

# EPA ORD ENGINEERING HIGHLIGHTS

A bi-monthly 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 Darlene Watford of the Office of Technology Transfer and Regulatory Support, Phone : FTS 260-7891.

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Institute for presentation at the 24th International Symposium on Combustion in Sydney, Australia. (W. Linak, AEERL, 629-5792)

### *Hydrocarb Fuel Tests Successful*

AEERL researchers conducted combustion tests of carbon black, as 50% slurries in fuel oil and methanol, in a 250,000 Btu/hr furnace. Flame stability and emission characteristics observed with these fuels, which will be produced as a coproduct by the Hydrocarb process, show promise as clean nonpolluting substitutes for pulverized coal in the industrial sector. The principal advantage of the carbon black produced by Hydrocarb is the absence of ash, sulfur, and nitrogen. Use of this fuel can, therefore, effectively eliminate the major pollutants normally formed during combustion of conventional fuels. (Robert Borgwardt, AEERL, FTS 629-2336)

### *Diagnostic Measurement Yields Effective Value for Radon Entry Rate*

Under a cooperative agreement with Princeton University, AEERL sponsored the development of a measurement technique to assist researchers in better understanding the causes of elevated indoor radon levels. The method involves the simultaneous measurement of radon and a tracer gas such as a perfluorocarbon tracer (PFT) when the emitter is located in the basement or ground level of the house. Although any suitable tracer gas could be used, PFTs are preferred because the method requires an emission rate with a known constant. This measurement represents a significant development, because it depends solely on the interaction of the house with the soil, while the radon concentration depends on the interaction of the house with both the soil and the atmosphere. For cases in which entry is dominated by the pressure-driven flow of radon-containing soil gas, the entry rate will depend on the degree of depressurization of the building. Princeton has made extensive use of this measurement technique in the natural ventilation study. Radon entry models agree qualitatively with these measurements. Absolute verification is not possible because an independent measurement method is not known. (Ronald Mosley, AEERL, FTS 629-7865)

### *Coating Emissions Prevention*

AEERL is sponsoring the evaluation of coating technologies for prevention of volatile organic compound (VOC) and air toxics emissions. The technologies will be evaluated in five source categories: 1) Flexographic Printing, 2) Rotogravure Printing, 3) Graphic Arts, 4) Architectural and

### AIR

### *Incinerator Tests Study Improved Predictors of Transient Emissions*

The Air and Energy Engineering Research Laboratory (AEERL) has completed its first set of research experiments under the RCRA RD&D permit, which incorporates the recently installed afterburner/air pollution control system. The research included theoretical as well as experimental efforts to determine the effect of waste and sorbent properties on transient emissions from rotary kiln hazardous waste incineration. Results indicate that two waste parameters (stoichiometric oxygen requirement and normal boiling point) can be used to predict transient magnitudes, and may be better predictors than the waste heat of combustion, a parameter often used by industry. Several sorbent parameters were also found to be of secondary importance. These results are summarized in a research paper submitted to The Combustion



Industrial Maintenance Coatings, and 5) Consumer/Commercial Adhesives. The probability of technical and commercial success and the potential impact on emissions of coating technologies will be assessed. Research and/or demonstrations will be completed for the highest ranked opportunities. These projects are part of the Administrator's 2% Set-aside Pollution Prevention program. Participants include AEERL; the South Coast Air Quality Management District; and the Center for Emissions Research, Analysis, and Certification. (Michael Kosusko, AEERL, 629-2734)

#### *Radon Research Continues*

The Florida Radon Research Program (FRRP) and AEERL completed their second year of cooperative effort in radon research. FRRP is a \$1.348 million joint effort between the Florida Department of Community Affairs and AEERL, in which AEERL consults and assists in managing the state-supported radon research program. The goals of FRRP are to provide the technical basis for effective, practical, and enforceable new construction standards and to advance the understanding of radon generation, transport, entry, and distribution in buildings. Fundamental mathematical models are used to design, evaluate, and interpret the results of radon control experiments and demonstrations. Results will ultimately assist decision-makers in determining cost-effective radon control strategies. FRRP objectives for FY 1992 include: (1) establishing a radon potential mapping basis for the state of Florida, (2) determining the effectiveness of fill materials and concrete slabs as construction barriers to radon, (3) establishing radon resistant construction criteria for crawlspace houses, and (4) continued demonstration of the effectiveness of the current new construction standards. (D.C. Sanchez, AEERL, FTS 629-2979)

#### *ORD Develops Measurement of Methane Emissions from Rice Fields*

Wetland rice fields are a major source of methane, a crucial greenhouse gas responsible for global climate change. Scientists at the Environmental Research Laboratory in Corvallis, Oregon (ERL-Corvallis), in collaboration with the National Center for Atmospheric Research, have developed a new technology for continuous monitoring of methane emissions without the necessity for field enclosures. The basis of the new technology is a computer controlled conditional system to automatically select air samples based on vertical wind speed, coupled to a state-of-the-art flame ionization detector to measure atmospheric methane concentrations. This new technology applies small-scale (micrometeorological) principles to produce reliable real-time methane emissions measurements. This method will be useful to measure not only methane emissions for the global methane budget but also the impacts of climate, soils, and human agricultural practices on emission rates. A better understanding of these contributing factors will provide insight into mitigation practices to reduce methane emissions from rice fields. (David Olszyk, ERL-Corvallis, FTS 420-4311)

