United States Environmental Protection Agency

Solid Waste and Emergency Response (OS-110W)

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EPA TECH TRENDS

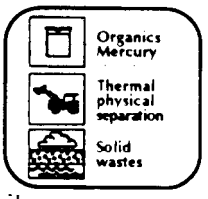
The Applied Technologies Journal for Superfund Removals and Remedial Actions and RCRA Corrective Actions

Border Crossing Sites

Both the U.S. EPA and Environment Canada have programs that support emerging innovative technology development and technical evaluation demonstrations. EPA's Superfund Innovative Technology Evaluation (SITE) Program and Environment Canada's Development and Demonstration of Site Remediation Technologies (DESRT) Program are described in the Special Insert to this issue of *Tech Trends*.

Additionally, the SITE and DESRT programs join together from time to time in evaluating innovative technologies. Don't miss the article on the Eco Logic system under "SITE Subjects" in this issue (page 3) that highlights a cooperative effort between the SITE and DESRT programs.

Thermal Desorption System Treats Wide Variety of Solid Wastes



by Paul R. dePercin, Risk Reduction Engineering Laboratory

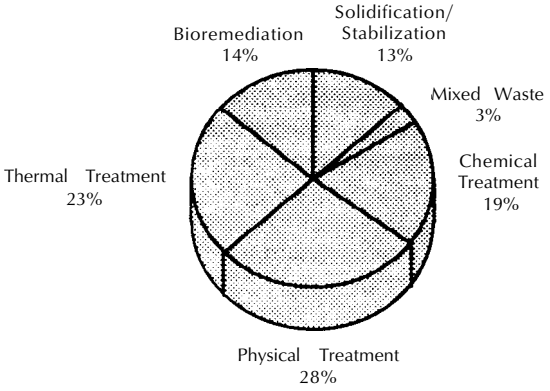
The X*TRAX™ Model 200 Thermal Desorption System developed by Chemical Waste Management, Inc., is a low-temperature process designed to separate organic contaminants from soils, sludges and other solid media. The system is a thermal and physical separation process that does not involve incineration. It is fully transportable and requires an area of about 125 feet by 145 feet.

The X*TRAX™ system was evaluated under the EPA s Superfund Innovative Technology Evaluation (SITE) program at the Re-Solve Superfund Site in North Dartmouth, Massachusetts. Approximately 35,000 tons of soils and sediments at the site are contaminated with PCBs in concentrations ranging from 181 to 515 milligrams per kilogram (mg/kg). The X*TRAX™ successfully removed PCBs at an average removal efficiency of 99.9%. PCB concentrations in all treated soil samples were less than 1.0 mg/kg; and, the average concentration was 0.25 mg/kg. Tetrachloroethene, total recoverable petroleum hydrocarbons and oil and grease, present in concentrations of 365 micrograms per kilogram (µg/kg), 893 mg/kg and 913 mg/kg, respectively, were all reduced to below detectable levels in treated soil.

During the SITE demonstration, about 215 tons of soil were treated at an average feed rate of 4.9 tons per hour for 2 hours with an average treated soil temperature of 732 degrees Fahrenheit First, contaminated solids were fed into an externally heated rotary dryer where temperatures ranged from 750 to 950 degrees. Evaporated contaminants were removed by a recirculating nitrogen carrier gas that was maintained at less than 4% oxygen to prevent combustion. Solids leaving the dryer were sprayed with treated cooling water to help reduce dust when the treated soilids were returned to their original location to be compacted in place. The nitrogen carrier gas was treated to remove and recover dust particles, organic vapors and water vapors.

*(see **X*TRAX™** page 2)*

SITE Program Technologies in ATTIC



Of 177 technologies reported, source documents include Demonstrations Bulletins, Technology Profiles, Technology Evaluation Reports and Applications Analysis Reports.

Canadians in the ATTIC

Not all Alternative Treatment Technology Information Center (ATTIC) users are from the United States. Of the more than 2,900 registered users to the ATTIC online information retrieval system, 5% are Canadians. Canadians share a need to easily access accurate, up-to-date, hazardous waste cleanup information.

