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United States Environmental Protection Agency | Office of Research and Development Washington, DC 20460 | Office of Solid Waste and Emergency Response Washington, DC 20460

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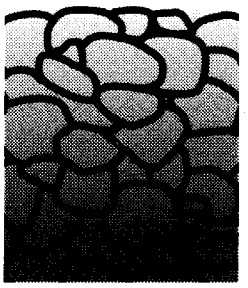
EPA

Bioremediation Field Initiative



CURRENT PARTICIPANTS

Office of Research and Development
- Office of Science, Planning and Regulatory Evaluation
- Office of Environmental Engineering and Technology Demonstration
- Office of Environmental Processes and Effects Research
- Office of Health Research

Office of Solid Waste and Emergency Response
- Technology Innovation Office
- Office of Emergency and Remedial Response

Regional Offices
- Atlanta
- Chicago
- Kansas City
- Denver
- San Francisco
- Seattle

State Agencies
- Michigan Department of Natural Resources
- Minnesota Pollution Control Agency

U.S. Air Force

Industry

Universities

A cooperative effort of the U.S. EPA's Office of Research and Development, Office of Solid Waste and Emergency Response, and regional offices, and other federal agencies, state agencies, industry, and universities to expand the nation's field experience in bioremediation technologies for Superfund and other contaminated sites.

Background

Many of today's more promising technologies for solving hazardous waste problems involve bioremediation, an engineered process that relies on microorganisms, such as bacteria or fungi, to transform hazardous chemicals into less toxic or nontoxic chemicals. Until recently, however, the use of bioremediation has been limited by a lack of information on the controlled application of biodegradative processes to environmental cleanups.

In 1990, the U.S. Environmental Protection Agency (EPA) established the Bioremediation Field Initiative as part of its overall strategy to increase the use of bioremediation to treat hazardous wastes at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) and other contaminated sites. Recognizing the need to gather data on the many different waste types and site conditions suitable for bioremediation, EPA's Superfund program made a major investment in the Initiative. The Initiative is a cooperative effort among EPA's Office of Research and Development (ORD), Office of Solid Waste and Emergency Response (OSWER), and regional offices, and other federal agencies, state agencies, industry, and universities. It is joined with other public and private efforts in bioremediation through EPA's Bioremediation Action Committee (BAC), an affiliation of government, industry, and academic representatives working jointly to expand the use of bioremediation.

A driving force for the Bioremediation Field Initiative is the commitment by the Superfund program to seek the development of more cost-effective solutions, such as bioremediation, to provide more permanent treatment of contaminated sites. Some 45 Superfund projects have already selected bioremediation. These sites demonstrate an ongoing commitment to deploy state-of-the-art technology solutions.

Goals

The Initiative was launched with three primary goals:

- To more fully assess and document the performance of full-scale bioremediation field applications.
- To create a data base of current field data on progress in determining the treatability of contaminants.

(continued on page 4)

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Libby Ground Water Site

Location: Libby, Montana

Laboratories/Agencies: U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), Utah State University (USU), U.S. EPA Region 8

Media and Contaminants: Pentachlorophenol (PCP) and polycyclic aromatic hydrocarbons (PAHs) in soil and ground water

Treatment: Surface soil bioremediation, aboveground fixed-film bioreactor, in situ bioremediation

Date of Initiative Selection: Fall 1990

Objective: To evaluate the performance of three biotreatment processes for degradation of PCP and PAHs

Reilly Tar a Chemical C

Location: St. Louis P Minnesota

Laboratories/Agenc U.S. EPA Risk Reduct

Media and Contami cyclic aromatic hy (PAH) in soil

Treatment: Bioventi

Date of Initiative Se October 1992

Objective: To evalua effectiveness of bioven contaminated soil

Hill AFB

Location: Salt Lake City, Utah

Laboratories/Agencies: U.S. Air Force, U.S. EPA Risk Reduction Engineering Laboratory (RREL), U.S. EPA Region 8

