



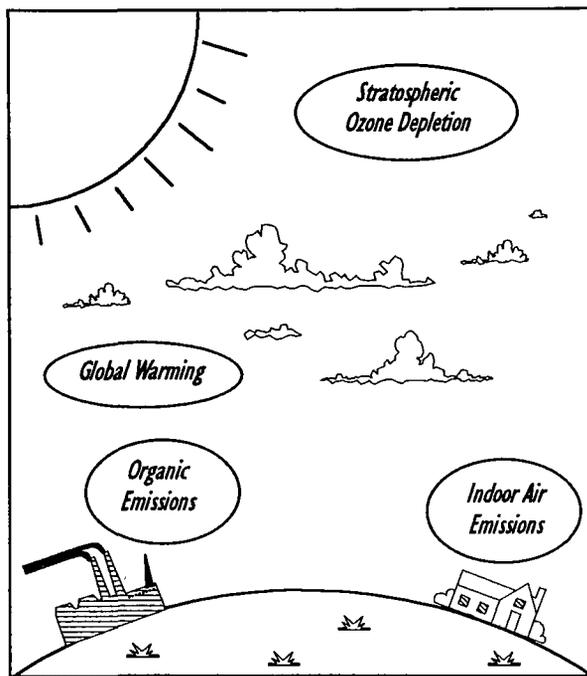
Pollution Prevention Research Programs

Air and Energy Engineering Research Laboratory

The Pollution Prevention Act of 1990 established a national policy that pollutants be eliminated at the source wherever feasible. The U.S. Environmental Protection Agency's Air and Energy Engineering Research Laboratory is advancing the state of the art in pollution prevention through research that develops and demonstrates pollution prevention techniques for both indoor and outdoor air contaminants.

EPA's Office of Research and Development (ORD) implements an Agency-wide program of science and engineering research to address critical environmental issues. ORD's Air and Energy Engineering Research Laboratory (AEERL), located in Research Triangle Park, North Carolina, has worked for more than two decades on research techniques for controlling air pollutants from stationary sources.

At AEERL, pollution prevention is a primary research focus in the areas of indoor air quality, organic chemicals, stratospheric ozone depletion, and global warming. AEERL's pollution pre-



Preventing Air Pollution at the Source

vention research includes scoping studies to characterize industry or process emissions, technology assessments to evaluate the technical and economic feasibility of pollution prevention techniques, cooperative technology demonstrations with academia and industrial partners, and information transfer through publications, national conferences, and other means.

Part of AEERL's research supports pollution prevention for industries and industrial operations subject to new regulations covered by EPA's Source Reduction Review Project (SRRP). Through SRRP, EPA is integrating pollution prevention into new air, water, and hazardous waste regulations for 17 industrial source categories.

This brochure highlights pollution prevention research projects in four of AEERL's eight branches. A selected list of AEERL's pollution prevention publications appears on page 7.

For More Information...

For additional information about specific projects described in this brochure, please call the listed EPA project contact.

For general information about AEERL pollution prevention research, please contact Richard Stern at (919) 541-2973 or Wade Ponder at (919) 541-2818. For information specific to indoor air quality, contact Michael Osborne at (919) 541-4113. The fax number for AEERL is (919) 541-2157.

For information about AEERL research on SRRP industrial source categories, please contact Carlos Nuñez at (919) 541-1156.



Organics Control Branch (OCB)

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Volatile organic compound (VOC) emissions contribute to ground level ozone concentrations that exceed the national standard in many areas in the U.S. In addition, Toxics Release Inventory reports show that millions of tons of toxic organic chemicals are released to the air each year. OCB conducts research to reduce and prevent VOC and toxic organic chemical emissions.

Equipment and Surface Cleaning

Solvent Alternatives Guide. To help businesses identify alternative cleaning systems for specific applications, OCB has developed the Solvent Alternatives Guide (SAGE). SAGE is a computerized decision-tree system that is updated and expanded regularly. SAGE is available to the public free of charge.

