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EPA

Research and Development

Looking to the Future



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ORD

is the Office of Research and Development . . . the Environmental Protection Agency's center of scientific expertise on environmental issues. Working with their colleagues in the academic and industrial communities, ORD's managers and staff are committed to solving the increasingly complex environmental questions of the 1990s.

At 12 laboratories across the United States, ORD's 2,000 scientists, engineers, and support staff conduct the field studies, chemical analyses, and intricate mathematical calculations that enable EPA to identify the mechanisms and effects of pollution and understand the complex interactions of environmental processes. The President's budget request for fiscal year 1993 calls for approximately \$526 million to fund ORD activities.

ORD is the Agency's "bench laboratory" . . . the place where new, more effective, and less costly environmental technologies are developed and tested. ORD also works with the academic and business communities to move these advancements into the marketplace for practical application.

Today's Environmental Challenges Require High-Tech Science . . .

As environmental questions become more complex, scientists must look to cutting-edge technology for answers. ORD brings new techniques to bear on difficult problems . . . such as developing entirely new approaches for dealing with environmental problems . . . and understanding the complex interrelationships of animals, plants, and humans in wetlands, estuaries, and other ecosystems. For example, working together with scientists from the business and academic communities, ORD has conducted important research to enhance the recycling of chlorofluorocarbon (CFC) refrigerants in automobile air conditioners . . . and to pioneer the use of bioremediation techniques in helping clean up the 1989 oil spill in Prince William Sound, Alaska.

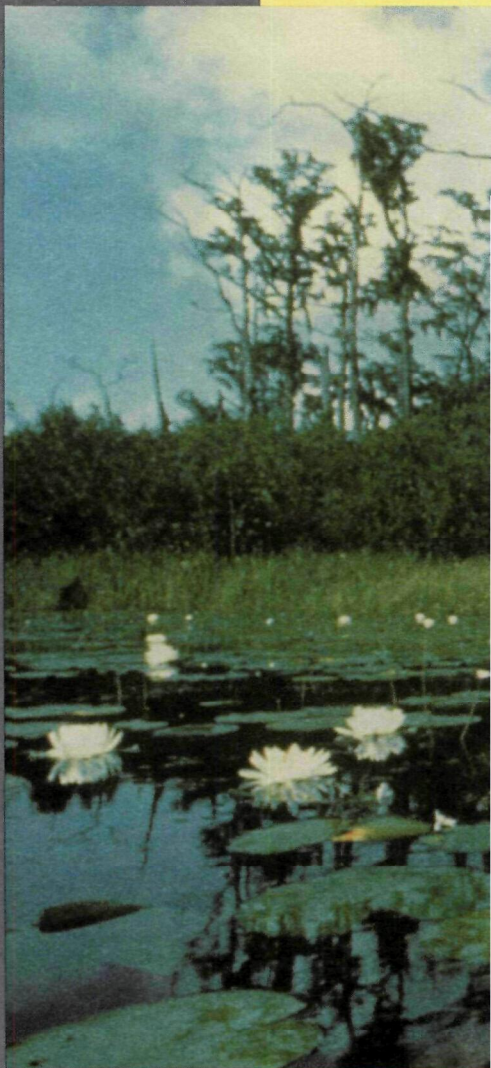
An EPA-Led Interagency Air Monitoring Team traveled to the Persian Gulf

to work with the World Health Organization (WHO) and other nations in assessing the magnitude and effects of pollution from the Kuwaiti oil well conflagrations. ORD scientists routinely collaborate on important projects with colleagues from other agencies, the academic community, other nations, and international organizations such as WHO, adding vital knowledge to large-scale national and international environmental studies.



Protecting and restoring wetlands

requires keen understanding of these complex ecological systems, which shelter vital wildlife and help prevent flooding and water pollution. ORD's Wetlands Research Program is testing ways to assess the ecological importance of different types of wetlands.