Richard Glue, Regional Coordinator for Environment Canada s National Contaminated Sites Remediation Program (NCSRP) in the Pacific and Yukon Region in North Vancouver, British Columbia, is a frequent user of ATTIC. He manages remediation projects in the region and works with contractors and local governments to evaluate appropriate actions for hazardous waste sites.

Mr. Glue, like many ATTIC users, has limited time and resources to research data on new technologies. He uses ATTIC to quickly identify sites where new technologies have been demonstrated. For example, he is able to search the ATTIC database using the keywords PCBs, soil, and SITE Program to find 24 reports describing Superfund Innovative Technology Evaluation (SITE) Program projects that involved soil contaminated by polychlorinated biphenyls. The case studies and reports found in ATTIC are helpful in evaluating the technologies recommended by contractors for remediation of various Canadian sites. Mr. Glue explained that Canadians use ATTIC because it is a well established system with a large amount of cleanup data that can be easily searched. The U.S. EPA has been involved in site clean up for a long time; and, the NCSRP is willing to take advantage of the knowledge and expertise gained from EPA s experiences.

The international border crossing is not a one way ticket. ATTIC provides detailed information on a wide range of alternative treatment technologies, not only in the U.S. but abroad as well. For example, 30 of the 2,900 abstracts currently in the ATTIC database describe Canadian sites. ATTIC can help users to share information and encourage technology transfer between nations and among environmental professionals.

For information about ATTIC, contact the ATTIC Program Manager, Joyce Perdek at 908-321-4380. On-line access to ATTIC is available by dialing 301-670-3808.

X*TRAX™ *from page 1*

An eductor scrubber removed dust particles and 10 to 30% of the organic contaminants from the carrier gas. Scrubber liquid collected in a phase separator from which sludge and organic liquid phases were pumped to a filter press, producing filter cake and filtrate. The filtrate was then separated into organic liquid and water phases. Most contaminants removed from the feed solids were transferred to the organic liquids or the filter cake. The filter cake was blended with feed solids into batches and reprocessed in the system, while the concentrated organic liquids were treated or disposed of off site.

Carrier gas exiting the scrubber passed through two condensers in series, where it was cooled to less than 40 degrees F. The condensers separated most of the remaining water and organic vapors from the gas stream. Organic vapors were recovered as organic liquids; water was treated by carbon adsorption. (The water could be used to cool and reduce dusting from treated solids, or either could be treated and discharged.) About 5 to 10% of the gas exited the system through a process vent, passing through a particle filter and carbon adsorption system before being discharged to the atmosphere. The volume of gas released by the X*TRAX™ system is about 100 to 200 times less than the amount released by an equivalent capacity incinerator. At Re-Solve, organic air emissions were negligible (0.4 grams per day); and, no PCBs were detected in vent gases. Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans were not formed within the system. Metals concentrations and soil physical properties were not altered by the X*TRAX™ system.

Bench, pilot and full-scale X*TRAX™ systems have been used to treat solids contaminated with the following wastes: PCBs; halogenated and nonhalogenated solvents; semivolatile organic compounds; polynuclear aromatic hydrocarbons; pesticides; herbicides; fuel oils; BTEX (benzene, toluene, ethylbenzene and xylenes); and mercury. The system has also treated Resource Conservation and Recovery Act (RCRA) hazardous wastes to meet Land Disposal Restrictions (LDR) treatment standards. RCRA wastes treated include petroleum refinery wastes (K048 through KO52) and multisource leachate treatment residues (FO39).

For more information, call Paul dePercin at EPA s Risk Reduction Engineering Laboratory at 513-569-7797 (FAX: 513-569-7620).

Crossing the Border

Environment Canada

Canada's DESRT Program Funds Innovative Technology from the Beaker into the Marketplace

by Ginny Hardy and David Hutchinson,
Technology Development Branch, Environment Canada

In 1989 the Canadian government established a five-year program to work with industry to stimulate the development and demonstration of new and innovative remediation technologies for sites containing soils, sediments, ground water or surface water and wastes contaminated by hazardous substances. This program, known as DESRT (Development and Demonstration of Site Remediation Technology), has been funded at $50 million over five years, beginning in 1990.

