



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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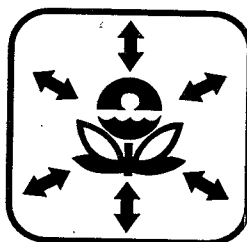
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Technology Transfer

AEERL Cosponsors International Workshop on Natural Gas Losses

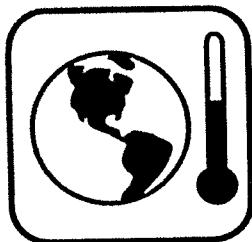
The Air and Energy Engineering Research Laboratory (AEERL) recently cosponsored the 1994 International Workshop on Environmental and Economic Impacts of Natural Gas Losses held in Prague, Czech Republic. The single largest series of papers presented AEERL's methodology for sampling and calculating methane losses from the U.S. gas industry. Since the process of privatization in the Eastern European countries will require an assessment of their gas industry emissions, representatives were extremely interested in AEERL's methodology and in having us assist them in their efforts. Other sponsors of the Workshop included the Gas Research Institute, Radian Corporation, Price Waterhouse, Transgas, Statoil, and the Air and Waste Management Association. The workshop, hosted by the Czech Gas and Oil Association, was attended by about 75 representatives of Western and Eastern Europe, as well as the Ukrainian and Latvian gas industries. Sessions included (1) Global Climate Change, (2) Accounting for Lost Gas, (3) Methane Emission Studies, (4) Evaluating Emissions, (5) Mitigation and Cost Reduction, and (6) Resources for Environmental Studies and Infrastructure Improvements.

(David A. Kirchgessner, AEERL, 919/541-4021)



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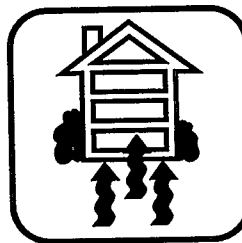
Global Climate



Motor Vehicle Air-Conditioning Systems Could be More Ozone-Friendly in the Future

At the request of EPA's Office of Air and Radiation, AEERL conducted performance and durability tests of oil additives with HFC-134a refrigerant. Test results show that it may be feasible to retrofit some motor vehicle air-conditioners with HFC-134a refrigerant and oil additives. Mineral oil is used as the lubricant in automotive air-conditioners with CFC-12 refrigerant. CFC-12 will not be produced after 1995, and it is estimated that over 100 million vehicles will be retrofitted with HFC-134a. Although HFC-134a and mineral oil are not miscible, certain oil additives may enable retrofitting. Cooling performance of the retrofitted system was nearly the same as that of the original CFC-12 system. The retrofitted system passed a compressor durability test with no unusual signs of wear. Automotive manufacturers would need to do more extensive testing before conclusions can be made regarding feasibility. However, if the additives are successful, retrofitting procedures might be simplified, and the transition to ozone-friendly refrigerants should be made easier. (James J. Jetter, AEERL, 919/541-4830)

Radon



Preliminary Standard for Radon Resistant Construction of Large Buildings

As a result of cooperatively sponsored research between AEERL and the state of Florida, a draft preliminary standard for the construction of radon resistant large buildings in Florida is now under development. This standard will be a technical consensus standard for use in discussions and negotiations with large building owners and operators. It will be developed based on (1) good engineering practice experience from the residential radon resistant construction demonstration program set up by the Florida Radon Research Program (FRRP), (2) national indoor air quality (IAQ) research experience in large buildings, and (3) preliminary large building research conducted under the FRRP. Specifications for structural barriers, soil depressurization systems, and heating, ventilating, and air-conditioning systems will be addressed. Additionally, a standards applicability protocol will be proposed consistent with the FRRP-developed radon source potential mapping for the state of Florida.