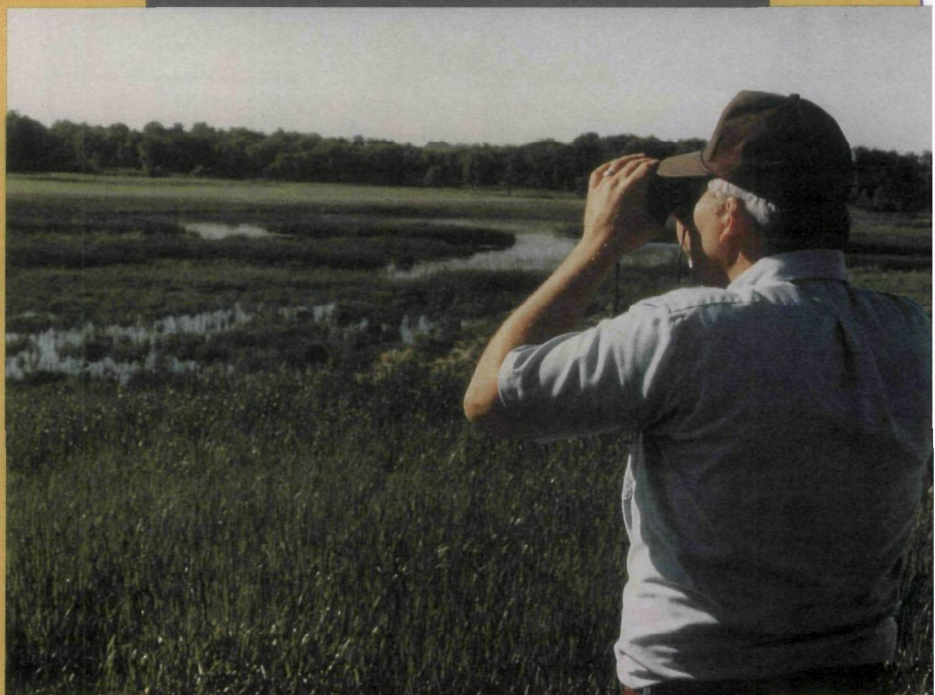


Observing and Understanding the Environment . . .

requires many different kinds of scientific expertise. In its own laboratories and in cooperation with other organizations, ORD utilizes the services of ecologists, chemists, biologists, toxicologists, and other specialists to assess the status of our ecological resources, measure pollution, evaluate the effects of contaminants on the environment and human health, and predict future trends. The scope of study could be as large as the planet itself, or as small as a pond . . .

The Environmental Monitoring and Assessment Program (EMAP)

is our "report card on the environment" . . . a pioneering effort to monitor the status of (and trends in) the nation's ecological resources, spot emerging environmental problems, and understand the efficacy of efforts to deal with environmental problems. In partnership with



other federal and state agencies and the academic community, ORD is using advanced technology (satellite imagery, for example) . . . rigorous statistical design and sampling . . . and hands-on field research to diagnose the health of whole ecosystems, such as estuaries, arid lands, forests, and wetlands. The goal of EMAP is to meet the crucial need for comprehensive, long-term environmental information.