Contact : Charles Darvin, (919) 541-7633.

Measuring Cleaning Performance. Users of organic solvent cleaners frequently are reluctant to use alternatives if they are unsure of performance in their particular application. OCB is testing alternative cleaners and cleaning equipment with the goal of developing a standardized scale for determining the level of cleanliness required for specific applications.

Contact : Charles Darvin, (919) 541-7633.

Solvent-free Cleaning Techniques. OCB has evaluated solvent-free precision and non-precision cleaning techniques to replace conventional organic cleaners that are significant sources of VOC and toxic organic emissions. In 1994, an automotive parts manufacturer will demonstrate a technique that uses frozen carbon dioxide as a cleaning material.

Contact : Charles Darvin, (919) 541-7633.

Equipment Cleaning in the Coated and Laminated Paper Industry. Organic solvents used for equipment and surface cleaning in the coated and laminated substrate manufacturing industry (e.g., paper, film, foil) are major sources of organic chemical emissions. OCB is identifying and demonstrating reduced-VOC and toxic organic techniques for cleaning process equipment in this industry.

Contact : Michael Kosusko, (919) 541-2734.

On-site Assessments at Federal Facilities. Executive Order 12856 directs all federal facilities meeting Toxics Release Inventory reporting thresholds to develop pollution prevention plans by December 31, 1995. OCB is assisting pollution prevention efforts at Warner Robbins Air Force Base and the U.S. Marine Corps Maintenance Depot in Georgia. These projects focus on identifying and quantifying emissions from surface cleaning operations and demonstrating alternative, lower-emitting systems.

Contacts : Charles Darvin, (919) 541-7633,

Jamie Whitfield, (919) 541-2509.

Low- and No-VOC Adhesive Products

Waterborne Adhesives for Tapes, Tags, and Labels. Solvent-borne adhesives used in products such as tapes, tags, and labels are a major source of methyl ethyl ketone and toluene emissions. OCB-sponsored research is demonstrating and evaluating waterborne adhesives that can reduce or eliminate organic chemical emissions.

Contact : Chester Vogel, (919) 541-2827.

Adhesives Alternatives Guide. OCB is developing an Adhesives Alternatives Guide (AAGE) to assist users of solvent-borne adhesives in identifying low- and no-VOC alternatives for specific applications. AAGE will start as a hard-copy summary of available systems which will then be made into a computer-based decision support system.

Contact : Chester Vogel, (919) 541-2827.

Printing Systems

Polymer Surfactants to Control Properties of Waterborne Inks. Although the use of waterborne inks is expanding, solvent-borne inks still predominate in a number of high performance applications. OCB is developing the use of polymer surfactants to influence and improve the physical properties of traditional waterborne inks so that they can meet these specialized performance standards.

Contact : Jamie Whitfield, (919) 541-2509.

Commercial /Consumer Products

Many commercial/consumer products contain substantial amounts of organic chemicals. OCB has targeted several major uses of these products for detailed emissions characterization and pollution prevention demonstration projects. These uses include textile manufacturing, furniture repair and refinishing, roofing, mold release agents, and heating, ventilating and air conditioning coil and parts cleaning. For example, OCB is evaluating low-VOC coating strippers that can remove low-VOC coatings used in the wood furniture manufacturing and refinishing industries.

Contacts : Michael Kosusko, (919) 541-2734,

Robert McCrillis, (919) 541-2733,

Jamie Whitfield, (919) 541-2509.

Coatings and Coating Application Systems

Wood Furniture. Wood furniture manufacturers use large quantities of VOC-based coatings. OCB has evaluated the status of very low-VOC coatings for wood furniture finishing and is selecting ten coatings for further evaluation and testing in commercial facilities. OCB and the California South Coast Air Quality Management District also have developed a two-component water-based epoxy resin coating for this industry.

Contact : Robert McCrillis, (919) 541-2733.