Objectives

DESRT focuses primarily on technologies, processes, methods and procedures in the areas of site characterization and assessment, remediation and compliance monitoring. A second objective of the program is to enhance the scientific knowledge base in Canada and the development of opportunities to market Canadian expertise and technology internationally. (Although preference is given to Canadian comparues, United States companies can apply to the program for support.)

Priorities

Similar to EPA s SITE program, the first priority of the program is to encourage the demonstration of promising new technologies that have been developed to the pilot plant stage. The second priority, similar to EPA s Emerging Technologies program, is to encourage the advancement of technologies that are in the laboratory stage of development in order to offer alternative technologies for site remediation. DESRT also encourages technologies that are in the stages leading up to, but not including, commercialization.

Demonstration

The demonstration component of the DESRT program evaluates operation, cost and reliability of the innovative technology under actual field conditions so that it can be assessed as an alternative to other remediation technologies. The DESRT program will share costs of an approved demonstration project with industry, developers of technology, owners of contaminated sites and other collaborators for the initial field application of a pilot or prototype. Allowable costs in demonstration projects include engineering and consulting services, equipment, installation, start-up, monitoring and evaluation, equipment dismantling and clean-up,

(see **DESRT** page S-3)

A Supplement to Trends May 1993

EPA

EPA's SITE Program Supports Emerging Innovative Technology Development and Technical Evaluation Demonstrations

by John Martin, Risk Reduction Engineering Laboratory

The Superfund Innovative Technology Evaluation (SITE) Program, now in its eighth year, is an integral part of EPA s development of alternative cleanup methods for hazardous waste sites around the United States. The SITE program was authorized by the Superfund Amendments and Reauthorization act of 1986 with the goal of identifying technologies, other than land disposal, that are suitable for treating Superfund wastes. The program is administered by the Risk Reduction Engineering Laboratory (RREL) in Cincinnati, Ohio.

Objectives and Priorities

The program provides an opportunity for technology vendors to develop and demonstrate their innovative technologies capability to successfully process and remediate Super-fund waste. EPA evaluates the technology and provides an assessment of potential for future use for Superfund cleanup actions. The SITE program consists of four related components: (1) the Demonstration Program, (2) the Emerging Technology Program, (3) the Monitoring and Measurement Technologies Program and (4) Technology Transfer activities that disseminate information from the other three programs and provide technical support to EPA Regions, other Federal agencies, States and Superfund contractors.

Demonstration

Through field demonstrations of pilot or full-scale technologies, the SITE Demonstration Program develops reliable engineering, performance and cost data on innovative, alternative technologies so that potential users can evaluate a technology s applicability for a specific waste site. EPA works with developers to match the technologies with appropriate sites, based on several considerations: the developer s waste and location preferences, relevance of the technology to the site cleanup and Regional needs. Cooperative agreements between EPA and the developer set forth responsibilities. Developers are responsible for operating their systems at the site, and are expected to pay the costs to transport the equipment to the site, operate the equipment on site during the demonstration and remove the equipment from the site. EPA is responsible for protect planning, sampling and analysis, quality assurance and quality control, preparing reports and disseminating information.

Emerging Technology

The Emerging Technology Program (ETP) provides a funding framework to encourage bench- and pilot-scale testing and evaluation of technologies that, at a minimum, have proven conceptual and bench-scale feasibility. Through a cooperative cost sharing agreement between EPA and the technology developer, EPA may fund up to $150,000 for one year, with an additional year of funding ($300,000 maximum for the two years) for projects that show significant progress. After the second year or significant progress, emerging technologies may be considered for the SITE Demonstration program. Federal agencies, as well as private developers, can participate in the ETP.

Monitoring and Measurement Technologies Program

The Monitoring and Measurement Technologies Program (MMTP) tests the ability of advanced technologies to assess the nature and extent of contamination and evaluate cleanup levels. The MMTP is looking for new or modified technologies that can detect, monitor and measure hazardous and toxic substances in the subsurface (saturated and vadose zones); air, biological tissues, wastes, and surface waters, as well as technologies that characterize the physical properties of sites. The MMTP is particularly interested in chemical sensors for in situ measurements, ground water sampling devices, soil and core sampling devices, soil gas sampling devices, fluid sampling devices for the vadose zone, in situ

(see **SITE Program** page S-3)

SITE Program *from page S-2*

and field-portable analytical methods and expert systems that support field sampling or data acquisition and analysis. Funding by EPA is generally not provided to developers under this program.