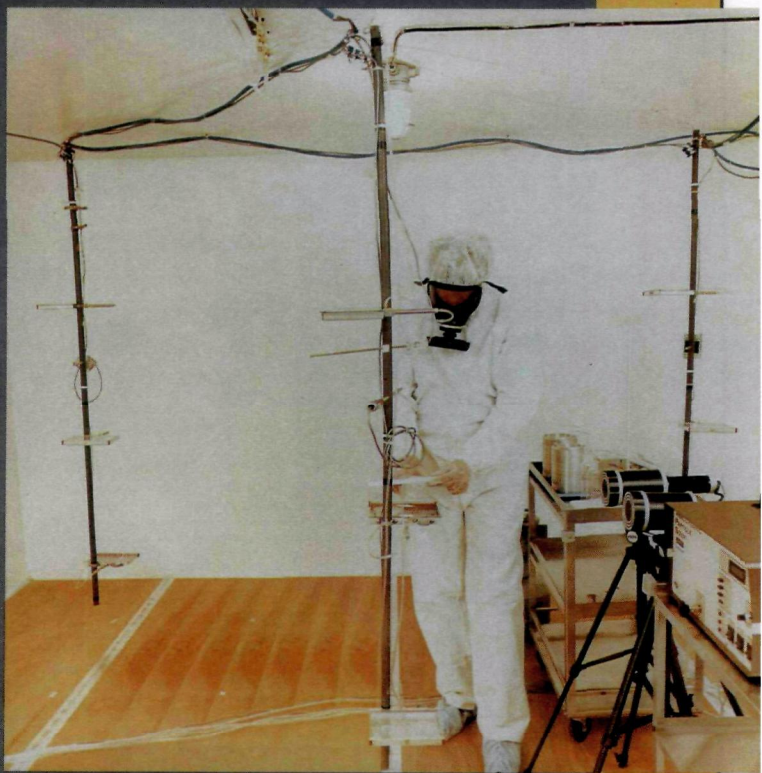
Global Climate Change



Emissions of carbon monoxide, methane, and other greenhouse gases are altering the chemistry of the atmosphere, and have the potential to change Earth's climate. But there are many uncertainties about the extent and consequences of those processes. ORD's research will give us important information on the role of the terrestrial environment in this atmospheric chemistry.

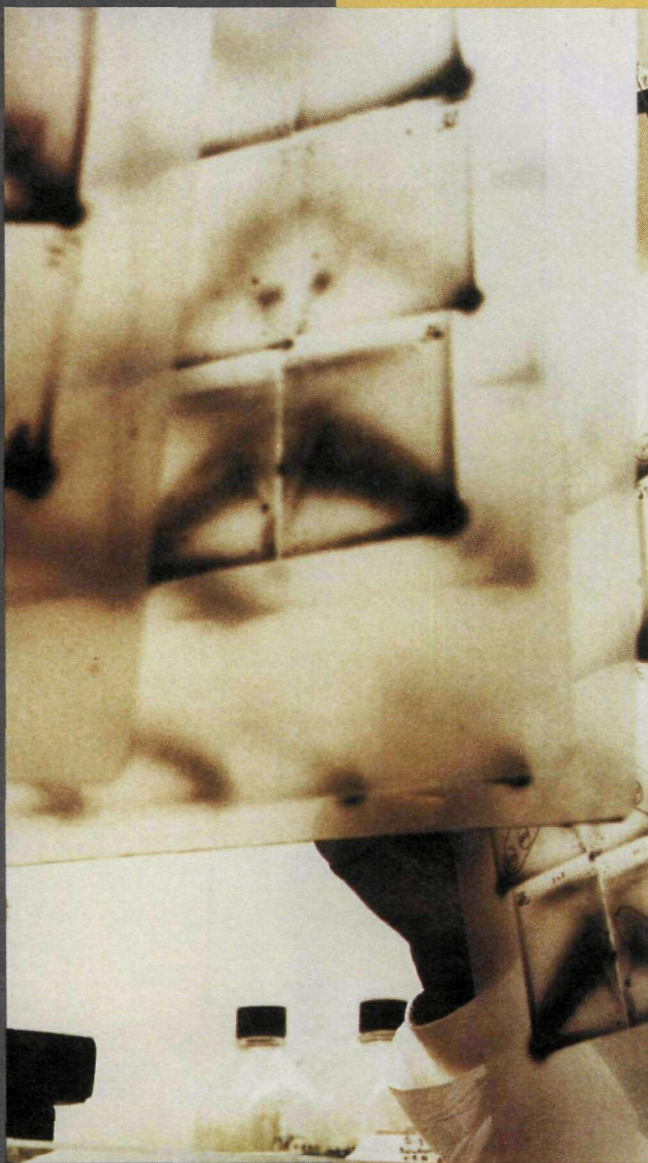
ORD Is Conducting State-of-the-Art Research to Assess Indoor Air Quality