Media and Contaminants: JP-4 jet fuel in unsaturated soil

Treatment: Bioventing

Date of Initiative Selection: Spring 1991

Objective: To evaluate the effectiveness of bioventing jet fuel in deep vadose zone soil

Public Service Co. of Colorado

Location: Denver, Colorado

Laboratories/Agencies: U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), U.S. EPA Region 8

Media and Contaminants: BTEX in ground water

Treatment: In situ bioremediation of ground water with nutrient and hydrogen peroxide addition

Date of Initiative Selection: Spring 1991

Objective: To evaluate the effectiveness of in situ bioremediation of used oil and the potential for future environmental impact from residual contaminants

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Location: Fairbanks, Alaska

Laboratories/Agencies: U.S. Air Force, U.S. EPA Risk Reduction Engineering Laboratory (RREL), U.S. EPA Region 10

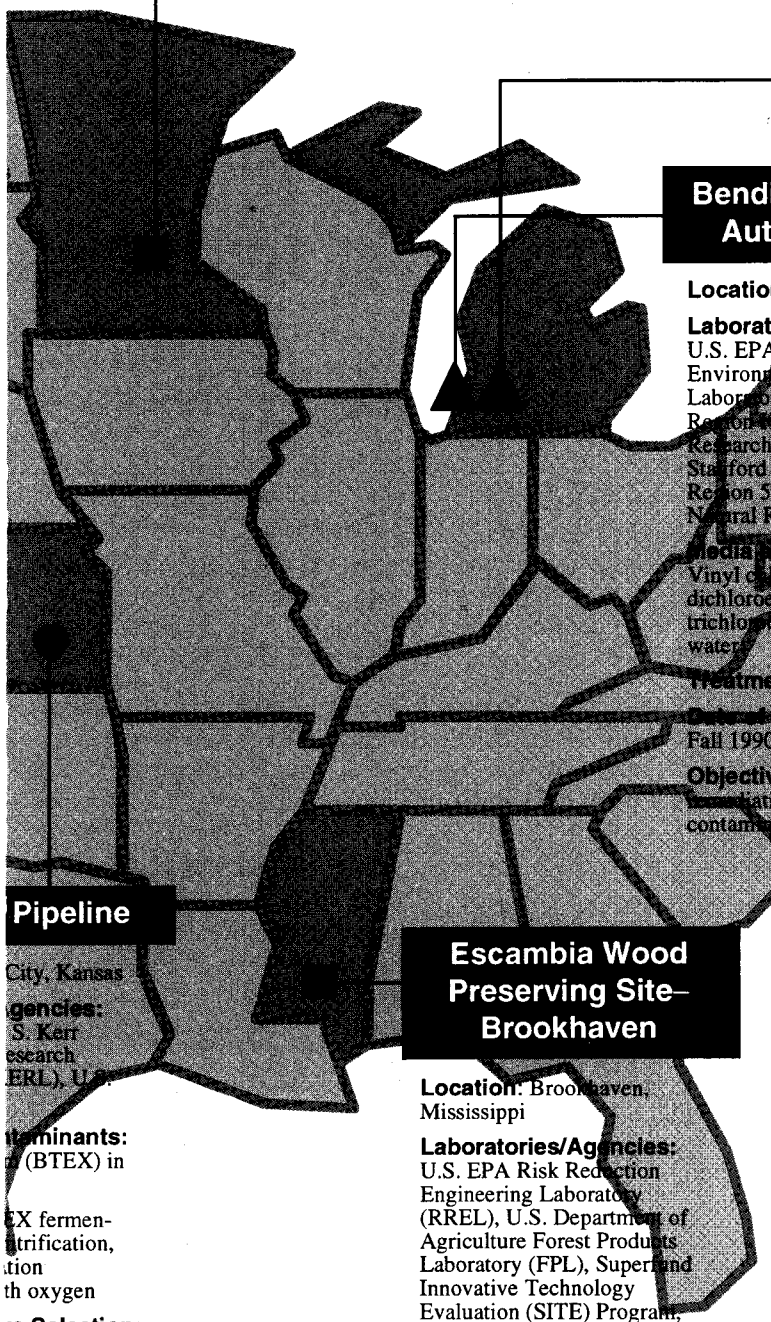
Media and Contaminants: JP-4 jet fuel in shallow unsaturated soil