Solicitation

Annual solicitations for the SITE Demonstration program are advertised in the *Commerce Business Daily* in January. Annual solicitations for the ETP are advertised in the *Commerce Business Daily* in July. The identification of candidate technologies for the MMTP is ongoing; therefore, technology developers are encouraged to submit unsolicited new and updated information at any time.

EPA Contacts and Additional Information

More detailed information on the SITE program, with an extensive list of EPA contacts is contained in The *Superfund Innovative Technology Evaluation Program: Technology Profiles Fifth Edition* (Document No. EPA/540/R-92/077). This publication further describes the program and profiles 156 demonstration, emerging and monitoring and measurement technologies being evaluated under the SITE program. Each profile describes the technology; discusses its applicability to various wastes; discusses its development or demonstration status and demonstrations results, if available; and provides demonstration and technology contacts. This publication can be ordered from EPA s Center for Environmental Research Information (CERI) at 26 West Martin Luther King Drive, Cincinnati, Ohio 45268; please refer to the document number noted above when placing an order.

The SITE contacts in the EPA s Risk Reduction Engineering Laboratory are John Martin (513-569-7758) for the Demonstration Program and Norma Lewis (513-569-7665) for the Emerging Technology Program; John and Norma s address is United States Environmental Protection Agency, Risk Reduction Engineering Laboratory, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268. The contact for the SITE Monitoring and Measurement Technologies Program is Lary Jack (702-798-2373); Lary s address is United States Environmental Protection Agency, Environmental Monitoring Systems Laboratory, P.O. Box 93478, Las Vegas, NV 89193-3478. The EPA Headquarters contact for innovative technology development is John Quander (703-308-8845); John s address is United States Environmental Protection Agency, Technology lnnovation Office (OS-110W), 401 M Street, S.W., Washington, DC 20460.

DESRT *from page S-1*

data quality assurance and quality control, economic assessment and report preparation.

Research & Development

The research and development (R&D) component of the DESRT program supports the evolution of promising new or innovative technologies through the laboratory and small pilot stages of development up to the point of field testing. The program provides financial assistance for a portion of the salary costs of scientific, engineering and technical personnel working on specific processes or products for which accelerated development is warranted. Subcontracts to universities, government and other research institutions collaborating in the project may be included as an eligible direct cost. In the case of government research institutions, incremental costs only are eligible; salary and related overhead costs are not. The program may make a financial contribution toward the purchase of specialized equipment necessary for completion of a research project.

Solicitation

Two approaches are used to initiate DESRT proposals: unsolicited proposals and requests for proposals. Unsolicited proposals are those submitted by an organization on its own initiative, to satisfy the technology development and demonstration objectives of the DESRT

*(see **DESRT** page S-4)*

DESRT *from page S-3*

program. DESERT requests proposals when development and demonstration needs arise which are not otherwise being addressed.

Eligibility

Those eligible for the DESRT program are incorporated companies, universities, municipalities, trade and research organizations and consulting firms with demonstrated competance in the field of environmental technology. For individual projects, preference will be given to applicants that are, or are working in close collaboration with, the owners(s) of a contaminated site(s) or parties designated responsible for the remediation of contaminated sites. All projects must be directed toward new and improved technologies that reduce or eliminate threats posed to the human health or the environment by contaminated sites. The technology must be unique, or used uniquely, and must have the potential for wide application across Canada or must relate to a serious problem identified in an area within Canada. The project must involve considerable technological risk in achieving commercialization of the technology and should be designed to lead, ultimately, to commercialization of the technology. Eligible proposals for either type of project are distributed for review and recommendation within the federal government and within the pertinent provincial or territorial government. As DESRT involves joint funding by both levels of government, both levels of government must approve a project.