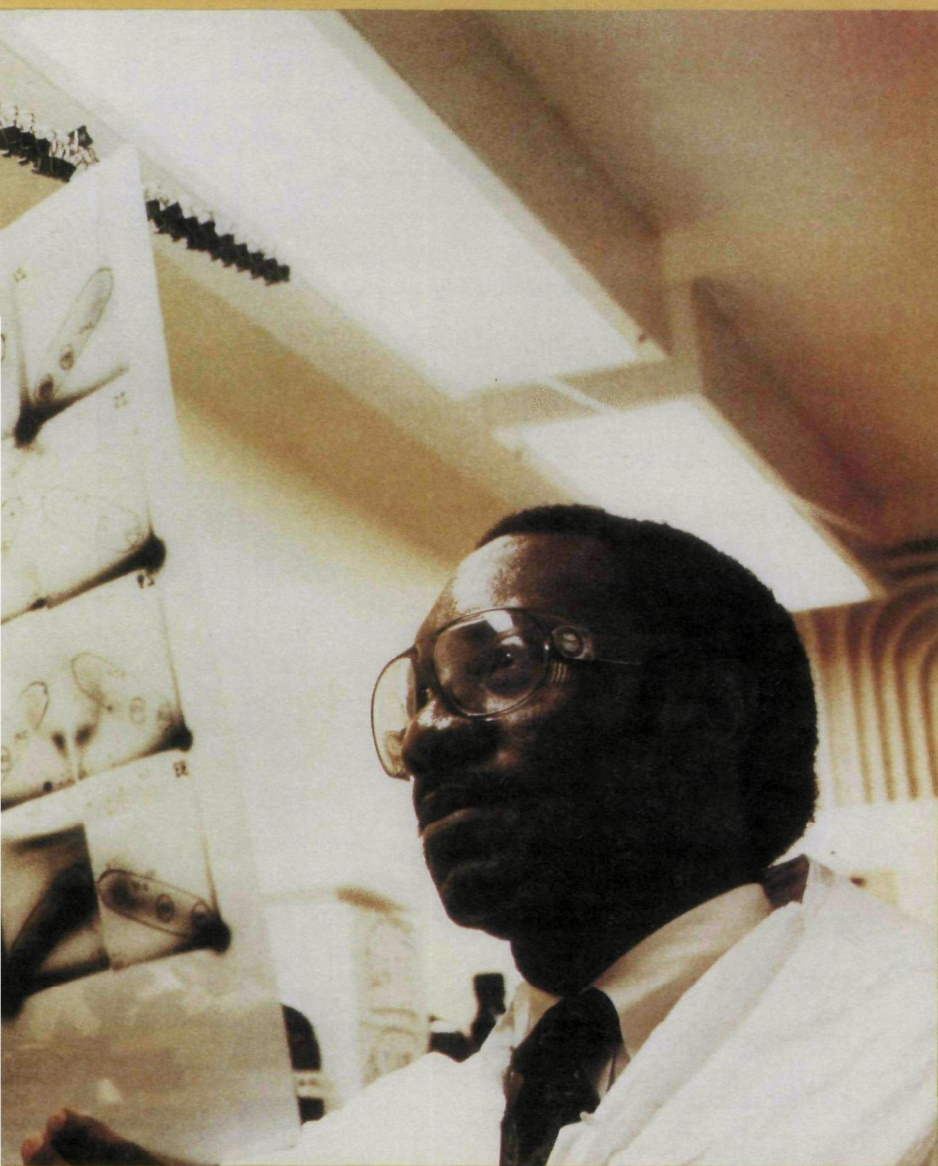
The past decade has seen increasing concern about the possible health effects of indoor air. ORD is using the latest science to identify the components of indoor air . . . precisely measure contaminants down to minute levels . . . and generate data to fill gaps in our understanding of these exposures and their potential effects. At ORD's Environmental Monitoring Systems Laboratory, for example, a special test chamber gives scientists a unique tool for assessing potential health risks from low-level indoor pollutants.



Studying the Effects of Complex Environmental Mixtures

Whether the subject is hazardous waste cleanup or air pollution prevention, environmental protection requires an understanding of how different pollutants interact. Every day, ORD scientists study complicated physical and chemical reactions to determine, for example, how the combined effects of chemicals differ from the effects of individual substances ... and how one pollutant interacts with another.



