



ORD ENGINEERING HIGHLIGHTS

A bimonthly compilation of EPA's Office of Research and Development engineering research activities and results and related research activities in pollution prevention and mitigation. To discuss any of these activities, contact the ORD lead person listed below. For general information, contact Charlotte Bercegeay of the Office of Environmental Engineering and Technology Demonstration, Phone: 919-541-2482.

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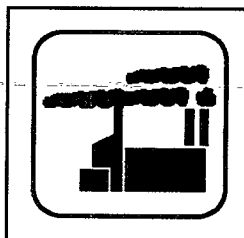
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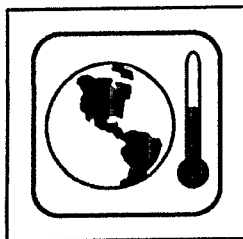


AIR

Enhanced Combustion Woodstove Patent Issued

A patent entitled "Single Chamber Woodstove Including Gaseous Hydrocarbon Supply" was recently issued to the Air and Energy Engineering Research Laboratory (AEERL) for an innovative woodstove design that significantly reduces particulate emissions from woodstoves. This Enhanced Combustion Woodstove (ECW) technology can lower particulate emissions from residential woodburning stoves to a record 1 g/hr. The current EPA-certified woodstove emission rate is 7 g/hr, and the conventional, uncontrolled woodstove emission rate is 22 g/hr. Recent laboratory testing has focused on the gas controls, leading to the perfection of an automated, fail-safe, pilot ignition/gas control system using off-the-shelf components approved by the American Gas Association. Under a Cooperative Research and Development Agreement (CRADA), EPA and Aladdin Steel Products, Inc., are finalizing the adaptation of the ECW to an improved-design woodstove. Stress testing and limited field trials for 20 stoves are planned to begin around December 1993. A patent application has been filed for the adaptation of the ECW technology to fireplaces. (Robert C. McCrillis, 919-541-2733)





GLOBAL CLIMATE CHANGE

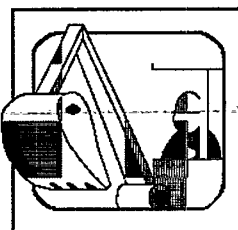
Electric Motor Energy Reduction —Fuzzy Logic Energy Optimizer

Fuzzy logic is a mathematical approach that uses approximate reasoning to resolve complex programming problems. AEERL is nearing completion of laboratory studies for an energy optimizer based on fuzzy logic to reduce the energy consumption of electric motors. Motor speed control is achieved without the use of a feedback signal from a tachometer. The project has moved from the laboratory prototype stage to the microchip stage. Efficiency gains in the laboratory compare favorably to those predicted by computer simulation. Predictions are for energy savings with a generic fuzzy logic energy optimizer that will allow payback within 6 months and savings of several billion kWh per year in the United States. To commercialize the technology, AEERL has begun CRADA and licensing negotiations with GM/Delco Remy. The patent application has been sent to GM for evaluation and potential use in GM's electrical propulsion systems for new electric vehicles. (Ronald Spiegel, AEERL, 919-541-7542)

New Chemical Could Replace CFC-11 Refrigerant

Approximately 65,000 large, centralized air-conditioning systems use CFC-11, the refrigerant of choice for many years. CFC-11 will be phased out of production on January 1, 1995, however, and no permanent alternatives have been found by industry to replace it. Industry has proposed a hydrochlorofluorocarbon (HCFC) as an alternative, but HCFC also is subject to phaseout because it contains chlorine. AEERL researchers reported results on the evaluation of a new chemical, HFC-245ca, that shows considerable promise as a replacement for ozone-depleting CFC-11. The AEERL research group developed HFC-245ca, which has no chlorine or bromine atoms and therefore has zero potential to destroy stratospheric ozone. The compound also has a relatively short atmospheric lifetime of 6.4 years, a feature that helps minimize its impact on global warming. Computer modeling, using measured thermophysical properties of the compound, indicates that acceptable performance would be achieved by chiller systems. Experiments also indicate that the chemical is com-