Auto Body Refinishing. Automobile body refinishing has traditionally required the use of substantial amounts of solvent-borne coatings. Refinishing operations are small, dispersed area sources of VOC emissions. OCB is demonstrating and evaluating promising pollution prevention technologies for automobile body refinishing, including low-VOC paints, high-volume/low-pressure (HVLV) spray guns, water-based primers, and infrared curing systems.

Contact : Geddes Ramsey, (919) 541-7963.

Architectural and Industrial Maintenance Coatings. Architectural and industrial maintenance (AIM) coatings are a significant source of toxic organic, heavy metal, and VOC emissions. OCB, in collaboration with Research Triangle Institute, industry, and trade organizations, is targeting high-risk applications of AIM coatings in order to conduct on-site evaluations of the technical and economic feasibility of alternative, low-emitting coatings.

Contact : Michael Kosusko, (919) 541-2734.

Coating Systems Containing Reactive Diluents. VOC emissions from coatings result largely from evaporation of the coating's diluent. OCB is working with the California South Coast Air Quality Management District to demonstrate the technical and economic feasibility of using reactive diluents, which are based on the physical and chemical properties of veronica oil, in alkyd and epoxy coating formulations.

Contact : Robert McCrillis, (919) 541-2733.

Coatings Alternatives Guide. To enable users of coatings to locate information about less-polluting coating systems, OCB is developing the Coatings Alternatives Guide (CAGE). CAGE will contain information about innovative coating technologies and their applications. CAGE will eventually be developed into a computer-based decision support system.

Contact : Michael Kosusko, (919) 541-2734.

Ultra-Low Volume Spray Gun Systems. To address VOC emissions from coating operations, OCB is working with the U.S. Air Force to evaluate an innovative ultra-low volume spray gun system. This system can reduce VOC emissions by 50 to 75% through its high transfer efficiency and its ability to use coatings that have a higher solids content.

Contact : Charles Darwin, (919) 541-7633.

Pollution Prevention for Newly Regulated Industries and Industrial Operations

Scoping of Selected Source Reduction Review Project Categories. Through the Source Reduction Review Project (SRRP), EPA is exploring ways to build pollution prevention into new regulations. To assist industries that fall within SRRP industry source categories, OCB is using focus groups to identify pollution prevention opportunities in three industries: reinforced plastics, integrated iron and steel manufacturing, and paper and other webs (i.e., facilities that coat paper, plastic film, metallic foil, and other web surfaces).

Contact : Carlos Nuñez, (919) 541-1156.

UV and Radiation-cured Coatings. To assist industries that use coatings covered by regulations included in EPA's SRRP, OCB is identifying research opportunities to promote the use of radiation-cured or waterborne coatings that can reduce or eliminate VOC and toxic organic emissions. OCB will identify and characterize key technical issues, such as concerns about coating toxicity and the difficulty of coating complex parts using radiation-cured coatings.

Contact : Carlos Nuñez, (919) 541-1156.

Innovative Ink Feed Systems. Pollutant emissions from printing operations have become a regulatory focus for EPA. Substantial sources of toxic organic emissions from printing operations include tanks, piping, and mixing systems used to feed ink to printing presses and the subsequent cleaning of these systems. To assist printers with source reduction, OCB is working with Research Triangle Institute to identify and evaluate lower-emitting ink feed systems.

Contact : Carlos Nuñez, (919) 541-1156.

Low-Emitting Vapor Degreasing System Design. To help industries reduce emissions from vapor degreasing systems subject to Maximum Achievable Control Technology standards, OCB has evaluated two low-emitting vapor degreasing system designs. These systems use vacuum technology to reduce solvent emissions by more than 90% as compared with conventional open-top vapor degreasers.

Contact : Charles Darwin, (919) 541-7633.

