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Office of Solid Waste and Emergency Response
Technology Innovation Office

TECH TRENDS

The applied technologies journal for Superfund removals and remedial actions and RCRA corrective actions

Welcome to Tech Trends

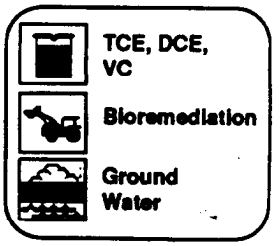
Focus on innovations in cleanup action

It comes as no great surprise that Regional personnel involved in CERCLA removals or remedial actions or RCRA corrective actions can become overwhelmed with information. Some is good, some is bad, and most is relevant. The problem is, who's got time to keep up with it all?

Over the past couple of years, OSWER and ORD laboratories have increased their efforts devoted to getting the word out. The Technical Support Project, the OSC/RPM Support Program, a number of electronic databases, and more technical conferences have all added to the amount of information available to folks out in the field. Recent surveys all highlight the fact that people need guidance through the forest of information.

Tech Trends will bring current information on hazardous waste treatment innovations to Regional staff, their State and local counterparts, and their contractors. Tech Trends will address innovative uses of existing technologies, overcoming bureaucratic obstacles to the use of innovative technologies, and the transfer of innovative Superfund cleanup technologies to RCRA corrective actions.

Biological Cleanup of TCE, DCE, and VC in Ground Water



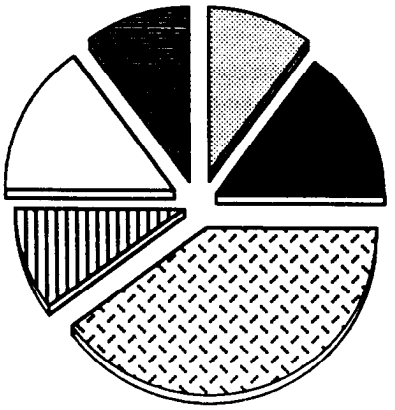
by Marion Scalf
Robert S. Kerr Laboratory

Ordinarily, trichloroethylene (TCE), *cis*- and *trans*-dichloroethylene (DCE), and vinyl chloride are not biodegraded in oxygenated ground water. Recent advances in biotechnology, however, offer an attractive alternative to physical or chemical treatment of water contaminated with these substances. In 1984, Dr. John Wilson of EPA's Robert S. Kerr Environmental Research Laboratory (RSKERL) in Ada, Oklahoma, discovered that microorganisms that degrade methane contain an enzyme that fortuitously transforms TCE, DCE, and vinyl chloride to the corresponding epoxides. The epoxides decompose in water to other compounds that are easily decomposed by ordinary microorganisms. In laboratory studies, the chlorinated aliphatics were mineralized completely to CO_2 and water.

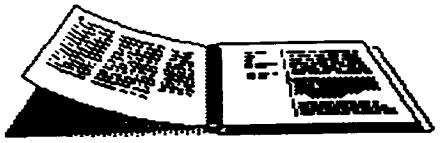
In order to demonstrate the process in a field situation, RSKERL entered into a cooperative agreement with Stanford University, and, in cooperation with the U.S. Navy, demonstrated biological removal of TCE, *cis*- and *trans*- DCE, and vinyl chloride in a shallow, semi-confined, sand and gravel aquifer. The demonstration

*(see **Biological Cleanup**, page 3)*

Superfund Bioremediation RODs: Waste Source Analysis



- Pesticide (2)
- Petrochemical (3)
- Wood Preserving (9)
- Manufacturing (2)
- Chemical Formulation and Use (3)
- Commercial Waste Disposal (2)



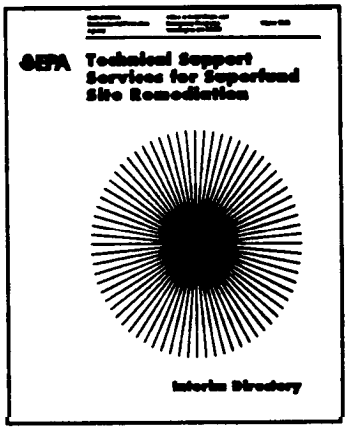
New for the Bookshelf

Directory of Technical Support Services

Finding the right source of technical assistance for Superfund sites has just gotten a lot easier. says Walt Kovalick, Director of OSWER's Technology Innovation Office.

A new directory, *Technical Support Services for Superfund Site Remediation,* is organized by source of information and contains descriptions, contacts, phone numbers, and cross-references to engineering programs, risk assessment information, ground water assistance, a number of easily accessible databases, several major technical publications. and other sources.

While TIO hopes to have a directory in everyone's hands by summa, Dr. Kovalick encourages people to contact ORD Publications at FTS 684-7562 or 5 13-569-7562 if they haven't received a copy.