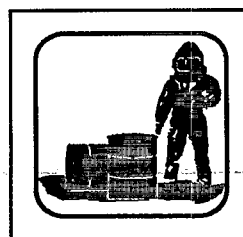
patible with chiller equipment materials and with certain polyester lubricants. Initial tests performed to date show no evidence of toxicity problems, although more testing remains to be done. One possible drawback of HFC-245ca is its slight flammability at certain air ratios, depending on the moisture content of the mixture. Ways are being evaluated to eliminate or reduce this risk. AEERL's new chemical could make a significant difference in industry's ability to reduce stratospheric ozone depletion. (N. Dean Smith, AEERL, 919-541-2708)



SITE REMEDIATION

Numerous Research Projects Evaluated for Emerging Technology Program

The Risk Reduction Engineering Laboratory (RREL) SITE Emerging Technology Program provides funding to developers to continue research efforts from the bench- and pilot-scale levels to promote the development of innovative technologies for hazardous waste cleanup. The program reviewed 77 research projects, of which 18 were invited to submit full preproposals and cooperative agreement applications. The projects reviewed were categorized as follows: Solidification/Stabilization, Biological Treatment, Chemical Treatment, Physical Treatment, and Thermal Treatment. (Randy A. Parker, RREL, 513-569-7271)



HAZARDOUS WASTE

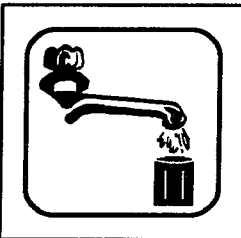
RCRA Facility Permit Renewed

EPA's Region IV and the State of North Carolina have renewed AEERL's RCRA Research, Development, and Demonstration (RD&D) permit to operate a hazardous waste incineration research laboratory. AEERL performs bench-, laboratory-, and pilot-scale research examining phenomena related to the formation of metal aerosols, destruction of organic wastes in rotary kiln incinerators, NO_x reduction via combustion modification, and the capture of heavy metals in fluidized beds. At the request of the Office of Solid Waste, AEERL recently devised means to reduce emissions caused by the opening of incinerator emergency

safety vents during system failure, to minimize effects to workers and others in the near vicinity. (Paul Lemieux, AEERL, 919-541-0962)

Loring AFB Feasibility Study To Be Presented to Congress

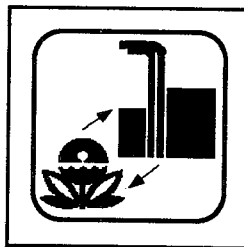
RREL participated in a study to evaluate the use of Loring AFB in Maine as a national environmental research center. The final report is being reviewed by EPA and OMB before its presentation to Congress in the near future. The feasibility study presents options for a national engineering research center to evaluate innovative technologies for use in cleaning up hazardous waste sites. The engineering center will be operated as a GOCO (government-owned/contractor-operated facility) by RREL; it will complement other research operations in Jefferson, AR, and Cincinnati, OH. The Maine facility is also being considered for a national environmental response training center. (John S. Farlow, RREL, 908-321-6635)



WATER

RREL Employee Receives American Water Works Association 1993 Research Award

Dr. Robert Clark was selected as the recipient of the American Water Works Association (AWWA) Research Award for 1993. Established in 1967 in honor of Dr. A. P. Black, the award recognizes outstanding research contributions to water science and water supply practices rendered over an appreciable period. Dr. Clark received the award for his many contributions to the drinking water industry. His research has generated major advancements in improved drinking water quality, cost-effective treatment options for water utilities, impacts on the direction of water treatment through immediately applicable research, and education of engineers and students through publication of technical papers and books. The award will be presented at the Annual AWWA Conference on June 7 in San Antonio, TX. (Robert Clark, RREL, 513-569-7201)



