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The Applied Technologies Newsletter for Superfund Removals & Remedial Actions & RCRA Corrective Action

ABOUT THIS NEWS

This issue highlights the results of demonstrations of a number of innovative technologies and processes for reducing risks at and remediating Superfund, RCRA, and other sites.

Southeastern Technology Center Tests Aerobic System at Georgia Landfill

by Milton Gorden, STC

Southeastern Technology Center (STC) reports that early data from a demonstration of an aerobic biodegradation system at a landfill in Columbia County, GA, indicate that methane levels can be reduced by 50-90%, biological oxygen demand in the leachate can be reduced by more than 50%, and metal contamination of the leachate can be prevented. STC is a non-profit organization that facilitates the transfer of commercially viable technologies from the government sector to the private sector to promote economic growth regionally and nationally.

STC conducted the demonstration project under a cooperative agreement with the U.S. Department of Energy-Savannah River (DOE-SR) to commercialize innovative technologies developed by the agency. Columbia County, GA, and American Technologies Inc. of Grovetown, GA, also participated in the demonstration program. DOE-SR personnel provided technical support for these demonstrations.

The aerobic system STC tested at the Columbia County Landfill is designed to reduce or eliminate problems associated with the anaerobic ("dry tomb") technology commonly used in design, construction, and closure of municipal landfills. Disadvantages of the traditional anaerobic process include the production of methane, leaching of metals, formation of toxic compounds, slow stabilization, and odor. Conversion of the Columbia County Landfill to an aerobic system involved the injection of air into the subsurface through horizontal pathways. The injected air provided oxygen to aerobic microorganisms located in the overlaying waste mass, thereby promoting microbial population growth and activity. This system involves the return of leachate collected from the landfill to the top of the waste mass, where it is allowed to percolate down into the waste, providing moisture for microorganisms. The stimulated aerobic microorganisms promote the decay of carbon compounds into carbon dioxide and water.

Under the DOE cooperative agreement, STC also managed development of the HaloSnif™ fiber-optic spectrochemical sensor, the BaroBall™ technology using pressure differentials in gas venting wells, depth-discrete sampling ports for multiple depth sampling in a single well, and the PHOSter™ system (described in the March issue of *Tech Trends*). For additional information, contact James Ullery (STC) at 706-722-3490 or the World Wide Web site www.CSRA.net/SETC.

Studies Focus on Reducing Lead Bioavailability at Superfund Site

by Mark Doolan, EPA Region 7, and Stan W. Casteel, Ph.D., University of Missouri

EPA Region 7 is supporting field tests to determine the effectiveness of various forms of phosphorous amendment in

reducing the bioavailability of lead in soil from the Oronogo-Duenweg Mining Belt Superfund Site in Jasper County, MO. The amendments include phosphoric acid, triple super phosphate, rock phosphate, iron-rich material, and compost material. Methods of treatment with these amendments include rototilling, surface aeration, and pressure injection.

In conjunction with the field studies, University of Missouri researchers are testing a new method for determining lead bioavailability using immature swine dosed with lead-contaminated soil from the site. Researchers selected swine for the bioavailability testing because immature swine are physiologically similar to young children, on which EPA's lead-uptake model is based. Dosing trials with phosphorous-amended, lead-contaminated soil indicate that a 50% or greater reduction in lead bioavailability may be possible.

These tests will help EPA regulatory officials determine whether using phosphate to treat lead-contaminated soil will modify existing cleanup levels. An existing contingent Record of Decision (ROD) for the site calls for excavation and replacement of top soil for 2,400 residential properties with lead contamination levels as high as 10,000 ppm. At properties where phosphate amendment is successful in significantly reducing bioavailability rates, excavation and replacement of the soil may be greatly reduced.

EPA anticipates completion of the Oronogo-Duenweg Mining Belt Site lead studies in early 1998.

Results of previous swine studies using lead-contaminated soil reinforce the usefulness of site-specific bioavailability measurements in setting priorities or determining remedial needs. For example, in one study conducted with lead-contaminated soils taken from the Smuggler Mountain Superfund Site in Aspen, CO, 50 juvenile male pigs were dosed orally with varying amounts of lead-contaminated soil over a 15-day period. Post-mortem analysis of liver, kidney, and bone tissues (weighted) indicated relative bioavailability values of 63-64%. These results differed significantly from the lower absorption rates measured in studies involving high doses administered to animals with physiologies unlike humans, such as adult rodents.

Other studies involved dosing juvenile swine with lead-contaminated soil samples from widely diverse sites across the country. In these studies, relative bioavailability of lead varied substantially among sources, with absolute bioavailability rates ranging from 15% to 45%.