Treatment: Bioventing with and passive soil warming

Date of Initiative Selection: Spr

Objective: To examine the use of soil-warming technologies to enhance the effectiveness of bioventing jet fuel-contaminated soil in a cold climate

Bioremediation Field Initiative
Evaluation Sites



West KL Avenue Landfill

Location: Kalamazoo, Michigan

Laboratories/Agencies: U.S. EPA Risk Reduction Engineering Laboratory (RREL), U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), Center for Microbial Ecology at Michigan State University (MSU), U.S. EPA Region 5, Michigan Department of Natural Resources

Media and Contaminants: Solvents in landfill and ground water

Treatment: In situ bioremediation of landfill material and ground water

Date of Initiative Selection: October 1992

Objective: To evaluate the feasibility of bioremediating the ground water and landfill material

Bendix Corp./ Allied Automotive Site

Location: St. Joseph, Michigan

Laboratories/Agencies: U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), Western Region Hazardous Substance Research Center (WRHSRC) at Stanford University, U.S. EPA Region 5, Michigan Department of Natural Resources

Media and Contaminants: Vinyl chloride (VC), dichloroethylene (DCE), and trichloroethylene (TCE) in ground water

Treatment: In situ bioremediation

Date of Initiative Selection: Fall 1990

Objective: To evaluate the in situ remediation of VC and TCE contamination in ground water

Pipeline

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Escambia Wood Preserving Site– Brookhaven

Location: Brookhaven, Mississippi

Laboratories/Agencies: U.S. EPA Risk Reduction Engineering Laboratory (RREL), U.S. Department of Agriculture Forest Products Laboratory (FPL), Superfund Innovative Technology Evaluation (SITE) Program, U.S. EPA Region 4

Media and Contaminants: Pentachlorophenol (PCP) and creosote sludge in soil

Treatment: White-rot fungi

Date of Initiative Selection: Spring 1991

Objective: To evaluate the effectiveness of white-rot fungi treatment for wood preserving wastes

KEY TO SITE CONTAMINANTS

- Petroleum
- Wood Preserving Wastes
- Solvents

PERFORMANCE EVALUATIONS

Through the Initiative, performance evaluations are conducted at selected sites across the country. Currently, nine sites have been selected for performance evaluations. These sites represent a variety of waste types, including petroleum, wood preserving wastes, and solvents, in soil and ground water. At each site, the Initiative is assisting with the field tests and independent evaluation needed to generate solid cost and performance data on the biotreatment technologies being used.

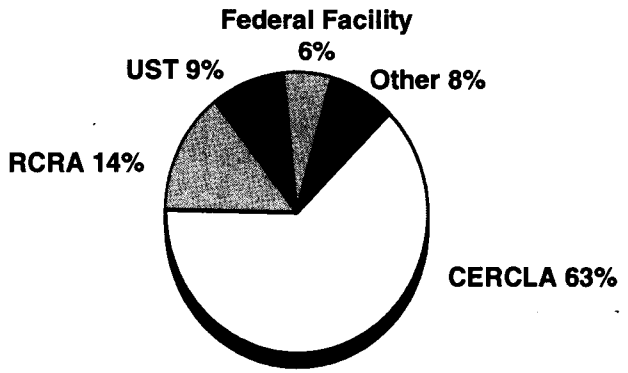

Figure 1. Breakdown of bioremediation sites by legislative authority.

- To provide technical assistance to regional and state site managers using or considering bioremediation. Assistance is provided in various stages of cleanup activities, from site characterization to full-scale implementation.