Indoor Air Branch (IAB)

Michael Osborne, Chief

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Airborne concentrations of many pollutants are higher in indoor environments than outdoors. As a result, IAB researches low-emitting or low-impact materials and products that prevent indoor air emissions of pollutants. In addition to pollution prevention, AEERL's indoor air research includes source characterization and management, ventilation, air cleaning, cost analysis, modeling, and radon mitigation.

Office Equipment

Office equipment, such as photocopiers and printers, can emit ozone, organic chemicals, and fine particles into the indoor air environment. IAB is working with office equipment makers to identify and characterize sources of indoor air emissions. The project is examining equipment manufacture and design in order to develop and demonstrate low-emitting equipment.

Contact : Kelly Leovic, (919) 541-7717.

Aerosol Consumer Products

Aerosol consumer products can emit contaminants that degrade indoor air quality. IAB-sponsored research is underway to characterize, predict, measure, and prevent pollutant emissions from aerosol consumer products. IAB will develop pollution prevention techniques and guidelines for formulating more effective and less toxic aerosol products.

Contact : Kelly Leovic, (919) 541-7717.

Composite Wood Products

Composite wood products contain organic chemical constituents that can be emitted when the products are placed indoors. IAB is working with the composite wood manufacturing industry to characterize emissions from composite wood products, such as residential and office furniture, and to develop low-emitting/low-impact substitutes. The project is exploring how changes to product design and manufacturing processes can reduce and/or prevent indoor air emissions.

Contact : Betsy Shaver, (919) 541-7915.

Dry Cleaning

Nearly half of all perchloroethylene (PCE) in the U.S. is used in the dry cleaning industry. Residual PCE in dry-cleaned garments can be emitted indoors. To help dry cleaners comply with new regulations and reduce emissions of PCE into the indoor environment, IAB is identifying and testing alternative cleaning systems which do not use PCE.

Contact : Betsy Shaver, (919) 541-7915.

Textile Products

Textiles can contain organic chemicals that can be emitted to the indoor air environment. Textiles can also adsorb and re-emit contaminants. IAB is researching methods for reducing organic chemical emissions from textiles. Projects include identifying low-emitting textile processing chemicals, reducing emissions from binders used in apparel production, and evaluating how a textile's physical and chemical structure affects its ability to adsorb and emit pollutants.

Contact : James White, (919) 541-1189.

Preventing Biocontaminant Growth

Building materials such as insulation, wallboard, and ceiling tiles can support the growth of bacteria, molds, and other biocontaminants that can degrade indoor air quality. IAB-sponsored research is testing materials that resist these biocontaminants and are also exploring how humidity affects biocontaminant growth.

Contact : John Chang, (919) 541-3747.

Environmental Resource Guide

Building design and the selection of building materials can have a major effect on indoor air quality. To help architects and other design professionals consider the environmental impacts of building design decisions and materials specifications, IAB and the American Institute of Architects are developing the Environmental Resource Guide (ERG). The ERG is a comprehensive reference resource that contains case studies, professional advisories, and technical analyses of the life-cycles of building materials.

Contact : James White, (919) 541-1189.

Facility Life-Cycle Design Tools

IAB and the U.S. Army Construction Engineering Research Laboratories are developing a computer-based system to evaluate the life-cycle environmental impacts of building materials and design decisions, including exposure of a building's occupants to contaminants and building material disposal considerations. The system will provide information on environmentally sensitive techniques and building material alternatives, and it will be compatible with existing software environments, such as Computer-Aided Design and Drafting.

Contact : James White, (919) 541-1189.

Stratospheric Ozone Protection Branch (SOPB)

William Rhodes, Chief
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Ozone depleting substance (ODS) releases have significantly reduced the stratospheric ozone that protects the Earth from harmful ultraviolet radiation. SOPB is developing, testing, and evaluating ODS replacements as well as modified processes and products to efficiently use non-ODS replacements.