For more information on the phosphate amendment studies at the Oronogo-Duenweg site, contact Mark Doolan (EPA Region 7) at 913-551-7169. For more information on bioavailability testing in swine, contact Stan W. Casteel, Associate Professor of Toxicology (College of Veterinary Medicine, University of Missouri) at 573-882-6811.

Phase III of DoD's UXO Demonstration Program Completed

by Kelly Rigano, U.S. Army Environmental Center

The U.S. Department of Defense (DoD) Army Environmental Center (USAEC), in partnership with the Naval Explosive Ordnance Disposal Technology Division, has completed Phase III of the Unexploded Ordnance (UXO) Technology Demonstration Program. The U.S. Army Jefferson Proving Ground in Madison, IN, hosted 15 demonstrations of various technologies at a 16-hectare, controlled test site containing a known baseline of emplaced, inert ordnance.

Phase III results indicate that UXO technologies show continued improvement in detection performance since the initial Phase I demonstrations in 1994. Improvements to the capabilities for discriminating UXO from background clutter, however, need a focused effort. Additionally, performance of excavation technologies has not improved significantly. Results also show that technology for remote excavation is feasible, but slow and inefficient.

The detection technologies demonstrated in Phase III utilized electromagnetic induction, gradiometers, magnetometers, and ground penetrating radar sensors. Top performers detected over 95% of the emplaced ordnance targets. Corresponding false alarms (demonstrator target reports that do not correspond to baseline ordnance targets) exhibited by all demonstrators were high. For optimum performers, the false alarm (FA) ratios (the number of FAs/number of detected ordnance) ranged between 1.91 and 5.18. This means that 2-5 targets were identified for every baseline ordnance target detected. These results show that demonstrator detection performance was dependent not only on the type of sensor used, but on each demonstrator's entire technical process for collecting, processing, and reporting data.

In its Phase III final report, *UXO Technology Demonstration Program at Jefferson Proving Ground, Phase III, April 1997*, DoD recommends establishment of target discrimination goals and standard formats for raw sensor data, identification of discrimination factors, and availability of raw sensor data to technology developers. DoD also recommends further funding for development of innovative and high-risk technologies and the availability of a test area at the Jefferson Proving Ground for technology development. For further information, contact Kelly Rigano (USAEC) at 410-612-6868.

Polyurea Spray Elastomer Used for Containment

by Carol J. Miller, Ph.D., P.E., Wayne State University

Researchers recently found that a polyurea elastomeric material is highly effective in forming a continuous, seam-free landfill liner. Experts from Wayne State University, Drexel University, and Foamseal collaborated to develop the elastomer as an alternative to the materials conventionally used for landfill liner and cover systems.

The elastomer consists of an isocyanate-terminated prepolymer reacted with an amine-terminated resin. These liquids are pumped by a two-component dispense unit at 2000 psi and 155° F and sprayed through a mechanical purge gun in a fan-shaped pattern. Application of the elastomer is performed by hand or with automated equipment utilizing a transversing spray gun. Completed chemical reaction occurs within minutes of application. A color coding system is used to reflect varying thickness of the liner needed for differing site conditions, ranging from red, for a thickness of 165 mil, to green, for 105 mil. By uniquely coloring base materials, field personnel responsible for spraying the elastomer are guided in achieving the required thickness and controlling uniformity of the spray. Complete coverage with the spray is achieved when base materials lose color.

Calendar

IBC's Second Annual Conference on Innovative Remediation Technology; **July 21-23, 1997; Swissotel, Boston, MA; 508-481-6400 extension 451, e-mail mnowakowski@ibcusa.com, or the World Wide Web site http://www.ibcusa.com/conf/innovative.**

Midwest Remediation Market Conference; **July 22-23, 1997; Holiday Inn - Mart Plaza, Chicago, IL; 800-783-3870.**

South Central Remediation Market Conference; **November 13-14, 1997; Monteleone, New Orleans, LA; 504-523-3341.**

Superfund XVIII; **December 2-4, 1997; Sheraton Washington Hotel, Washington, D.C.; 301-986-7800 or the World Wide Web site http://www.ejkrause.com.**

Laboratory testing of mechanical and hydraulic properties of the polyurea spray indicated a tensile strength, at maximum stress, of 20.8 MPa, tear resistance of 4.0 N/mm, and puncture resistance of 16.6 N/mm. Water vapor transmission occurred at 7.1×10^{-10} cm/sec. Direct shear testing results showed a friction angle and cohesion of 38.7° and 2 psi, respectively, when the elastomer was sprayed onto soil; 14.5° and 0 psi when sprayed onto geotextile material; and 37.4° and 0 psi when combined with geotextile material and sprayed on soil. Product cost is competitive with more traditional landfill liner material options. The application cost for a typical 60 mil liner is estimated as $10/yd^2.

