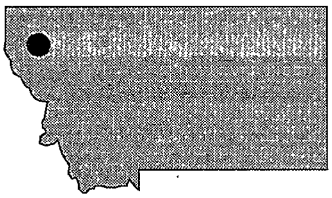
United States Environmental Protection Agency | Office of Research and Development Washington, DC 20460 | Office of Solid Waste and Emergency Response Washington, DC 20460
EPA/540/F-93/510A | September 1993

EPA

Bioremediation Field Initiative Site Profile: Libby Ground Water Superfund Site

SITE FACTS



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

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Background

The Libby Ground Water Superfund site in Libby, Montana, is located in part at the site of an operating lumber mill currently owned by Champion International Corporation. A wood preserving facility formerly operated at the site contaminated soil and ground water with two wood preservatives: pentachlorophenol (PCP) and creosote (PAHs). PAHs are the primary contaminants of concern associated with the soil phase. PAH-contaminated soils from three primary source areas have been excavated and moved to a central waste pit.

The U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), in cooperation with Utah State University (USU), is carrying out a performance evaluation of three biological treatment processes at the Libby site: (1) surface soil bioremediation in a lined, prepared-bed land treatment unit (LTU); (2) ground water treatment

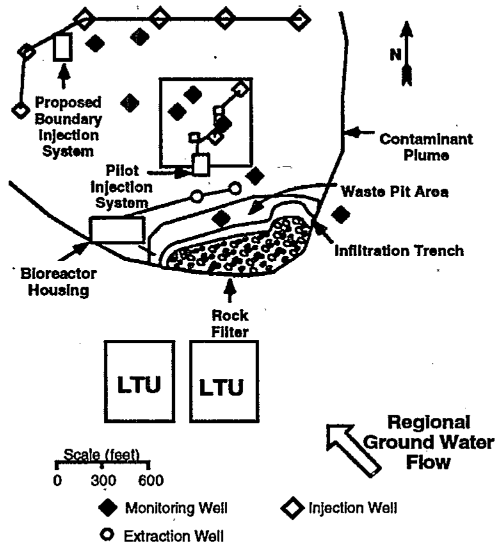

Figure 1. Plan view showing LTU, bioreactor, and ground water injection system (from Piotrowski, M.R. 1991. Full-scale in situ bioremediation at a Superfund site: a progress report. Second Annual West Coast Conference, Hydrocarbon Contaminated Soils and Ground Water. Newport Beach, CA. March 1991).

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in an aboveground fixed-film bioreactor; and (3) in situ bioremediation of the upper aquifer. Each process is being evaluated with regard to design, operation, monitoring, and performance. Figure 1 is a plan view of the site, showing the LTU, bioreactor, and ground water injection systems.

Field Evaluation

Surface Soil Bioremediation. The LTU consists of two adjacent 1-acre cells, lined with low-permeability materials to minimize leachate infiltration from the unit (see Figure 2). Contaminated soil is applied to the cells in 9-in. lifts and treated until target contaminant levels are achieved within each lift. Evaluation of the effectiveness of the land treatment includes sampling the soil in the LTU, studying field-scale treatment and toxicity reduction, analyzing the influence of moisture and soil structure, and calculating the mass balance of contaminants in terms of soil and leachate.

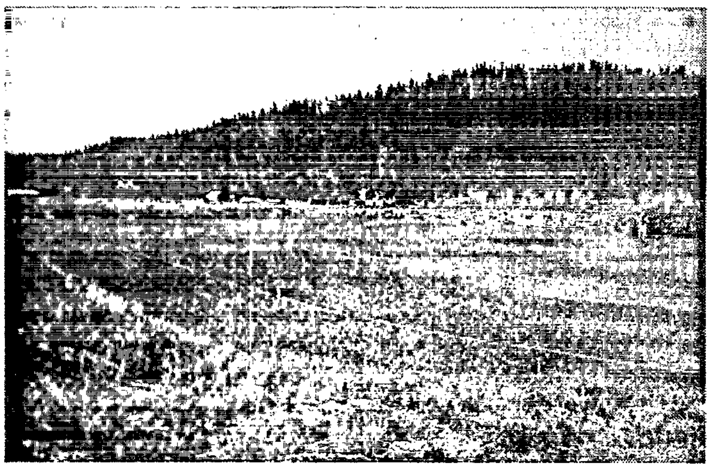

Figure 2. Land treatment unit.

LTU soil analysis data will be used to determine the statistical significance, confidence, and extent of biodegradation at this site. Degradation kinetics and toxicity reduction studies will generate data that can be used to help assess overall bioremediation effectiveness and predict performance of similar bioremediation processes at other sites.

Aboveground Fixed-Film Bioreactor. Aboveground treatment of ground water occurs in two fixed-film reactors, which operate in series. The effluent from these reactors is amended with nutrients and reoxygenated prior to reinjection through an infiltration trench. The Initiative will be monitoring the performance of the bioreactors, including flow composited sampling, analysis of biofilm dynamics, calculation of mass balance of contaminants, and treatment optimization.

In Situ Bioremediation of the Aquifer. The in situ bioremediation system involves addition of hydrogen peroxide and inorganic nutrients to stimulate growth of contaminant-specific microbes. Evaluation of this process will include determining dissolved oxygen profiles across the site, sampling aquifer material to identify contamination and correlate microbial content, distinguishing between abiotic and biotic effects, and correlating dissolved oxygen uptake with biodegradation and toxicity reduction.

Status

Currently, remediation of each lift of soil applied to the LTU takes 32 to 163 days. Based on these results, it is predicted that remediation of the 45,000 yd^3 of contaminated soil will take 8 to 10 years. Preliminary performance data on the fixed-film bioreactors indicate that PAH and PCP removal is taking place. Aquifer core samples have a chemically reduced condition, indicating that the site has an abiotic as well as a biological oxygen demand. Investigators plan several tests to differentiate between the abiotic and biotic oxygen demands.

The Bioremediation Field Initiative was established in 1990 to expand the nation's field experience in bioremediation technologies. The Initiative's objectives are to more fully document the performance of full-scale applications of bioremediation; provide technical assistance to regional and state site managers; and provide information on treatability studies, design, and operation of bioremediation projects. The Initiative currently is performing field evaluations of bioremediation at eight other hazardous waste sites: Park City Pipeline, Park City, KS; Bendix Corporation/Allied Automotive Superfund site, St. Joseph, MI; West KL Avenue Landfill Superfund site, Kalamazoo, MI; Eielson Air Force Base Superfund site, Fairbanks, AK; Hill Air Force Base Superfund site, Salt Lake City, UT; Escambia Wood Preserving Site—Brookhaven, Brookhaven, MS; Reilly Tar and Chemical Corporation Superfund site, St. Louis Park, MN; and Public Service Company, Denver, CO. To obtain profiles on these additional sites or to be added to the Initiative's mailing list, call 513-569-7562. For further information on the Bioremediation Field Initiative, contact Fran Kremer, Coordinator, Bioremediation Field Initiative, U.S. EPA, Office of Research and Development, 26 West Martin Luther King Drive, Cincinnati, OH 45268; or Michael Forlini, U.S. EPA, Technology Innovation Office, Office of Solid Waste and Emergency Response, 401 M Street, SW., Washington, DC 20460.