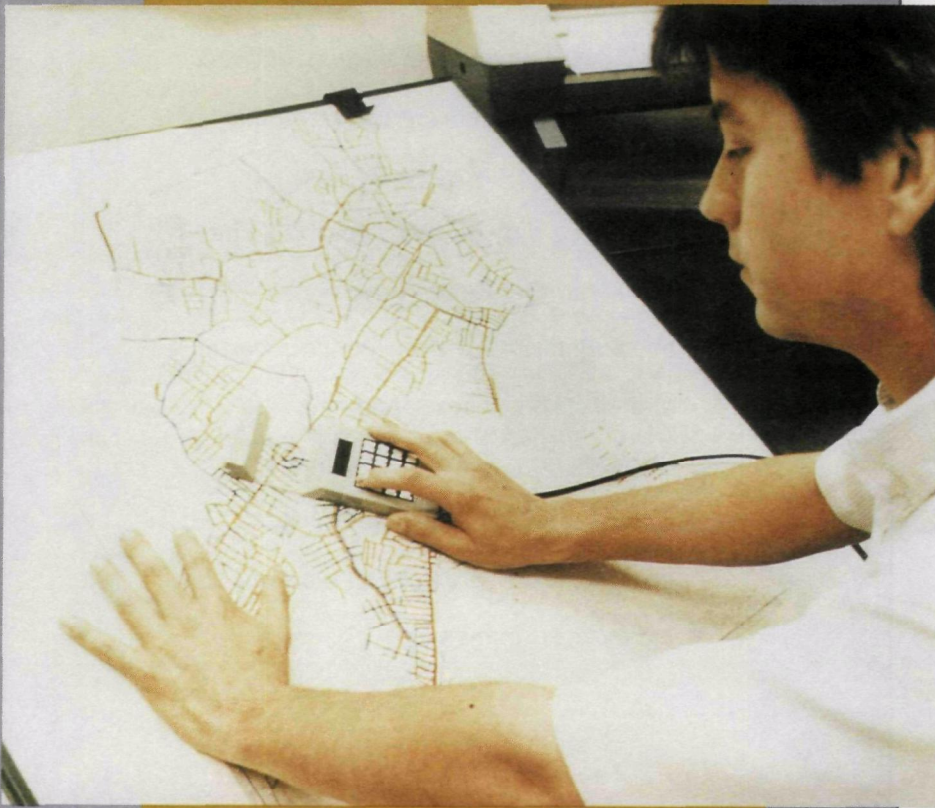


Risk Assessment . . .

is the difficult but crucial process of determining what magnitude of hazard a given chemical or physical agent may pose to human health or the environment. Accurate risk assessment is a necessary first step for any action taken by EPA. ORD's researchers advance science by finding better ways to identify and measure risk . . . and thus reduce uncertainty. In the case of dioxin, they also have recognized the evolution of science by re-examining an existing risk assessment in light of up-to-date biological, physiological, and cellular discoveries . . .

Using Geographic Information Systems (GIS) to Track Environmental Quality

gives scientists a promising tool for quickly identifying pollution problems and speeding hazardous waste cleanup. By studying a section of terrain through computerized overlay maps and making mathematical calculations, scientists can estimate, for example, how far pollution may spread from contaminated wells. ORD researchers are working on advancements in this intriguing technology through a series of demonstration projects.



Finding Innovative Solutions . . .

Looking beyond traditional approaches, ORD seeks new, more efficient, and less costly tools for cleaning up hazardous waste, treating wastewater, and preventing dirty air emissions. ORD has pioneered the use of everyday microorganisms to clean up toxic waste and oil spills . . . developed new methods for ensuring safe drinking water . . . and in many other ways brought new environmental tools and technologies into being.



Wastewater Treatment through Constructed Wetlands



is an innovative yet simple process being researched by ORD.

Wastewater is discharged into a manufactured wetlands area identical to nature's own. Through biochemical reactions, natural microbes in the sediment and root systems convert the wastes and help clean the water. ORD is conducting studies to determine the effectiveness of constructed wetlands, and how they function compared with natural wetlands.

