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LEAD RECLAMATION FROM SUPERFUND WASTE

By Laurel Staley, National Risk Management Research Laboratory

Lead
Smelter
Soil

Materials from three Superfund sites, a construction site and a bridge sandblasting operation were processed with regular feed to a secondary lead smelter as part of an EPA Superfund Innovative Emerging Technology Evaluation. Since secondary lead smelters already recover lead from recycled automobile batteries, it seemed likely that this technology could be used to treat waste from lead-acid battery contaminated Superfund sites. Such sites are very widespread and constitute a significant problem in site remediation.

In general, the EPA evaluation demonstrated that secondary lead smelters can treat lead contaminated wastes from Superfund sites provided that the waste is reduced to the right size (less than 1/4 inch) and is not fed too quickly (at more than 50% of the smelter feed rate). Waste feed combinations of between 1% and 45% can be successfully fed into the secondary smelter. Lead waste was reclaimed from all test materials over a range of efficiencies, from an estimated 70% for the abrasive blasting material to 99.5% for NL Industries site wastes, which consisted of lead slag, debris, dross, ingots, battery case pieces, baghouse bags, pallets and cans, which had initial concentrations of 20% to 57%. Initial lead concentrations for iron shot bridge-blasting material, rubber and plastic battery cases, with some soil and demolition debris coated with lead paint ranged from 3.2% to 14.7%.

The cost for remediating lead-acid battery sites using this technology ranged from $35/ton to $375/ton based on a variety of factors such as lead concentration, market price for lead, distance from the smelter, percent of test material that becomes incorporated into the final slag, iron content, BTU value of the test material and sulfur content.

The first step in reclaiming lead from Superfund wastes is acquiring and transporting the material to one of the smelters. Pre-processing includes screening to remove soil, large stones or non-contaminated debris that cannot be processed through a secondary smelter. Larger debris (>12 in.) is also removed because large material tends to remain unburned in reverberatory furnaces.

Material is blended with typical feed prior to processing through the furnaces. Typical blend ratios range from 10% to 50% by weight, based on treatability tests and other factors, such as lead, sulfur, iron or ash content.

Smelters typically contain tandem reverberatory/blast furnace processes. The lead-containing material that is to be reclaimed is first charged to the reverberatory furnaces. They process the feed material into slag, which typically contains 60% to 70% lead and a soft (pure) lead product.

The reverberatory furnace slag is enhanced by processing it through a blast furnace. Iron and limestone are added as fluxing agents to enhance furnace production. The blast furnaces are tapped continuously to remove lead and intermittently to remove the slag. The blast slag, is transported to an offsite landfill for disposal.

Lead produced in the blast and reverberatory furnaces is transferred to the refining process where metals are added to make specific lead alloys. The lead is then pumped to the casting operations where it is molded into ingots for use in the manufacture of new lead-acid batteries.

For more information, call Laurel Staley at EPA's National Risk Management Research Laboratory at 513-569-7863.

RCI TO EXPEDITE TECHNOLOGIES TO MARKET

By Stanley Chanesman, U.S. Dept. of Commerce

The Rapid Commercialization Project (RCI) is an innovative partnership of Federal inter-agency, interstate government and industry, the primary role of which is to accelerate commercialization of environmental technologies. Although the goal of easing the commercialization path of technology is the most significant aspect of the RCI, another innovation lies in the initiation of collaborative strategies to unite private sector technology developers, States, Federal agencies and regulatory bodies at national, State and local levels to identify and work through the environmental technology commercialization barriers under the aegis of the RCI. Federal agencies include the Departments of Commerce (DOC), Defense (DoD) and Energy (DOE) and the Environmental Protection Agency (EPA); participating States and State organizations include The State of California Environmental Protection Agency, Southern States Energy Board and the Western Governors Association.

The RCI currently addresses three key barriers to commercialization: assistance in finding appropriate field sites for demonstrating/testing near-commercial environmental technologies; assistance in verifying the performance and cost of performance of technologies; and assistance in facilitating and expediting the issuance of permits. RCI offers services appropriate to addressing each barrier. From the services available, the technology developer selects the services needed for the project, thereby using the developer's best assessment as to what barrier(s) the technology faces.