Funding Arrangements

DESRT funding must bring incremental value to the project; if it would otherwise proceed at the same level of effort without DESRT assistance, the project is ineligible. Decision on the DESRT share of funding is negotiated on a case-by-case basis. The level of financial assistance and the starting date for financial assistance are confirmed in a formal contract or other financial agreement between the applicant and the designated federal or provincial agency representing the DESRT program. The process is competitive and subject to availability of funds.

Ownership Rights

Technology ownership rights are among the topics negotiated in reaching a contractual agreement under the DESRT program. Since the primary interest of the Canadian government is to provide new developments to assist in remediation of high risk contaminated sites in Canada, the foremost consideration in negotiations of ownership rights will be the potential for successful commercialization and replication of the new technology. Additionally, the government considers factors such as funding history of the project, the capacity of the proponent to exploit the new technology and the contribution made by the proponent.

Canadian Contacts

For a more complete description of the DESRT program and for additional information on the guidelines for application, egligibility and selection criteria, please contact either Ginny Hardy (telephone: 819-953-0962) or David J. Hutchison (telephone: 819-953-5228) at Environment Canada s DESRT Office. Their Fax number is: 819-953-9029. Their address is:

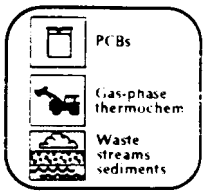
DESRT Office
Technology Development Branch
Conservation and Protection
Environment Canada
Fourth Floor, Place Cartier
425 St. Joseph Blvd.
Hull, Quebec
CANADA KIA 0H3

For your information, the Canadian government also has a program that specifically promotes research on innovative ways to clean up ground water and soil contaminated with petroleum hydrocarbons. The Groundwater and Soil Remediation Program (GASReP), established as a joint government/ industry venture focuses on basic/ applied research and /or technology development. For a fuller summary of GASReP, see the March 1993 issue of EPA s *Ground Water Currents* (EPA Document No. EPA/542/N-93/003), which can be ordered from NCEPI by referring to the EPA Document Number by fax (513-891-6685) or by mail addressed to NCEPI, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242. For detailed information, contact Alex Lye, the CASReP Manager at:

Environmental Technology Office
Canada Centre for Inland Waters
P.O. Box 5050
867 Lakeshore Road
Burlington, Ontario
CANADA L7R 4A6
Telephone: 416-336-6438
Fax: 416-336-4858

Chemical Reduction of PCBs

by Gordon M. Evans, Risk Reduction Engineering Laboratory



EPA s Superfund Innovative Technology Evaluation (SITE) program and its Environment Canada equivalent, the Development and Demonstration of Site Remediation Technology (DESRT) program, have coordinated on a SITE evaluation of the patented Eco Logic system. The Eco Logic system is a gas-phase thermo-chemical process which employs a reduction reaction of hydrogen with organic and chlorinated organic compounds at elevated temperatures. The reduction reaction breaks the large-chain molecules into less problematic hydrocarbons. Approximately 95% of the reformed gaseous product is recirculated back to the reactor, with the remaining 5% used to co-fire a propane fired preheat boiler. The boiler stack emissions are not significant.

The system, as tested, consists of a process reactor (6 ft. in diameter and 10 ft. tall, capable of handling 25 tons of material per day), a scrubber, a propane-fired pre-heater and a heat exchanger. The unit is housed on two flat bed hailers and is designed to handle aqueous and oily waste streams. as well as harbor sediments. The presence of water enhances the reduction reaction, thus eliminating the need for dewatering.

The SITE demonstration took place last fail in Bay City, Michigan where the unit was used to destroy PCB contaminated water and oils drawn from beneath a landfill owned by the city. The polychlorinated biphenyl (PCB) concentration in the oily waste was approximately 40%. A known quantity of perchlorethylene (PCE) was added to the waste stream as a control; PCE is known as a reliable surrogate measure for PCBs. The reactor test program consisted of two distinct test conditions; a nigh oil/low water feed and a low oil/high water feed. Three separate test runs were conducted for each test condition. In addition, the unit was put through a controlled 72-hour engineering performance run.

