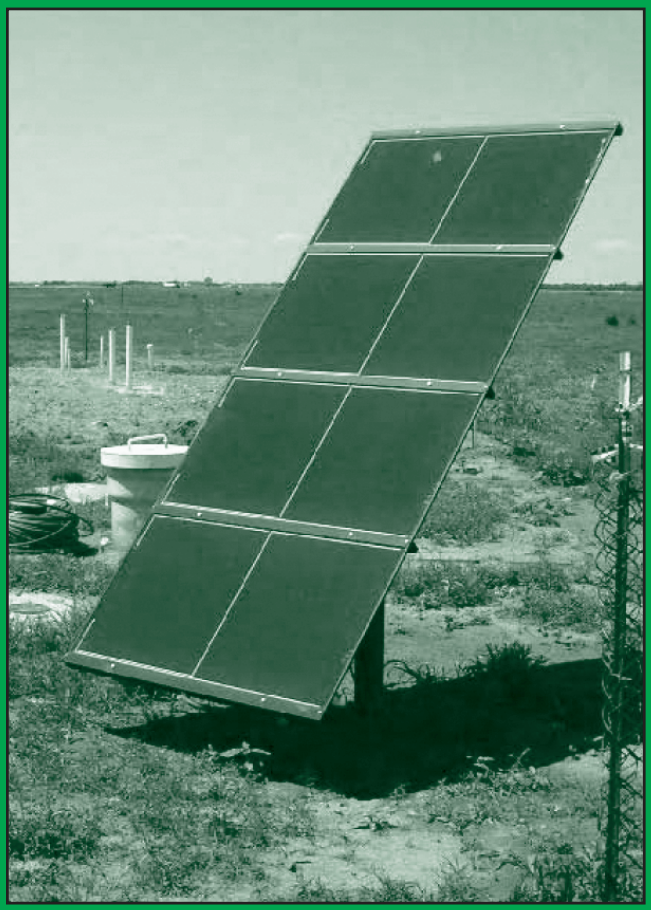
The reports in this focus area provide broad assessments of technologies based on results from field experience gained from multiple sites. Five new reports were added to this focus area, bringing the total to more than 88, including two new reports from the Interstate Technology and Regulatory Council (ITRC) and one each from AFCEE, ESTCP, and USACE. The ITRC reports provide information on *in situ* bioremediation and enhanced attenuation of chlorinated organic compounds. The ESTCP report examines ways to estimate cleanup time when source area remediation is combined with monitored natural attenuation. The USACE report describes a landfill off-gas collection and treatment system, while the AFCEE report provides technical guidance for enhanced anaerobic bioremediation using techniques such as permeable mulch biowalls and bioreactors.

HIGHLIGHT OF REMEDIATION TECHNOLOGY ASSESSMENT REPORT

Technical Protocol for Enhanced Anaerobic Bioremediation using Permeable Mulch Biowalls and Bioreactors

This document, prepared by the Air Force Center for Engineering and the Environment (AFCEE), describes the scientific and technical basis for use of permeable mulch biowalls and *in situ* bioreactors for enhanced *in situ* anaerobic bioremediation of chlorinated solvents, perchlorate, and explosives in groundwater. The report provides guidance on technology selection, site screening, design criteria, installation methods, performance monitoring, and data interpretation for the various engineered approaches currently being used. Since site conditions dictate the effectiveness and type of the biowall or bioreactor, this protocol is intended to assist the practitioner in recognizing potential biowall and bioreactor sites where the probability of success is high, and in selecting specific approaches that are suitable for achieving remedial goals and performance objectives. The report includes three case studies that illustrate the design and implementation of these anaerobic bioremediation techniques and are listed below.

1. Bioremediation of Chlorinated Solvents Using a Permeable Mulch Biowall at the Ash Landfill Site, Seneca Army Depot Activity, New York
2. Permeable Mulch Biowall at Landfill 3, Operable Unit 1, Altus Air Force Base, Oklahoma
3. Demonstration of a Recirculation Bioreactor at Landfill 3, Altus Air Force Base, Oklahoma

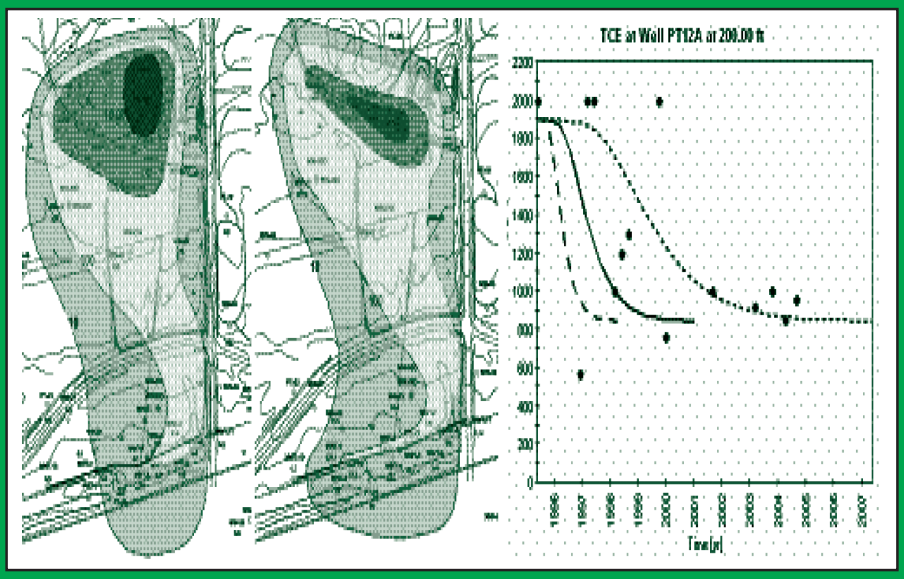


Solar-powered pump for groundwater circulation at the Altus Air Force Base, Oklahoma

HIGHLIGHT OF REMEDIATION TECHNOLOGY ASSESSMENT REPORT

Estimating Cleanup Times Associated with Combining Source-Area Remediation with Monitored Natural Attenuation

This Environmental Security Technology Certification Program cost and performance report provides an overview of a demonstration that evaluated the capability of the Natural Attenuation Software (NAS) to provide reasonable estimates of monitored natural attenuation (MNA) cleanup time frames in a variety of geologic or hydrogeochemical environments and sites throughout the United States. NAS was developed as a screening tool for estimating time of remediation (TOR) for MNA with varying degrees of source area remediation. NAS consists of a combination of computational tools to make complex analytical and numerical solutions of the TOR problem accessible to remedial project managers (RPM) and their contractors using site-specific remediation objectives. This report describes in detail the demonstration design, performance assessment, cost assessment, and implementation issues. A methodology and tool such as this one can allow stakeholders to make informed decisions on its application, forecast budget requirements for long-term monitoring programs, and allow better program planning to meet future needs of cleanup programs.



FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE SUMMARY OF ACTIVITES: SEPTEMBER 2009 (EPA-542-F-09-001) — ORDERING INFORMATION

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