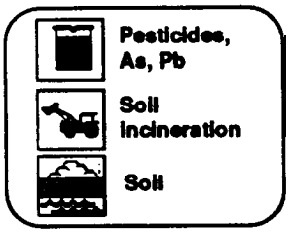
Recent EPA publications are available from ORD's Center for Environmental Research Information in Cincinnati. You can order them electronically on the OSWER Electronic Bulletin Board or directly from CERI. To contact CERI's Publications Unit, call FTS 684-7562, or 513-569-7562. You must have the EPA report number or the exact title of the document.

Selected Alternative and Innovative Treatment Technologies for Corrective Action and Site Remediation. Lists EPA publications on technology survey reports, treatability studies, treatment technologies, guidance, technical support, international surveys, and databases.
Publication number EPA/540/8-90/003.

Technological Approaches to the Cleanup of Radiologically Contaminatec Superfund Sites. Identifies technologies for the control and remediation of radioactive contamination at Superfund sites. Technologies include: stabilization/ solidification, vitrification, chemical extraction, and physical separation. On- and off-site disposal methods are also discussed.
Publication number EPA/540/2-88/002.

Soil Incineration at Baird and McGuire

by Michael Royer, Donald Oberacker, and Marta Richards
Risk Reduction Engineering Laboratory



The Risk Reduction Engineering Laboratory (RREL) investigated the fate of metals and organics during the incineration of contaminated soil from a former pesticide batching and mixing plant.

As part of ORD's Superfund Technical Assistance Remedial Technology (START) program, the study was done at the laboratory's Incineration Research Facility (IRF) to assist Region I in defining conditions for successful treatment of soils at the Baird and McGuire (B&M) site in Holbrook, MA.

RREL conducted an IRF treatability test on soil from the site. The test consisted of a series of muffle furnace tests and a series of rotary kiln incineration tests on soils contaminated with pesticides, arsenic (As), and lead (Pb). (Soil samples were chosen from locations on the site which did not contain dioxins, due to permit limitations at the IRF.)

The muffle furnace testing showed that the volatilization of As and Pb was concentration dependent, *i.e.*, as the soil metal concentration increased the percentage of volatilization also increased. The rotary kiln incinerator tests were performed on blended B&M site soils, which averaged 85 ppm As, 20 ppm Pb, 54 ppm DDE, 70 ppm methoxychlor, 228 ppm DDD, and 334 ppm DDT.

The following conclusions were drawn from the pilot scale incineration test program:

- Both As and Pb partitioning to the ash decreased as kiln temperatures increased.
- Kiln ash Pb was not significantly leachable via the Toxicity Characteristic Leaching Procedure (TCLP).
- Kiln ash As was significantly less TCLP-leachable for high kiln excess air (high oxygen content and moderate temperature).

*(see **Soil Incineration**, page 3)*

Soil Incineration

from page 2)

Extrapolation of the incineration test results suggest that soil with As levels as high as 1200 mg/kg could be incinerated to give a kiln ash with a TCLP-leachate concentration of less than 5 mg/L provided suitable operating conditions were maintained. No detectable levels of organics were found in any of the residual samples that were sampled, extracted, and analyzed using approved EPA methods.

For additional information cm START assistance at the B&M site contact Michael Royer at FTS-340-6633. For additional information on the incineration testing on B&M soils, contact Marta Richards at FTS-684-7645.

Biological Cleanup

(from page 1)

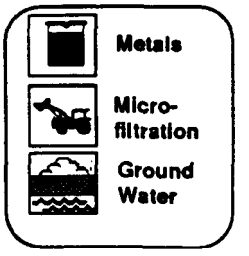
was conducted at Moffett Naval Air Station located near the southern end of San Francisco Bay. Water was extracted from the aquifer and amended with oxygen, methane, and the chlorinated hydrocarbons, then reinjected into the aquifer. The concentration of the chlorinated organic contaminants was determined in water from monitoring wells 1.0m, 2.2m, and 3.8m down-gradient from the injection well. The ground water velocity was near 2 m/day.

The aquifer apparently already contained organisms that use methane. It was not necessary to inoculate the aquifer with foreign organisms, but it was necessary to supplement the aquifer with nitrogen or phosphorus. After complete acclimation, the microorganisms removed more than 95% of the vinyl chloride, more than 90% of the *trans*- DCE, more than 45% of the cis- DCE, and about 20% of the TCE.