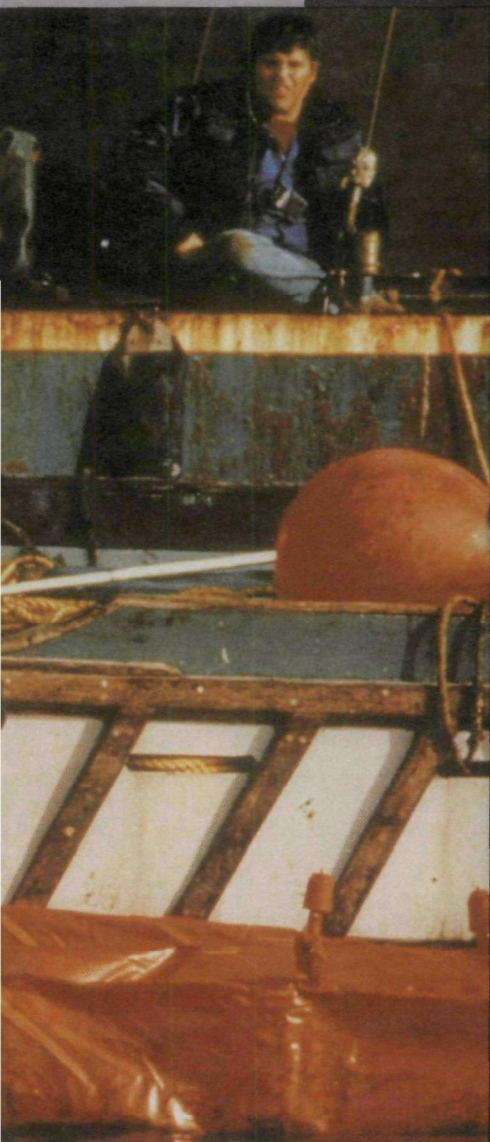


Technology Transfer

is the means by which new discoveries in ORD and other federal laboratories are disseminated

to the world at large . . . benefitting everybody. The Federal Technology Transfer Act gives ORD a valuable pipeline for commercializing its new technology. Through Cooperative Research and Development Agreements, ORD is able to work with private industry to develop new tools and techniques for protecting the environment, and move these ideas into the marketplace. For example, EPA/industry collaboration under a cooperative agreement led to highly successful research concerning the use of microorganisms to enhance the natural biodegradation of oil spilled in Prince William Sound, Alaska. In partnership with the Department of Commerce, the Department of Energy, and other federal agencies, EPA in 1992 conducted the National Technology Initiative, a major series of conferences across the United States to encourage further interaction with private industry . . . and ORD followed those conferences with additional workshops focused specifically on commercializing

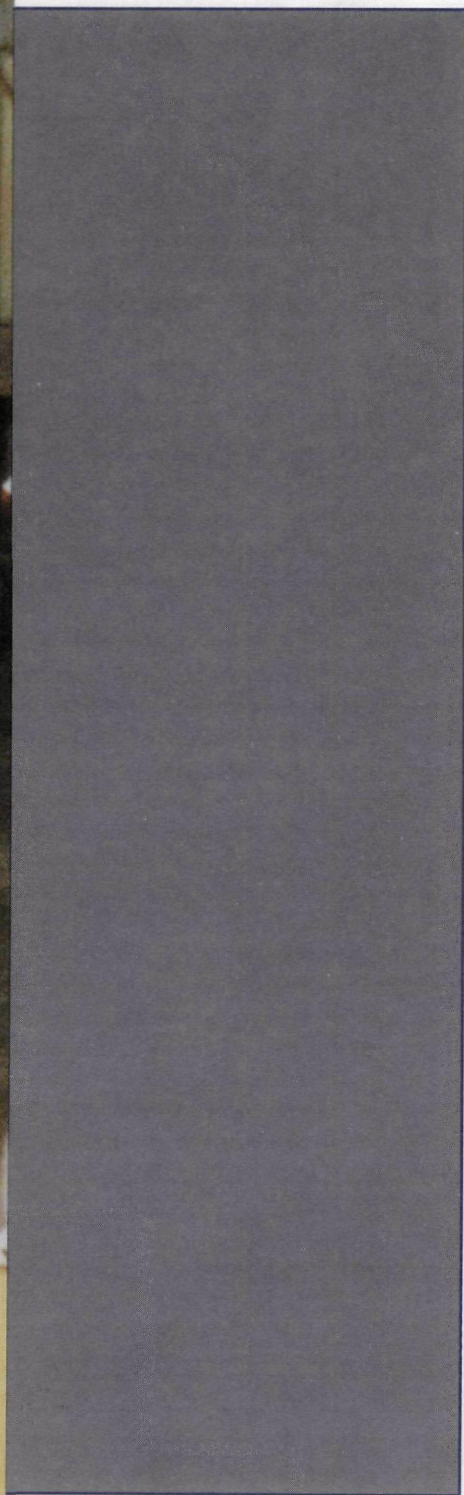
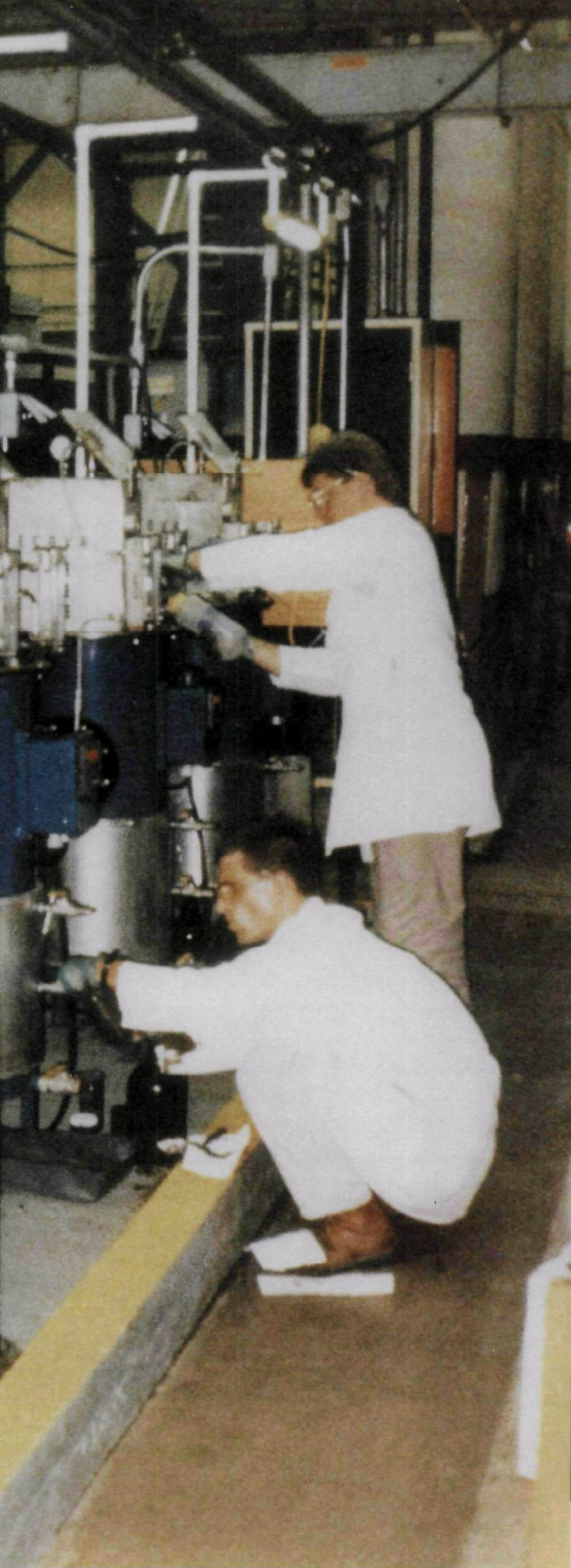
new environmental technologies.