New Chemicals to Replace ODSs

SOPB is identifying, synthesizing, and evaluating potential non-ozone-depleting chemical replacements for ODSs. SOPB is screening non-ODS replacements by evaluating their environmental and health effects as well as other functional characteristics such as their flammability and compatibility with lubricating oil. SOPB is also working with the private sector to find substitutes for halons used for fire and explosion suppression.
Contact : Dean Smith, (919) 541-2708.

Foam Insulation

Hydrochlorofluorocarbon (HCFC) replacements for chlorofluorocarbon (CFC) blowing agents in foam insulation also have an ozone-depleting potential. SOPB is evaluating cost-effective replacement blowing agents with no ozone-depleting potential that maintain foam insulation performance.
Contact : Robert Hendriks, (919) 541-3928.

Heat Pumps

The most significant HCFC in use today is HCFC-22, which is used as a refrigerant in heat pumps and air conditioners. SOPB is examining alternative refrigerants and evaluating heat pump and air conditioning equipment that will optimize refrigerant performance.
Contact : Robert Hendriks, (919) 541-3928.

Reducing ODS Use In Refrigeration

Refrigerants. In 1991 nearly 260,000 tons of ODSs were used as refrigerants. SOPB is researching newly developed refrigerants, modified refrigeration cycles, and equipment in application testing in order to optimize these new refrigerants.
Contact : Cynthia Gage, (919) 541-0590.

Superinsulating Panels. SOPB is accelerating the commercialization of superinsulating panels for home refrigerators. Unlike traditional panels, superinsulating panels do not use ODS blowing agents. These panels can also improve a refrigerator's energy efficiency by 20%.
Contact : Robert Hendriks, (919) 541-3928.

Global Warming Control Branch (GWCB)

Michael Maxwell, Chief

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Fax (919) 541-2382

Fossil fuel combustion, particularly at electric power generating stations, is a major source of greenhouse gas emissions that contribute to global warming. GWCB is working to reduce greenhouse gas emissions by developing improved methods to produce and use energy.

Optimization of Electric Motor Performance

Electric motors consume more than 60% of the electric power generated in the U.S. GWCB has patented a computer chip, called the "Fuzzy Logic Energy Optimizer," that allows large adjustable-speed drive motors, such as those used in large heating and cooling systems, to operate closer to peak efficiency under varying loads. The chip employs a mathematical technique known as "fuzzy logic" that allows for degrees of truth or falseness in evaluating information to establish optimal motor operating speeds. Improving the efficiency of these motors can reduce greenhouse gas emissions by over 15 million tons per year.

Contact : Ronald Spiegel, (919) 541-7542.

Clean Transportation Fuels

Mobile sources account for 30% of U.S. carbon dioxide emissions. Alternative fuels derived from biomass can eliminate the net emissions of greenhouse gases from mobile sources, reduce VOC-equivalent emissions by 80%, produce 40% less ozone per vehicle mile travelled, and reduce risk-weighted toxics emissions by 90%. GWCB will begin operation of a bench-scale test facility in 1995 to evaluate improved technology for biofuel production.

Contact : Robert Borgwardt, (919) 541-2336.

Biomass-fueled Energy Conversion

Energy conversion technologies fueled with biomass would reduce or eliminate sulfur dioxide emissions from fossil fuel combustion, carbon dioxide and methane emissions from open burning of biomass and biomass deterioration, and other associated air toxic emissions and waste disposal problems. In addition, these technologies generate no excess carbon dioxide emissions, and they reduce costs by avoiding tipping fees for solid waste disposal and by reducing fossil fuel purchases. GWCB is evaluating and demonstrating the technical, economic, and environmental feasibility of small (200-5000 kW) energy conversion technologies fueled with biomass. These technologies can be applied to agricultural centers, industrial sites, rural areas, and developing countries.

Contact : Carol Purvis, (919) 541-7519.

Selected AEERL Pollution Prevention Publications

Documents with National Technical Information Service (NTIS) numbers are available from the NTIS, 5285 Port Royal Road, Springfield, VA, 22161 [Phone: (800) 553-6847]. Include the NTIS publication number with your request. Documents with EPA-625 numbers are available from EPA's Center for Environmental Research Information (CERI), 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268 [Phone: (513) 569-7562, Fax: (513) 569-7566].