TECHNOLOGY TRANSFER

RREL Bulletin on Cleanup of Lead Battery Recycling Sites

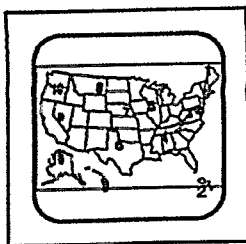
RREL prepared an engineering bulletin, "Selection of Control Technologies for Remediation of Lead Battery Recycling Sites." The document provides remedial project managers (RPMs), potentially responsible parties (PRPs), and their supporting contractors with information on treatment alternatives and cleanup services at lead battery recycling sites. The bulletin describes common operations and wastes generated; remediation technologies; information on treatability studies; information on recyclability of materials at sites; and profiles of innovative treatment technologies. The bulletin and its associated technical documents are part of a coordinated series that provide data and information on remediation of Superfund sites. Other documents are currently being prepared on solvent, pesticide, and metals sites. Copies of this bulletin are available from the Center for Environmental Research Information (CERI), 513-569-7562 (Publication No. EPA/540/2-91/014). (Michael D. Royer, RREL, 908-321-6633)

AEERL Report on PM-10 Emissions from Sand/Salt Applications to Roadways

This report, "Characterization of PM-10 Emissions from Antiskid Materials Applied to Ice and Snow Covered Roadways," completes the first phase of a two-winter (FY 1992 and 1993) test program to determine the amount of PM-10 emissions from sand/salt applications to urban road surfaces. The FY 1992 test data indicate that current emission factors are too low. The second phase of the field tests will be completed this winter. The report is available from the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161 (Report No. PB 93-150209). (Larry Jones, AEERL, 919-541-7716)

RREL Publication on Remediation of Wood-Preserving Sites

The publication "Contaminants and Remedial Options at Wood Preserving Sites" informs RPMs, PRPs, and their supporting contractors about facilitating remediation of sites contaminated with wood-preserving chemicals. Information is included on wood-preserving processes, wastes generated, contaminants commonly found, and their mitigation patterns. For each assessment an approach is presented for selecting remediation options that are most likely to achieve site-specific cleanup levels. The use of treatment trains instead of single technologies is stressed. Copies of the document are available from CERL, 513-569-7562 (Report No. EPA/600/R-92/182). (Mary K. Stinson, RREL, 908-321-6683)



REGIONAL OR STATE ASSISTANCE

Assistance to Region V on Superfund Site

RREL's Edison, NJ, staff continues to provide assistance to Region V on the Ninth Avenue Dump Superfund Site located in Gary, IN. The 17-acre site is for inactive chemical and industrial waste disposal, and is situated in an area of mixed industrial, commercial, and residential use. Buried wastes at the site include foundry sand, wood, concrete, bricks, metals, slag, noncontainerized liquids and sludges, and drummed liquid and solid material. Soils show contamination with a variety of ketones; chlorinated ethenes; benzene, ethylbenzene, toluene, and xylene

(BETEX); polynuclear aromatic hydrocarbons; phenols; pesticides; polychlorinated biphenyls; plasticizers; and dioxins/furans. RREL is currently reviewing results from the treatability studies to determine the best treatment technologies, which include soil washing, in-soil flushing with bioremediation, thermal desorption, and soil vapor extraction. (C. Chen, RREL, 908-906-6985)

Volume Reduction Unit Used at Sand Creek Site

RREL assisted Region VIII in assessing the feasibility of soil washing for remediating the Sand Creek Site in Commerce City, CO. The Record of Decision identified soil washing as the technology to be used to remediate soils contaminated with high levels of organochloride pesticides, 2,4-D herbicides, and metals. Development of the Remedial Design posed several problems. The surface soils had high levels of contamination whereas the subsurface soils were less contaminated. Because the action levels for the contaminants of interest are extremely low, achieving these levels will require extraction efficiencies greater than 99%. In addition, the soils are fairly fine. Soils with a large percentage of fine particles (clay and silt) are usually much less cost-effective to soil wash due to the larger amount of contaminated material that must be treated. Soil feed is mixed with water and various extraction agents to remove the contaminants and transfer them to the extraction fluid. Soils are then segregated by particle size. The volume reduction unit incorporates a wastewater treatment component, which processes the washwater to meet regulatory requirements for discharge or recycling. Although multiple washings may be required for highly contaminated surface soils, nonetheless soil washing can be very cost-effective in remediating this site to acceptable levels. (Patrick Augustin, RREL, 908-906-6992)

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Cincinnati, OH 45268

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