Cooperation between states, regulatory agencies and technology developers is defined into the program; it is the modus operandi of the RCI. During technology demonstrations, for example, multi-state participation on project teams will enable mutual sharing of technology performance data across states. States that do not have a technology being demonstrated or verified within their boundaries will also be part of RCI project teams to mutually share data and to serve as impartial monitors of procedures and results. RCI project teams will consist of representatives from all members of the technology and regulatory communities to facilitate dialogue about mutual problems and solutions.

States where verification tests are to be performed will facilitate the timely issuance of permits, where necessary, for technology testing and demonstration. In an innovative paradigm for state cooperation, the Interstate Technology and Regulatory Cooperation (ITRC) Working Group has sponsored a Memorandum of Agreement (MOU) that allows four States (California, Massachusetts, Illinois and New Jersey) to mutually accept support data and the results of demonstrations and verifications of environmental technologies. RCI will incorporate this MOU into RCI activities, so that environmental technology developers will be able to use data collected in an RCI project in MOU States to foster evaluation and promotion of technologies in sister States. This approach exemplifies the RCI program's willingness to use fresh approaches to accomplish its barrier reduction goals.

Most important, it is the responsibility of the Federal agencies participating in RCI to provide an interagency forum to implement RCI and to monitor project progress and program success. Federal agencies will collect "lessons learned" so that improved policies that foster industrial, State and federal cooperation and collaboration may be applied to minimize barriers to technology commercialization. The RCI process will give the technology an initial" stamp of approval" which will increase technology credibility and marketability.

Industry, represented by the private sector technology developer, has the responsibility to identify concerns that address barriers to commercialization. Industry is invited to propose innovative approaches to mitigate these barriers and to create new ways to measure the success of these approaches.

A fundamental premise underlying RCI is that projects selected would represent the best available developed technology from private sector technology developers. To make this determination, a four-step merit review process using equivalent technical and business factors was done by peer reviewers from within and outside the Federal government. As a result of a solicitation and review process, 10 out of a total of 36 proposals were chosen to participate in the first

(continued on page 3)

ELECTROCOAGULATION REMOVES METALS FROM WASTEWATER

Metals
Electrocoagulation
Water

By Steven Rock, EPA's National Risk Management Research Laboratory, Cincinnati, OH

The General Environmental Corporation's CURE Electrocoagulation Wastewater Treatment System was developed to remove an extremely broad range of dissolved metals from water, including aluminum, arsenic, barium, cadmium, lead, nickel, uranium and zinc. Because electrocoagulation can also remove other suspended materials from solution, this technology can also treat metals attached to suspended particles in mining, electroplating and industrial wastewater, as well as contaminated ground water. The U.S. Department of Energy and the EPA evaluated the CURE system at the Rocky Flats Environmental Technology Site in Golden, Colorado as part of the Superfund Innovative Technology Evaluation (SITE) Program.

The SITE demonstration evaluated the removal of uranium, plutonium and americium from solar evaporation pond (SEP) water. Analytical results demonstrate a significant reduction in uranium, plutonium and americium in effluent water. Total uranium was reduced 49.5% and 38% from influent concentrations of 2,633 and 2,866 milligrams per liter. Plutonium-239 was reduced 82.8% fanned 99% from influent concentrations of 0.209 and 29.85 pico curies per liter (pCi/L). Americium-241 was reduced 69.0 and 99.2% from influent concentrations of 0.187 and 71.99 pCi/L.

Prior to the SITE demonstration, during the treatability studies, the CURE system removed up to 99% of all contaminants by metals analysis. During the demonstration only gross alpha tests were used, which indicated complete removal of alpha contamination, but did not reflect total uranium content.

CURE was evaluated as a transportable, trailer-mounted unit that used a series of concentric iron or aluminum tubes, a power supply to control the current across the interior and exterior tube and a clarifier to remove floccule formed in the tubes. Contaminated waters can be processed at flow rates up to 7 gallons per minute.

During operation of the CURE system, contaminated water is pumped into the system influent storage tank. The water then passes through a small screening device to remove large debris that could clog or damage the subsequent equipment. Following screening, the water may be treated to adjust the acidity (pH), redox potential and conductivity to achieve maximum removal efficiency for specific waste streams and contaminants. The water then passes through the electrocoagulation tubes, which consist of a tube-shaped anode material that concentrically surrounds a tube-shaped cathode material, thereby leaving an annular space between the cathode and anode tubes. Typical retention time is less than 20 seconds. As the water passes through the annular space, contaminants coagulate with the metal and metal hydroxide cations derived from the electrocoagulation tubes to form floccule. The floccule is then removed from the treated water in the attached clarification unit.