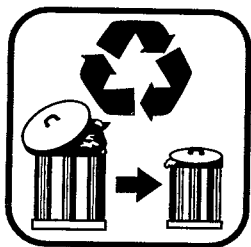
Hazardous Waste



Visitors from Ukraine and Russia Inspect the Risk Reduction Engineering Laboratory's (RREL's) Incineration Research Facility (IRF) Missile Propellant Burn Tests

A technical delegation from the Ukraine and Russia visited the IRF in Jefferson, AR, to view the pilot-scale rotary kiln incineration of the liquid missile fuel Unsymmetrical DiMethyl Hydrazine (UDMH). The delegates are charged with implementing an April 1993 Clinton/Yeltsin agreement to eliminate world strategic offensive arms; e.g., nuclear warhead ballistic missiles. The thermal destruction and materials-handling data being developed at the IRF will assist the U.S. incineration industry in designing, fabricating, and preparing safe operating protocols for a series of U.S.-built mobile incinerators to be shipped to various missile demilitarization locations in the Ukraine and Russia. The Ukrainian and Russian Environmental Federations have established maximum workplace exposure of relevant products of incomplete combustion that exceed RCRA-type incinerator parameters of destruction and removal efficiency. Possible combustion by-products are sampled and analyzed under this program, while category II quality assurance audit standards are maintained. Similar incineration tests of missile propellant oxidizer, nitrogen tetroxide "AMYL," will follow the UDMH tests. (Donald A. Oberacker, RREL, 513/569-7510)

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Pollution Prevention

Final White House Environmental Audit Report

The complete environmental portion of the Energy & Environmental Audit report has been submitted to the White House. The audit is part of the President's "Greening of the White House" project. This report is formatted and written to allow for public release as deemed appropriate by

the Office on Environmental Policy (OEP). Relevant environmental findings and recommendations are included for pollution prevention, solid waste management, environmental management systems, and environmental compliance for both the White House and Old Executive Office Building. RREL's scientist, James Bridges, was the Pollution Prevention Audit Team Leader and only representative from ORD and notes that a number of excellent pollution prevention recommendations for non-chemical paint stripping, alternative coatings, conservation, and materials reductions are included in the document. James R. Edward, AFT, is the White House Complex Environmental Audit Team Leader. (James S. Bridges, RREL, 513/569-7683)

RREL Supports Federal Facilities Multimedia Enforcement/Compliance Initiative

RREL has offered support to the Regional Coordinators to develop pollution prevention Supplemental Environmental Projects (SEPs) to enhance pollution prevention activities at federal facilities under the Initiative. RREL will provide solutions for violations and other identified areas of noncompliance. (James S. Bridges, RREL, 513/569-7683)

AEERL Research Project Applies Pollution Prevention Techniques to Develop Low Emitting Office Equipment

Available data indicate that some types of office equipment emit indoor air contaminants such as ozone, volatile organic compounds, and particulates. As a result, AEERL is researching the application of pollution prevention techniques to reduce emissions from office equipment. The research plans for this project were presented at a March meeting as the first step of this cooperative research effort between AEERL, Research Triangle Institute, Underwriter's Laboratory, and a group of Technical Advisors (representing industry and researchers). The objectives of the meeting were to obtain feedback and recommendations; establish a partnership with industry; identify the most appropriate emissions test methodology and testing scenarios (e.g., aging, ventilation, feed rates); and identify other key participants and related research. The two key outcomes from this meeting were (1) a subcommittee was established to develop a standard test method for determining emissions from office equipment and (2) the participants agreed with plans to research dry-process photocopiers (including color copiers), laser printers (in cooperation with a project currently underway at the National Institute of Occupational Health and Safety), and computer terminals. The next step of this project is to continue a literature search that covers several different types of equipment, their emissions, how the equipment works, and potential pollution prevention options. (Kelly Leovic, AEERL, 919/541-7717)

Environmental Pollution Prevention Project (EP3) Train-the-Trainer Workshop

The U.S. Agency for International Development (U.S. AID) and EPA recently held an international pollution prevention training workshop in Washington, DC, on May 9-13, 1994. Topics covered definitions and examples of pollution prevention, assessment procedures and process flow diagrams, environmental accounting, data collection, evaluation of options, and international pollution prevention resources. Attendees included consultants, government and university representatives from EP3 programs in Chile and Tunisia; other countries represented included Ecuador, Egypt, Argentina, India, Zambia, as well as representatives from the United Nations Environment Programme (UNEP). Participants developed training programs and practiced teaching pollution prevention concepts using participatory methods. Follow-up surveys are being developed to determine effectiveness of the course. Subsequent to the workshop, the newly trained participants will deliver pollution prevention training in their countries.