#### *Replacement of CFCs and Halons as Refrigerants*

At the International CFC and Halon Alternatives Conference in Baltimore, Maryland, December 3-5, 1991, the Office of Research and Development presented results of its efforts to find new chemicals to replace CFCs and halons. These results indicate that several partially fluorinated propanes and

fluorinated ethers are attractive as potential alternative refrigerants. Based on the thermophysical properties of these compounds, computer modelling of their performance in refrigeration cycles has shown these compounds to be comparable or superior to the currently used CFC refrigerants. The compounds have no ozone-depleting chlorine or bromine atoms. In addition, they are expected to be relatively short-lived in the atmosphere and to be of low toxicity and flammability. Performance testing of the most promising of these refrigerants is the next step toward their potential commercialization. One or more of these may prove to be a long lasting replacement for stratospheric ozone-depleting chemicals in refrigeration systems. (N. Dean Smith, AEERL, FTS 629-2708)

#### **WATER**

##### *Effects of Oil Spill Cleanup Technologies on Inland Surface Waters*

The Risk Reduction Engineering Laboratory (RREL) provided input for a manual that evaluates the impact of major cleanup technologies on a particular habitat (e.g., large river/open water, wetlands or marsh, etc.) and its biota and then evaluates that technology on spills of different typical oils. The oil types considered were: gasoline, #2 fuel oil/diesel, #6 fuel oil/bunker C, and medium-grade crude oil. This information will be useful for On-Scene Coordinators and other spill responders, Regional Response Teams, public interest groups, and others involved in environmental decision-making. The information for the manual was provided by experts who recently attended a workshop sponsored by the American Petroleum Institute in Dearborn, Michigan. (John S. Farlow, RREL, FTS 340-6635)

##### *Biological Treatment for Chlorinated Benzenes*

The Robert S. Kerr Environmental Research Laboratory (RSKERL) and the U.S. Air Force have joined forces to evaluate a biological treatment system for chlorinated benzenes in ground water at the Tyndall Air Force Base, near Panama City, Florida. RSKERL engineers will lead the field evaluation of the system, utilizing the microbial populations developed at Tyndall. RSKERL engineers have spent a considerable amount of time at Tyndall preparing equipment for the field work and organizing bench-scale studies, which will be performed at RSKERL. The field study is anticipated to begin by mid-spring after completion of lab studies and equipment preparations. (D. Miller, RSKERL, FTS 743-2263)

#### **HAZARDOUS WASTE**

##### *Fourteen Small Businesses Awarded Grants to Demonstrate Innovative Clean Technologies*

In the second year of the Agency's Innovative Clean Technologies Program, 14 small businesses recently received awards of up to \$25K to demonstrate innovative pollution prevention technologies. RREL reviewed 204 proposals and made the final selection with EPA's Office of Small & Disadvantaged Business Utilization. Research briefs of the demonstrations will be written to promote the transfer of successful pollution prevention methods. The resulting

selections are very encouraging. Of the 14 proposals, 12 are for source reduction methods and two are reuse/recycling techniques. Last year, 17 projects were selected for demonstration. Reports of last year's demonstration will be available in the spring of 1992. (Kenneth Stone, RREL, FTS 684-7474)

#### *Oil Spill Treatment Technologies to be Compared*

The design for an experiment to compare oil spill treatment technologies on a deliberate oil spill was recently discussed at a meeting held in Seattle, Washington. The field portion of the bioremediation project will take place in British Columbia, close to the Alaskan border, in the summer of 1992. The critical issues addressed by the project include the ecological impact of spill countermeasures, the subsurface oil problem, and the role of bioremediation. The type of beach desired for this spill would have coarse sediment, porous mixed sand and gravel, and low to medium wave energy. The original experimental design proposed in the December 1990, workshop called for 12 beach sites and 5 treatments (oiled beaches with and without treatments, unoiled beaches with and without treatments, and no replicates). (Dr. Albert D. Venosa, RREL, FTS 684-7668)

#### *Separating Heavy Metals from Sludges, Soil, and Wastewater*

Two technologies for separating heavy metals from sludges, soils, and wastewater were discussed as possible RREL research projects with IT Corporation: 1) Alkaline Hydrolysis Sludge Treatment, which employs thermochemical digestion to separate metals for subsequent precipitation, ion exchange or other conventional removal processes could offer a less costly alternative to the Zimpro wet air oxidation process or incineration; and 2) the Electromembrane process, a soil treatment that involves chelation and electrodeposition of lead from a contaminated soil. Under a National Science Foundation grant, IT conducted a bench-scale study which determined the feasibility of a soil treatment process involving chelation and electrodeposition of lead from a contaminated soil. The process may be applicable to a wide variety of lead-containing wastes. (Ronald J. Turner, RREL, FTS 684-7775)