Activities

Although most of the sites in the Initiative are Superfund sites, bioremediation also is being used to clean up contamination at federal facilities, Resource Conservation and Recovery Act (RCRA) sites, and Underground Storage Tank (UST) sites. The Initiative is providing support to states and regions for intensive evaluation of bioremediation at nine selected hazardous waste sites. These performance evaluations are intended to generate data needed to define the capabilities of bioremediation technology. These data will enable state and EPA project managers, consulting engineers, and industry to make better informed decisions about applying bioremediation in the field. For field performance evaluations, sites are nominated and selected through the regional offices or through the states with concurrence from the regional offices.

In addition to conducting performance evaluations, the Initiative has identified a rapidly growing number of other sites across the country that are considering, planning, or currently operating bioremediation technologies, or that have completed bioremediation activities. The Initiative currently is monitoring progress at over 150 of these sites and creating an electronic data base of site information. For each site, the data base contains information on contaminants, media, type of

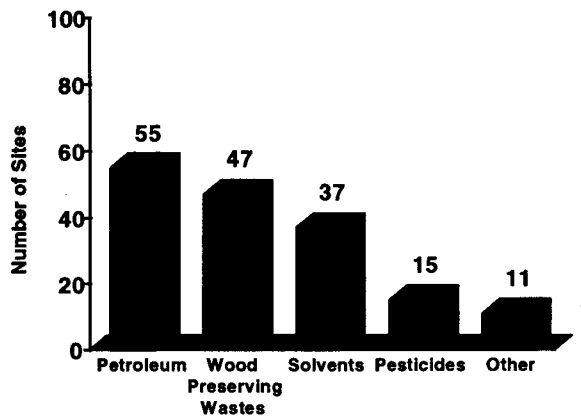

Figure 2. Breakdown of sites by type of contamination.

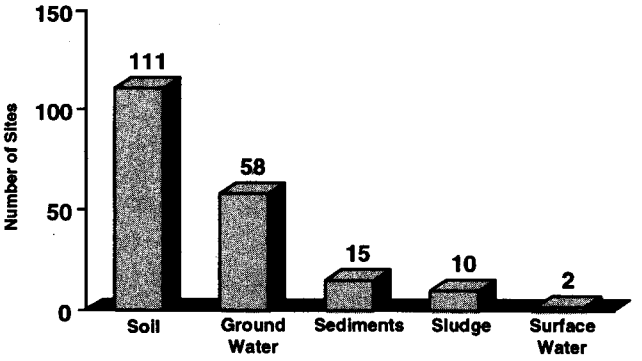

Figure 3. Number of sites treating each media type.

treatment, status of cleanup, capital costs, and operation and maintenance costs.

Sites in the data base include federal facilities, Superfund sites, RCRA sites, and UST sites. Over 60 percent of the sites fall under CERCLA authority, but the Initiative has begun to recognize an increasing number of sites under UST and RCRA authority (Figure 1). Monitored sites are distributed throughout all 10 EPA regions, with over 40 percent located in Regions 5 and 9. Analysis of the data base reveals that petroleum is the contaminant most frequently bioremediated, with wood preserving wastes a close second (Figure 2). Soil and ground water are the media most frequently treated with bioremediation technologies (Figure 3). Sites in the data base are undergoing a range of in situ and ex situ treatments, including land treatment, bioventing, bioreactor treatment, nutrient addition, and many other techniques.

The Initiative publishes a quarterly bulletin, entitled *Bioremediation in the Field*, which is distributed to over 5,000 individuals involved in the application of bioremediation. The bulletin contains a matrix of information on the status of sites identified by the Initiative, as well as updates on performance evaluations, new technologies, resources, and regulations. Past articles have discussed an extensive program to remediate Air Force sites using bioventing, permitting issues related to the disposal of polychlorinated biphenyls (PCBs), the impact of new land disposal restrictions on bioremediation, and the use of encapsulated microorganisms for bioprevention and bioremediation.

BIOREMEDIATION FIELD INITIATIVE CONTACTS

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To be added to the Bioremediation Field Initiative's mailing list to receive the bulletin, updates on the fact sheets, and other bioremediation information, please call 513-569-7562.

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