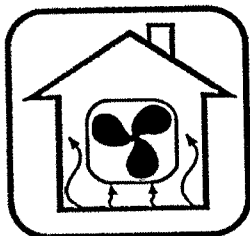
The objective of the EP3 project is to establish sustainable pollution prevention programs in developing countries. This is accomplished through in-plant diagnostic assessments, information dissemination, training, and governmental institutional support activities. (Deborah Hanlon, OEETD, 202/260-2726)

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EP3 Pollution Prevention Assessments Complete

EP3 has recently established pollution prevention offices in Santiago, Chile, and Tunis, Tunisia. Five pollution prevention assessments have been completed in these two countries using U.S. experts and in-country consultants. The assessments were conducted at a battery manufacturing facility, two leather tanning facilities, and two textile plants. These facilities represent a significant portion of each country's industrial base and agreed to be participants in the EP3 pollution prevention program. The preliminary results of these assessments are very promising, and many process changes were identified that will save the plants thousands of dollars in operating costs and significantly reduce pollution discharges.

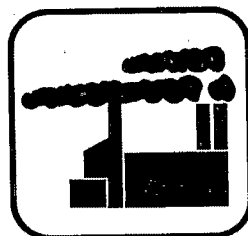
In the case of one tannery, a process modification costing less than \$5,000 is expected to result in annual savings of approximately \$60,000 and significantly reduce chrome effluent. The assessment at the battery manufacturing plant identified 19 pollution prevention opportunities that could save over \$1,875,000 in the first 24 months for an investment of \$687,000. The facility has already purchased boost charging equipment (\$100,000) and plans to purchase a liquid lead atomization mill to reduce emissions of lead oxide and improve process efficiency. (Deborah Hanlon, OEETD, 202/260-2726)



Indoor Air

Innovative Approach to Preventing the Entry of Soil Contaminants into the Indoor Environment

Preliminary results of a new study performed by Southern Research Institute are encouraging for a new method that AEERL has proposed for preventing the entry of soil contaminants into indoor air. In a recent patent application, AEERL suggested that a blocking barrier can be developed with the application of a DC electric field to prevent the movement of contaminants in the soil. The blocking layer of soil is formed when moisture accumulates near one electrode resulting in a decrease in the permeability and diffusivity of the soil layer. The water in most soils contains ions, usually positive, that will migrate under the action of an applied electric field. Through viscous forces, the ions will drag water along toward the cathode. Since water is not supplied near the anode, this region will be depleted of moisture. The electrical conductivity decreases as the moisture decreases near the anode causing the electrical current to decrease. To date, five soils ranging from clay to sand have been studied. Moisture, applied voltage, current, local conductivity, and permeability of these soils were measured as a function of time. The five soils studied showed varying degrees of reduction in permeability and electrical conductivity all of which were sufficient to influence the movement of soil contaminants. (Ronald Mosley, AEERL, 919/541-7865)



Air

Promising Field Results on the Enhanced Combustion Woodstove

Recent field test results show that the Enhanced Combustion Woodstove (ECW) technology is capable of achieving particulate emissions of only 1 g/hr while being used in a normal residence. This compares to conventional woodstove emission rates in residences of about 20 g/hr. In laboratory testing simulating in-home use, the ECW-equipped stove reduced particulate emissions by 90% compared to the same stove with the ECW features turned off. Field results show that in order for the ECW technology to be effective, properly seasoned wood must be used and the stove operated correctly. Field researchers observed that many homeowners stored their wood out in the open, exposed to rain and snow. Wood was cut and split as needed, instead of six months to a year ahead to allow the wood to dry. Consequently, homeowners were burning wood with at least 30-45% moisture. ECW technology requires properly dried wood that averages 10-25% moisture, depending on local atmospheric humidity. Researchers also found that homeowners traditionally run their stoves too cool. To achieve clean burning, even with traditional uncontrolled stoves, the stove should be heated up rapidly to a level sufficient to achieve secondary combustion above the wood. (Bob McCrillis, AEERL, 919/541-2733)