#### *ERL Laboratory Researches Non-Target Analytes*

Chemists at the Environmental Research Laboratory in Athens, Georgia (ERL-A) have estimated that identifications of compounds other than target analytes, which are made by computer matching of low-resolution electron impact mass spectra, are correct for only about 25% of the chemicals "identified" from samples taken at Superfund sites. By elucidating structures on the basis of additional spectral information, the Lab's multispectral identification team can identify, with > 99% reliability, compounds that are not even among the ten million chemicals in the Chemical Abstracts Services Registry. Spectra from high-and low-resolution electron impact mass spectrometry, high and low resolution chemical ionization mass spectrometry, and Fourier transform infrared spectroscopy are analyzed by the team in an iterative mode to define an unknown compound's structure. This capability, unique to ERL-A, allows much more comprehensive risk assessments than can be made by addressing only the few hundred priority pollutants and target analytes and also would permit the accurate identification of hundreds of chemical compounds that have a high frequency

of occurrence in Superfund sites. The 125 target analytes typically represent less than 2% of the potentially hazardous chemicals in wastewater and solid waste. Currently, ERL-A is looking at additional samples to support these observations. (William Donaldson, ERL-Athens, FTS 250-3183)

#### **REGIONAL OR STATE ASSISTANCE**

##### *Underground Storage Tank Technology Demonstrations*

At a meeting at New York's Department of Environmental Conservation (NYDEC) regional office on December 12, 1991, RREL presented a new integrated approach that consists of a soil vapor extraction system and an air sparging unit for cleaning up both saturated and unsaturated zones at leaking underground storage tanks sites. The potential application and demonstration of this new approach at Exxon's site in Brooklyn, New York, was discussed. Representatives from the EPA's Region II Office of Underground Storage Tanks (OUST); NYDEC Spill Prevention and Response Programs; Exxon Company, U.S.A.; and EA Engineering, Science, and Technology, Inc., were all interested in testing this new technology. During the meeting, RREL's QA/QC requirements and the details of a quality assurance project plan (QAPP) were discussed. A copy of the proposed generic QAPP for UST Demonstration Projects was distributed to EPA's Region II, OUST, NYDEC, and Exxon for their use as a reference in developing a demonstration QA project plan for the site. (Chi-Yuan Fan, RREL, FTS 340-6924)

#### **TECHNOLOGY TRANSFER**

##### *AEERL Emission Research Described at International Meeting*

At the invitation of the Secretariat of the Intergovernmental Panel on Climate Change (IPCC), an AEERL researcher attended a workshop recently on greenhouse gas emissions methodology in Geneva. The workshop, which hosted 73 participants from 41 countries, was convened to assess and improve methodology for estimating global emissions of greenhouse gases. The AEERL has been actively involved in estimating greenhouse gas emissions since 1988, and is developing PC software to provide a repository for the data. The software will present emission estimates on thematic maps, pie and bar charts, printed records, and gridded information for use with the Geographical Information System, and will enable users to update inventories easily. The software will be available in prototype form in mid-1992. (Lee Beck, AEERL, FTS 629-0617)

##### *Atmospheric Methane*

Three AEERL staff members have been asked to author two chapters of a NATO book on atmospheric methane's sources, sinks, distributions and role in global change. The book is expected to be the authoritative source of the latest and most credible data and information regarding global methane emissions. The AEERL researchers will write chapters on global waste management providing methane emission data and information on global waste management trends as well as industrial methane sources, including deep and surface coal mining, oil and natural gas production, transmission and

distribution facilities, and combustion sources. The book, to be published in spring 1992, will be distributed extensively throughout the world. (Richard Stern, AEERL, FTS 629-2973)

#### *Water Pipe System Symposium*

The Second International Symposium on Water Pipe Systems was held in Kobe City, Japan, from December 11-13, 1991. The symposium, "Challenges for Water Pipe Systems in the 21st Century," was sponsored by the Japan Water Pipe System Research Center and the Kobe City Water Utility. Dr. Robert Clark of the RREL presented information on the Safe Drinking Water Act and its Amendments, and their implication for design, operation, and maintenance of drinking water distribution systems in the upcoming decade. Japan is currently undergoing a review of its drinking water regulations and is especially interested in U.S. activities in this area. (Robert M. Clark, RREL, 684-7201)

#### *1991 SO2 Control Symposium*

AEERL's 1991 SO2 Symposium, cosponsored by the Electric Power Research Institute and the U.S. Department of Energy, attracted over 850 attendees from 21 countries. Over 90 papers and 20 posters presented research and operating results on SO2 control technologies, including economic, regulatory, and technical information. The emission allowance marketing program in the recently passed Clean Air Act Amendments was the focus of an opening day panel discussion by utility, regulatory, legal, and brokerage representatives. There was also considerable renewed interest in organic acid additives for limestone scrubbers, a technology developed by AEERL which is currently being used at 12 utility plants in the United States. (Brian K. Gullett, AEERL, FTS 629-1534)

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