Indoor Air Branch

- EPA's Indoor Air Quality Pollution Prevention Workshop (NTIS PB94-114782)
- Catalog of Materials as Sources of Indoor Air Emissions, Vol. 1 (NTIS PB93-212041)
- Radon Prevention in the Design and Construction of Schools and Other Large Buildings (EPA/625/R-92/016)
- Assessment of Fungal Growth on Ceiling Tiles Under Environmentally Characterized Conditions (NTIS PB93-222024)
- Environmental Resource Guide [for subscription information, contact Nancy Solomon, AIA, at (202) 626-7463]

Organics Control Branch

- Proceedings: Pollution Prevention Conference on Low- and No-VOC Coating Technologies (NTIS PB94-152246)
- Evaluation of Volatile Organic Emissions Data for Non-Process Solvent Use in 15 Commercial and Industrial Business Categories (NTIS PB94-152212)
- Improved Equipment Cleaning in Coated and Laminated Substrate Manufacturing Facilities - Phase I (NTIS PB94-141157)

- Surface Coating-Free Materials Workshop: Summary Report (NTIS PB93-101160)
- Estimation of Emissions From Charcoal Lighter Fluid and Review of Alternatives (NTIS PB90-186313)
- Solvent-based to Water-based Adhesive Coated Substrate Retrofit. Volume II: Process Overview (EPA Contact: Mike Kosusko, (919) 541-2734)

Stratospheric Ozone Protection Branch

- Simulation of Performance of Chlorine-Free Fluorinated Ethers and Fluorinated Hydrocarbons to Replace CFC- 11 and CFC-114 in Chillers (NTIS PB93-175511)
- Physical Properties of Fluorinated Propane and Butane Derivatives as Alternative Refrigerants (NTIS PB93-173102)
- Predictions of Azeotropes Formed from Fluorinated Ethers, Ethanes and Propanes (NTIS PB92-195908)
- Performance and Efficiency Evaluations of 11 Non-CFC Refrigerants (EPA Contact: Cynthia Gage, (919) 541-0590)
- Stratospheric Ozone Protection: An EPA Engineering Perspective (NTIS PB92-136894)
- HFC-236ea: A Potential Alternative for CFC-114 (EPA Contact: Dean Smith, (919) 541-2708)
- Performance of Chlorine-Free Binary Zeotropic Refrigerant Mixtures in a Heat Pump (NTIS PB92-149814)

Global Warming Control Branch

- Fuzzy Logic Motor Control for Pollution Prevention and Improved Energy Efficiency (EPA Contact: Ron Spiegel, (919) 541-7542)
- Reduction of CO₂ Emissions from Mobile Sources by Alternative Fuels Derived from Biomass (NTIS PB93-229144)

The Control Technology Center— A Link to EPA Expertise

The Control Technology Center (CTC) provides technical assistance, including pollution prevention information, on a range of air pollution control technology issues for stationary sources. Assistance includes engineering services, technical guidance, small business support, and greenhouse gas information. The CTC Hotline can be reached at (919) 541-0800.

The CTC also offers computer-based bulletin board systems and information databases accessible through the technology transfer network electronic bulletin board system (TTNBBS) which is operated by EPA's Office of Air Quality Planning and Standards. For on-line access to TTNBBS, dial (919) 541-5742 for 1200 or 2400 baud communication or (919) 541-1447 for 9600 baud communication. To access TTNBBS through Internet, TELNET to TTNBBS.RTPNC.EPA.GOV.

Solvent Alternatives Guide (SAGE) software may be downloaded directly from the CTC bulletin board on TTNBBS or ordered on diskette free of charge from the CTC hotline. Running SAGE requires an 80286 or later generation computer with DOS, 640K of RAM, and 4 MB of available hard drive storage space.