Polymers can be added to enhance flocculation, but were not used during the SITE demonstration. The clarifier underflow is dewatered using a bag filter that is integrated into the transportable treatment unit. Dewatered floccule produced by the CURE system typically do not require stabilization to pass the toxicity characteristic leaching procedure but may need to be stabilized to meet EPA land disposal restrictions.

Electrocoagulation does not remove metals that do not form precipitates. In addition, electrocoagulation will not remove soluble organic compounds.

For more information, call Steve Rock at EPA's National Risk Management Research Laboratory at 513-569-7149. To get on the mailing list for the Technology Capsule and Innovative Technology Evaluation Report of the SITE demonstration, send Steve Rock a FAX at 513-569-7105.

(continued from page 2)

RCI phase. The companies will enter cooperative partnership agreements with the RCI Federal and State participants for the demonstration of the technologies. The technologies and their developers are:

Verification of Oxyozone Biosolids Treatment System (Total Municipal Solids Recovery). A technology for reducing potential human pathogens in municipal wastewater biosolids and other organic waste

(continued on page 4)

(continued from page 3)

streams based on the disinfecting properties of ozone.

LASAGNA™ Integrated In-situ Remediation Technology (Monsanto Company). A comprehensive in-situ suite of technologies integrated to remove various contaminants from low-permeability soils. The process creates alternate layers of sorption and degradation zones through the introduction of sorbents, catalytic agents, microbes, oxidants and buffers.

Verification and Certification of the MAG-SEP Technology [Selective Environmental Technologies, Inc. (SELENTEC)]. A magnetic separations technology for ground water treatment using specially designed particles (polymer coated magnetite) to selectively adsorb contaminant metals.

Terra-Kleen Solvent Extraction Technology (Terra-Kleen Response Group, Inc.). A solvent extraction technology which uses non-toxic solvents to mobilize hazardous soil contaminants and then collects those contaminants for destruction off-site in an EPA-approved facility.

Solvated Electron Chemistry Remediation and Restoration (Commodore Environmental Services). Agent 313 is a solvated electron chemistry materials process used to destroy hazardous hydrocarbon contamination in soils.

Hand-Held Instruments for Measuring Low Levels of Trihalomethanes (ORS Environmental Systems). Hand-held instrument uses innovative sensor technology for detecting and measuring total trihalomethanes in water to parts per billion (ppb) levels.

Instrument for Measuring Petroleum Hydrocarbon Contamination (ORS Environmental Systems). Hand-held instruments using innovative sensor technologies for detecting and measuring trichloroethylene and volatile organic compounds in aqueous solutions to ppb levels.

Portable Spectrometer for Analysis of Soil and Water Contamination with Hanby Text Kits (Hanby Environmental Laboratory Procedures, Inc.). A field kit technology (previously available and successful commercially without the spectrometer) to conduct quantitative soil and water tests employing comparison of the sample results visually with a photographic standard. Now with the spectrometer it will interpret results directly. The objective is to prove the savings in analytical costs, labor, time and accuracy.

Waste Inspection Tomography/Active Passive Neutron Examination and Assay (Bio-Imaging Research, Inc.). Consists of digital waste inspection tomography and active passive neutron examination and assay for nondestructive and non invasive analysis of sealed radioactive containers.

Multi-Sampling Lysimeter/Cone Penetrometer (Bladon International, Inc.). A technology that integrates a multi-sampling lysimeter with a cone penetrometer to sample moisture and contaminants in the vadose zone before they reach the water table without drilling a well. The objective is to deploy to depths of 50 to 100 feet, retrieve soil pore liquid from the vadose zone and transport the liquid samples to the surface for performance verification.

An innovative "private electronic network" will enable project teams to exchange documentation and data to be used as information to facilitate the work of all teams. Results will be available on some of the projects within a few months. The longest projects will take about 18 months. The public can obtain updated information on the projects and the RCI from the RCI Web at: http://rci.gnet.org; so, watch that space for more information.

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