For more information, contact Dr. John Wilson at FTS-743-2259 or 405-332-8800

SITE Subjects

Demonstration of Microfiltration Technology

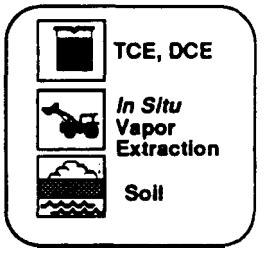


by John Martin
Risk Reduction Engineering Laboratory

The most recently completed field demonstration project under the SITE Program is the effort involving E.I. DuPont de Nemours and Co. and the Oberlin Filter Company. The field work was undertaken during April 1990, and a field visitors' day was held on April 10,1990, to familiarize guests with the operation of the filtration process. The demonstration took place at the Palmerton Zinc Pile Superfund Site in Palmerton, PA. The work involved microfiltration of a Superfund waste stream for the removal of precipitated metals, primarily zinc. The technology includes use of an automatic pressure filter unit, allowing semi-automatic operation and production of a relatively dry filter cake. The Tyvek™ filter medium was developed and supplied by DuPont. The Tyvek™ material, a fine, nonwoven sheet made from high-density polyethylene, is formed from continuous filaments that are thermally bonded. The material comes in rolls and provides filter capability to less than one micron. Tyvek™ is extremely resisent to chemical degradation or physical rupture and also allows clean release of the filter cake. For more information, contact John Martin at FTS-684-7758 or 513-569-7758.

News from the Centers

In Situ Vapor Extraction at Hinson Chemical Site



by André Zownir, Environmental Response Team and Fred Stroud, Senior OSC, Region IV

In December 1988, Region IV initiated a buried drum removal action at the Hinson Chemical Site in Lake Wylie, SC-once the location of a solvent recovery operation. The trenches were excavated and the drums were placed in a lined pit. The soil was stockpiled, replaced, and the surface was graded. The OSC in Region IV requested the Environmental Response Team's (ERT) Alternative Technology Section to provide treatment options for the soil contaminated with 1,1-dichloroethylene, *trans-1,2-dichloroethene,* benzene, trichloroethylene, and tetrachloroethylene.

The original soil structure at the site had four layers: an artificial layer of gravel that contained the highest contaminant levels; a fine sandy loam over a Georgia red clay layer: and a sand formation which extended into an underlying unconfined aquifer. During the removal action, the first three layers were intermixed. The extent-of-contamination survey showed about half an acre of contaminated soil. Three soil treatment alternative technologies were proposed and evaluated by the ERT: soil washing; low temperature thermal desorption; and *in situ* vapor extraction.

*(see **ISVE,** page 4)*

Bioremediation Field Initiative

OSWER and ORD have jointly instituted a Bioremediation Field Initiative to provide assistance to the Regions in conducting field tests and evaluations of bioremediation site cleanups planned or in progress over the next 18 to 24 months.

Sites that should be considered in this field initiative include CERCLA, RCRA corrective action facilities, and UST sites. This initiative is designed to 1) more fully document performance of full-scale field applications of biremediation, 2) provide technical assistance for sites in a feasibility or design stage to facilitate the conduct of treatability studies, field pilot studies, etc., and 3) regularly provide the Regions information on treatability studies, design, and full-scale operations of bioremediation projects in the Regions.

For more information, contact your supervisor or call Fran Kremer at FTS-475-6647 or 202-475-6647.

ISVE *(from page 3)*

Soil washing and low temperature thermal desorption were judged to be unacceptable on the fast day of testing due to the high clay content that would result in material handling problems. Additionally, these two technologies required excavation of the soils. In situ vapor extraction (ISVE) of the upper portion of the vadose zone was chosen for a pilot test at the site.

ISVE employs a well field that pumps and injects air out of and into the vadose zone. For the pilot test, six-inch diameter bore holes were drilled at depths up to nine feet. One-and-a-quarter inch perforated pipe was placed in each of 16 holes. Eight of the 16 holes were backfilled with crushed stone and native fill. These were used to pressurize the ground and enhance the pressure gradient, forcing vapors to the withdrawal vents. The exhaust fan used in this study generated a modest pressure differential of three inches water. Ten to twenty kilograms of organic vapors were drawn through the system in each of the two days of operation. Six compounds were monitored during the field exercise. Calculations indicated that at the pressure gradient used in the pilot test, 180 to 265 days of operation would be required to bring vapor levels down to below detection limits of the field instruments.

Based on the results of the successful pilot study and the results of an analysis showing that contamination extended into the fourth layer as well as the other three, the OSC directed the installation of a three-stage ISVE system with 18 deep and shallow well pairs along with 16 air injection wells. The recovered vapor was treated using two in-series 900 pound vapor phase activated carbon cells for each system.

The full-scale system started operations in May, 1990. Each of the three extraction systems consisted of six well pairs. In the first three weeks of operation, the three extraction systems recovered 60,200, and 500 pounds of the six target compounds, respectively.

For more information. contact André Zownir at FTS-340-6740 or 201-321-6740 or Fred Stroud at FTS-257-3931 or 404-347-3931.

Tech Trends welcomes readers' comments, suggestions for future articles, and contributions.
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