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Catalysts Show High Potential for Complete Destruction of Chlorinated VOCs

AEERL in cooperation with the University of Akron (UA) provided the best catalyst for destroying chlorinated organic compounds in a test at Dover Air Force Base. AEERL and UA have cooperatively developed new catalysts that show a high potential for the complete destruction of chlorinated VOCs. The catalysts are de-

signed to adsorb low concentration VOCs at room temperature and then destroy them when the catalyst temperature is raised to 350°C. Tremendous energy savings result from only having to heat the VOC-laden catalyst bed rather than the entire air stream. These improved catalysts almost totally eliminate by-product chlorine production. (Chester Vogel, AEERL, 919/541-2827)



Regional/Technical Assistance

RREL Performs Treatability Tests for Region 3 Contaminated Soil Site

Treatability testing of "fluff" waste and contaminated soil from the M.W. Manufacturing site in Pennsylvania was conducted at the EPA Incineration Research Facility (IRF) in Jefferson, AR.

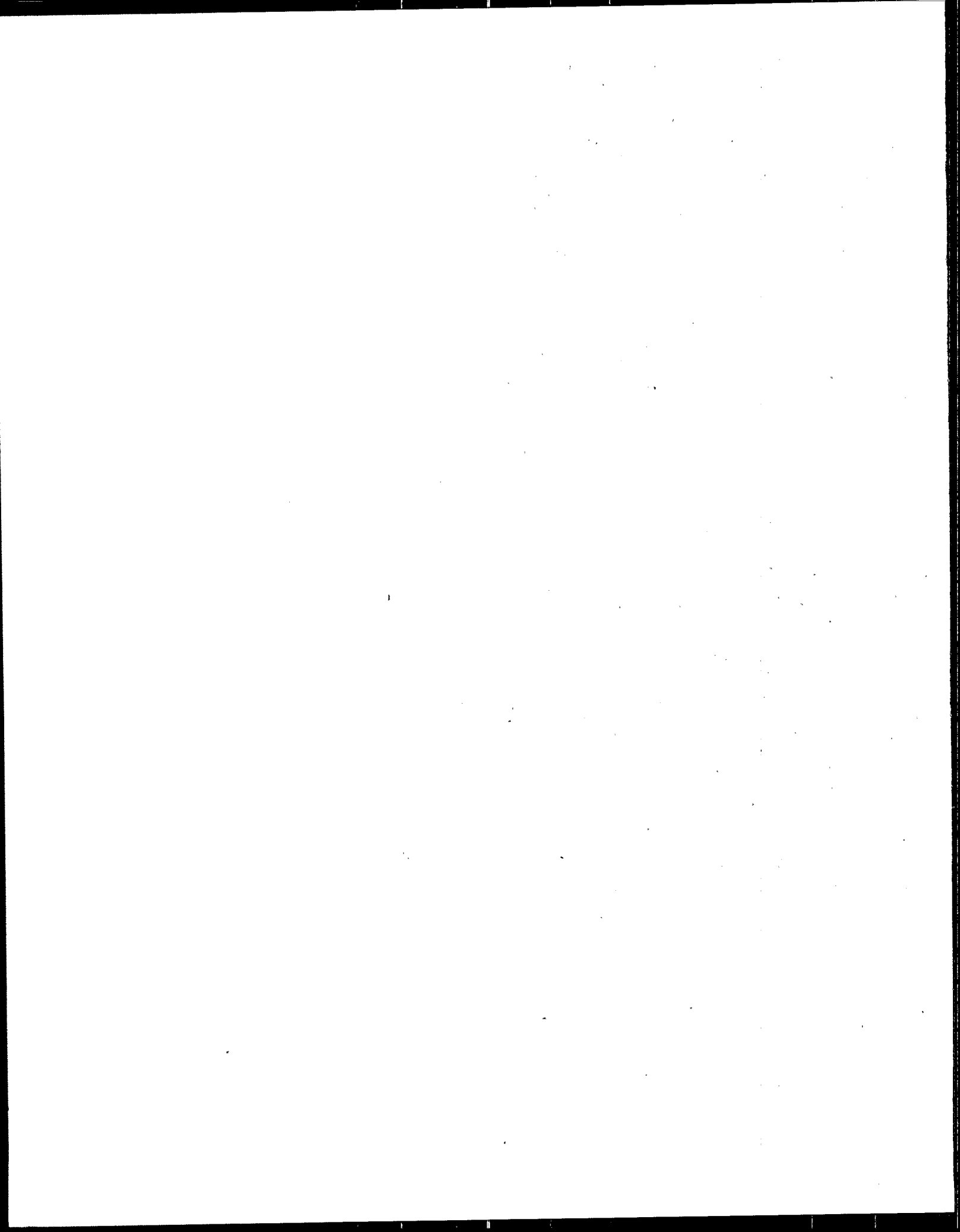
Fluff waste is the shredded residue from mechanical and chemical processes to reclaim copper from electrical/phone scrap wire. Large piles of the fluff waste, contaminated with organic compounds such as phthalate esters and chlorinated solvents, and metals (copper and lead), exist on site. The data will be used to assist in evaluating the suitability of incineration as a remediation treatment option. (Marta K. Richards, RREL, 513/569-7692)