An alternative use for the spray elastomer as a clay liner desiccation inhibitor was field tested on a limited scale; this application would have widespread use in arid and semi-arid climates where desiccation cracking of clay liners is a major threat. For more information, contact Carol Miller, Ph.D., P.E., (Wayne State University) at 313-577-3876 or Rick Tanis (Foamseal) at 810-628-2587.

NATO Pilot Study Meeting Held

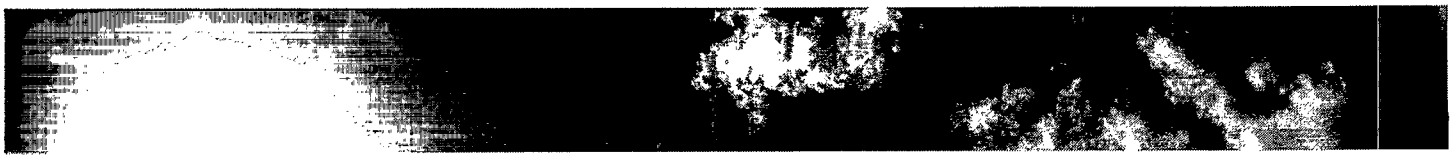
Members of the NATO Committee for the Challenges of Modern Society (CCMS) pilot study met March 17-21, 1997, in Golden, CO, in their fifth annual meeting to address contaminated land and groundwater. Colorado School of Mines hosted the meeting, which was sponsored by the EPA, DOE, and DoD. Representatives from eighteen countries participated in the meeting to evaluate demonstrated and emerging treatment technologies. In addition to technical presentations, members participated in field trips to DOE's Rocky Flats Environmental Site and the Clear Creek, CO, mining area to observe various innovative technologies. The agenda included discussions of selected technologies, such as phytoremediation, that researchers have identified for potential use at a low cost in Central and Eastern European countries.

During the past five years, the NATO/CCMS has reviewed over 50 treatment technologies under this U.S.-lead pilot study. A final report on the pilot study is scheduled to be released later this year. For more information, contact project Co-Directors Stephen James (EPA's Office of Research and Development) at 513-569-7877 or Dr. Walter Kovalick (EPA's Technology Innovation Office) at 703-603-9910. Information also is available on EPA's CLU-IN World Wide Web site (http://clu-in.com) under Partnerships.

Technical Issue Papers Released

EPA's Technical Support Project (TSP) has released two new issue papers. "On-Site Analytical Methods and Field Sampling for Explosives in Soil," sponsored by the TSP Federal Facility Forum, addresses screening procedures for the characterization of soils contaminated with explosive and propellant compounds. Technical experts from the U.S. Army Environmental Center, U.S. Army Cold Regions Research and Engineering Laboratory, DOE's Idaho National Engineering Laboratory (INEL), and EPA Region 10 participated in this analysis of the unique problems posed at facilities with potential explosive contamination.

"Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Sites" addresses analytical needs identified by the National Engineering Forum. INEL collaborated with EPA's National Exposure Research Laboratory (NERL) to provide information investigators need to determine whether site activities have resulted in elevated concentrations of inorganic contaminants in soil, compared with naturally occurring and off-site concentrations of the same contaminants. For more information on these and other TSP issue papers, contact Ken Brown (EPA/NERL Technology Support Center) at 702-798-2270.



Resources

Hazardous Waste Site Characterization on CD-ROM

Over 3,200 pages of RCRA and Superfund directives and manuals are now available in a single CD-ROM. The system contains capabilities for key word searches, as well as selected software packages such as ASSESS, Decision Error Feasibility Trials (DEFT), Geostatistical Environmental Assessment Software (Geo-EAS), and the Geophysics Advisor Expert System. Volume I of the system is available at a cost of $135 from the National Technical Information Service at 703-487-4650. Volume II, containing Volume I material plus over 12,000 pages of additional guidance, is scheduled for release in late 1997 with no licensing fee. For more information, contact Jeffrey van Ee (EPA/NRMRL) at 702-798-2367.

Preferred Alternatives Matrices Available On-Line

The Preferred Alternatives Matrices (PAMs), technology selection tools developed by DOE, are now available on the World Wide Web at http://www.em.doe.gov/define. PAMS are designed to help decision-makers identify appropriate technologies based on groups of site media and contaminants, otherwise known as "problem sets." The matrices rank proven, available technologies on the basis of performance, risk of technology failure, and cost against such problem sets. Project managers may use PAMs as a baseline for meas[illegible]lance of innovative technologies. Interested innovative technology vendors may request certification [illegible] the matrices. In the future, PAMS will include cost and performance data on technology demonstrations c[illegible]y DOE's Office of Environmental Restoration. For more information, contact Mary McCune (DOE) at 301-903-8152 or e-mail mary.mccune@em.doe.gov.

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