Although a number of tests were conducted during the SITE demonstration, the three primary objectives are summarized. The primary test objective was to determine the destruction and removal efficiency (DRE) for PCBs at the propane boiler stack The system successfully achieved 99.9999% DRE for ail six runs conducted under both test conditions. The second test objective was to determine the destruction efficiency (DE) for PCE the system successfully achieved 99.99% DE for all six runs conducted under both test conditions. The third test objective was to examine the fate of dioxin and furan compounds which are fed into the system. The demonstration showed that for each run under both test conditions, the system was a net destructor of dioxin and furan compounds.

A SITE Application Analysis Report and the Technical Evaluation Report will be available in the summer of 1993. Additional information is available from Gordon M. Evans, Site Project Manager, at EPA's Risk Reduction Engineering Laboratory at 513-569-7684. Gordon's fax is: 513-569-7620.

Recycling Superfund Lead Waste Proves Cost-Effective Alternative to Treatment and Land Disposal

by Mick Gilbert, U.S. Environmental Protection Agency, Region 2

You may want to consider sending lead contaminated drums and other lead bearing waste at your site to a recycling facility rather than to a Subtitle C landfill or an incinerator. EPA s Region II has discovered that recycling can be a viable and cost effective alternative. In 1992, Pat Augustin of EPA s Emerging Technology program worked with the Center for Hazardous Materials Research, Exide Corporation (a lead smelter and battery manufacturer) and EPA's Region II to assess the feasibility of lead recycling for the various lead bearing materials remaining at the NL Industries, Inc. Superfund Site in Pedricktown, New Jersey.

The NL Industries site is a 42 acre former secondary lead smelting facility. The facility operated from 1972 to 1984. At the facility, used batteries were broken, drained of acid and processed through a rotary furnace to reclaim the lead. Other lend bearing materials were also processed through the furnace.

*(see **Lead** page 4)*

Lead *from page 3*

When the company went bankrupt in 1984, the facility ceased operations, leaving large amounts of lead bearing materials on the site. These materials included lead drosses, baghouse bags, broken battery casings, lead-contaminated steel drums, pallets and debris.

In assessing recycling for the site, a treatability study was conducted on the various lead bearing materials remaining on the site. The matenals were initially processed through the secondary lead smelter at Exide on a test bum basis to determine the feasibility and economics of processing these types of materials. This test determined that much of the material could be processed through the furnace in an economically and environmentally sound manner.

Next, the consortium developed plans to process larger amounts of the materials to further evaluate if the smelting industry would be able to handle and process various lead bearing materials from Superfund sites. Over the next several months, approximately 2.7 million pounds of lead bearing materials from the site were recycled at the Exide facility. Material was processed through the furnace at a ratio of approximately 40% of material from the NL Industries site to 60% of Exide s regular feed stock. The study found that recycling can cost less than land disposal and alternative treatments. Initial cost estimates for processing various types of material are presented below. (Note that the estimates assume that the refined lead from recycling would sell at the then prevailing market price of $0.35 per pound; lower lead prices imply a higher cost to recycle.)

Incineration of debris containing lead (i.e., pallets, paper, personal protective equipment) runs from $250 to $500 per ton; by comparison, recycling costs less at $200 to $250 per ton. Land disposal of steel drums and debris costs approximately $300 per ton compared to recycling which costs $200 per ton. Land disposal of rubber battery cases runs from $250 per cubic yard compared to recycling at $150 per cubic yard. Incineration of paint residues is $350 per ton compared to recycling at $200 to $225 per ton. Treatment and disposal of lead laden soil runs $300 per ton for soils containing more than 25% lead compared to $250 per ton through recycling. Land disposal of baghouse bags (Resource Conservation and Recovery Act listed waste KO69) is prohibited by land disposal restrictions. Recycling of baghouse bags runs between $200 to $250 per cubic yard. Costs for lead drosses are: $300 per ton for land disposal of 50% or more lead content compared to recycling at $50 to $150 per ton; $300 per ton for land disposal of 25% to 50% lead compared to recycling at $150 to $200 per ton.

For more information, call Mick Gilbert, Remedial Project Manager in EPA s Region 2 at 212-264-6418.

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Tech Trends welcomes readers' comments and contributions. Address correspondence to: Managing Editor, Tech Trends (OS-110W) U.S. Environmental Protectton Agency. 401 M Street. S.W., Washington, DC 20460.

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