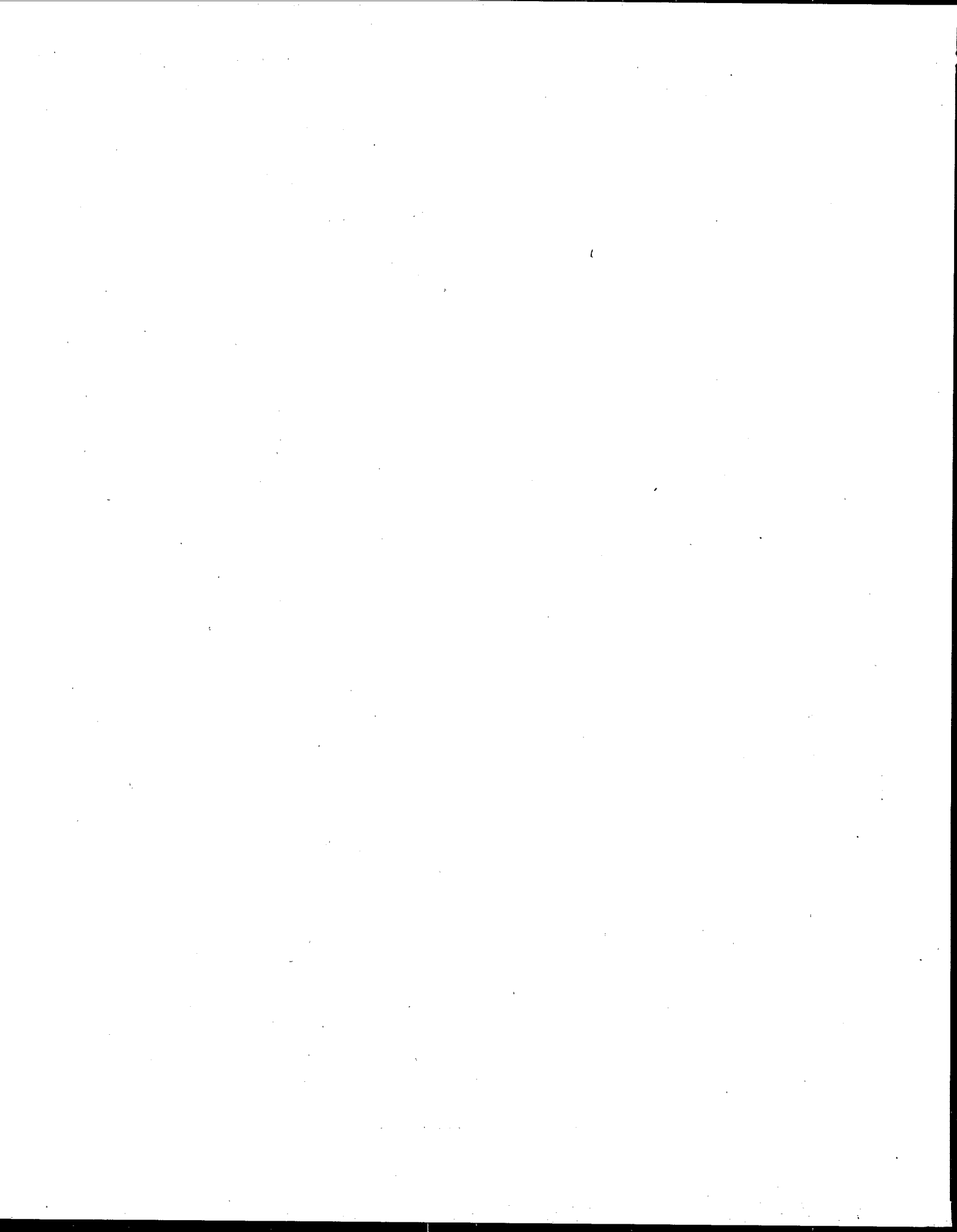
AEERL Technologies Headed to the Commercial Marketplace