A Bioslurry Reactor

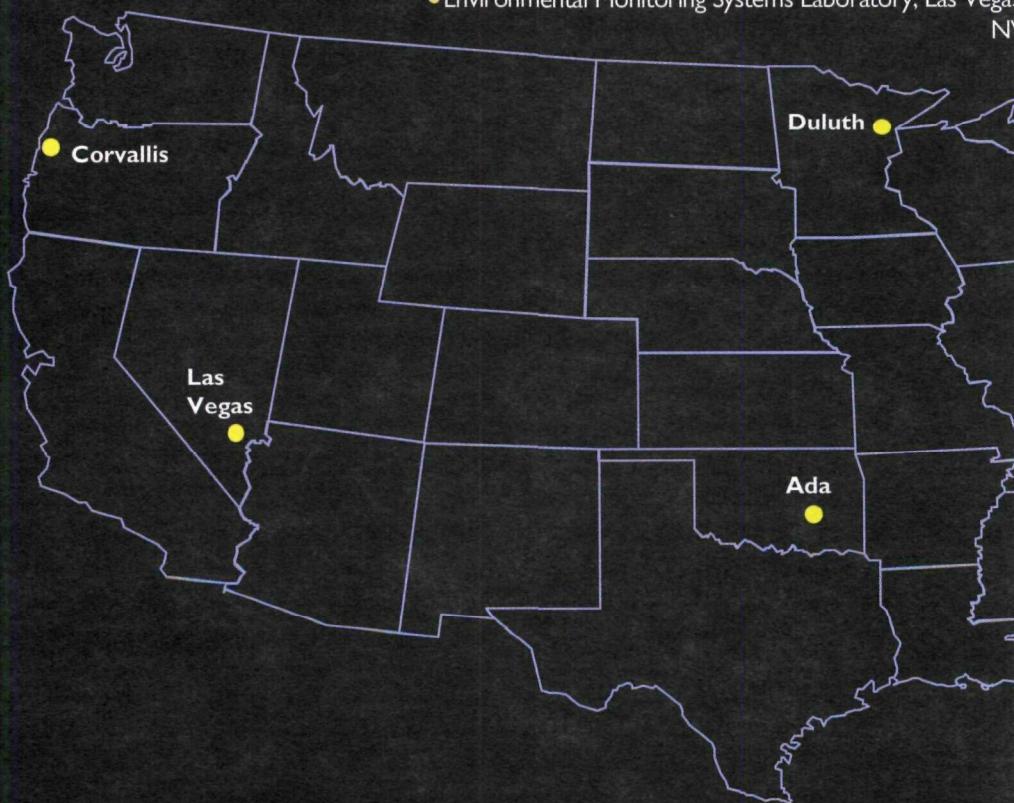
is one of the advanced tools that ORD is evaluating for more effective, less expensive hazardous waste cleanup. Soils contaminated with coal tars, hydrocarbons, and other wastes are put into the reactor. Water is added, and the resulting slurry is agitated and temperature-controlled to promote the natural activity of microorganisms in the soil that convert the wastes into non-harmful substances.







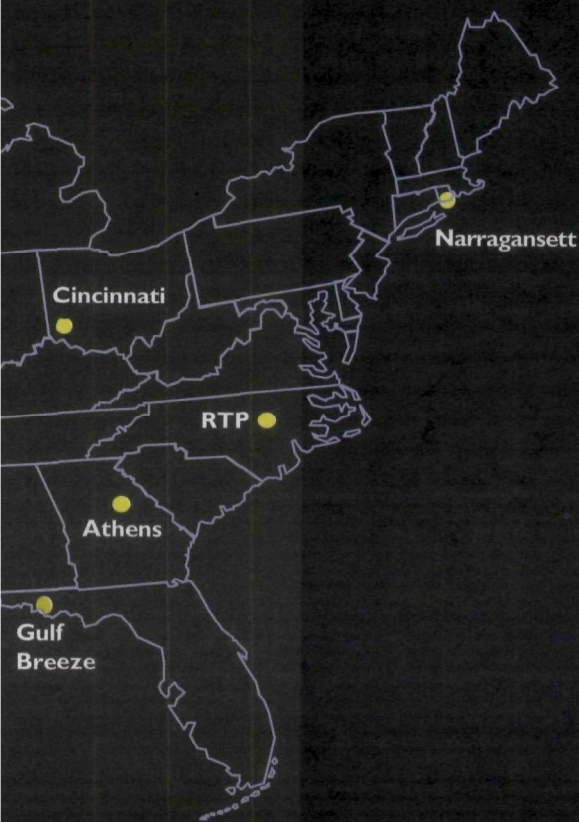
- Environmental Research Laboratory - Narragansett, RI
- Environmental Research Laboratory - Duluth, MN
- Environmental Research Laboratory - Gulf Breeze, FL
- Environmental Research Laboratory - Corvallis, OR
- R.S. Kerr Environmental Research Laboratory - Ada, OK
- Environmental Research Laboratory - Athens, GA
- Health Effects Research Laboratory - Research Triangle Park, NC
- Atmospheric Research and Exposure Assessment Laboratory - Research Triangle Park, NC
- Air and Energy Engineering Research Laboratory - Research Triangle Park, NC
- Environmental Monitoring Systems Laboratory - Cincinnati, OH
- Risk Reduction Engineering Laboratory - Cincinnati, OH
- Environmental Monitoring Systems Laboratory, Las Vegas, NV



“**A**s we head toward the 21st century, we face environmental questions that demand scientific and technical knowledge far beyond today’s understanding. ORD plays a critical role in generating the knowledge that we need to make sound, effective decisions today, and anticipate the complex challenges of tomorrow.”

Erich W.
Bretthauer

Assistant Administrator
for Research and
Development





ORD's Research on Air Pollution is recognized internationally, and its laboratories are at the forefront of studies to better understand and monitor air pollutants, and to find new, more effective ways of controlling them. For example, ORD scientists helped the newly independent government of Poland install and begin using the first state-of-the-art monitoring network in Eastern Europe, and ORD has followed that effort with additional technical assistance in Eastern and Central Europe.