AEERL signed license agreements on April 5 with a joint venture of two North Carolina incorporated companies, Seoul Sharp USA and the Center for the Environment and Development. Five AEERL-developed and patented technologies for improving electrostatic precipitators (ESP), widely used for control of fine particulate emissions, were transferred to the private sector for commercialization under the Federal Technology Transfer Act of 1986. Two of the technologies improve the operation of an ESP by separating and optimizing the charging and collection functions by allowing higher efficiency in a smaller, less costly unit. A second pair of technologies adds electrostatic precipitation to fabric filtration increasing capture of very fine particles. The remaining technology collects sulfur dioxide within an existing ESP and simultaneously improves its particle capture. The commercialization of these technologies, making them available to the user community, should help EPA's Office of Air and Radiation in its mission of improving control of very fine particles that often contain a high proportion of toxic matter. Sites for commercial demonstration of some of the technology are already being considered, and as the market develops a manufacturing facility will be set up in the U.S. (Norman Plaks, AEERL, 919/541-3084)

Cooperative Research of Cleaner Production Within the Optical Industry

RREL and the Naval Ophthalmic Support and Training Activity (NOSTRA) are developing a Memorandum of Understanding to reduce and/or eliminate waste generating heavy metals and other hazardous materials in optical laboratory processes and provide pollution prevention solutions to optical laboratory waste generating issues. RREL desires to encourage pollution prevention in ophthalmic eye wear production through a research and demonstration program that includes entering into Cooperative Research and Development Agreements (CRADA) with optical manufacturer(s) and associated trade associations. As a result of Optical Laboratories Association (OLA) members proposing a number of pollution prevention research and development proposals to NOSTRA, the first CRADA will be to evaluate a surface blocking system as an effective pollution-free replacement for low melting point alloys in ophthalmic laboratories. The evaluation will be conducted at NOSTRA with RREL and will compare factors such as waste generation, production efficiency, ease of operation, machine errors, downtime, cost of production, and compatibility of the new blocking system with equipment from a wide variety of optical manufacturers. Both CR-39 plastic and polycarbonate lenses requiring surfacing will be incorporated into the evaluation. Results of this evaluation will be distributed through OLA and EPA. (James S. Bridges, RREL, 513/569-7683)





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