•

BDK

nmunications, Education Pholic Affairs

Trading for the Future: New Approaches to Environmental Protection

SEPA JOURNAL

United States Environmental Protection Agency

Office of Communications, Education, and Public Affairs

William K. Reilly Administrator

Lew Crampton Associate Administrator

Charles Osolin Director of Editorial Services

John Heritage Editor

Karen Flagstad Associate Editor

Teresa Opheim Assistant Editor

Gregg Sekscienski Assistant Editor

Ruth Barker Assistant Editor

Jack Lewis Assistant Editor

Nancy Starnes Assistant Editor

Marilyn Rogers Circulation Manager

Editorial Assistance Leighton Price

Design Credits

Ron Farrah James R. Ingram Robert Flanagan

Front Cover: Action on the floor of the Chicago Board of Trade. The exchange plans to launch a futures market for EPA's sulfur dioxide allowances early next year. See articles on pages 21 and 27 discussing the use of the marketplace for pollution control. Photo by Robert Frenck for Tony Stone Worldwide.

EPA JOURNAL Subscriptions

The annual rate for subscribers in the U.S. for EPA Journal is \$10. The charge to subscribers in foreign countries is \$12.50 a year. The price of a single copy of EPA Journal is \$3.50 in this country and \$4.38 if sent to a foreign country. Prices include mail costs. Subscriptions to EPA Journal as well as to other federal government magazines are handled only by the U.S. Government Printing Office. To subscribe to EPA Journal, send a check or money order payable to the Superintendent of Documents. The requests should be mailed to: P.O. Box 371954 Pittsburgh PA 15250-7954

EPA JOURNAL is printed on recycled paper.

A Magazine on National and Global Environmental Perspectives

May/June 1992 Volume 18, Number 2 175-N92-003

From the Editor

s the nation's environmental cleanup taking a new shape as the decade moves along? For clues, watch the progress of approaches such as pollution prevention, information transfer, and the use of economic incentives.

The pollution control effort launched in the 1970s has been carried out largely by command-and-control regulations. These require all sources in a class to take specific actions by a certain time. The installation of catalytic converters on automobiles was brought about by such a regulation.

But several trends have developed which may be setting the stage for the introduction on a major scale of new approaches—or "tools"—to implement the cleanup. These trends are:

• An increased consensus that there are other ways to accomplish society's ends in a democracy than directives from government institutions. As much pollution might be eliminated by citizens armed with facts about a local plant's waste output as by a new federal rule. An environmentally educated population might produce cleaner, healthier surroundings over the long run than institutional fiats.

• A widening understanding that the pollution battle will not be won by focusing on industry alone. A big part of the enemy is us—our driving and buying habits, our leisure time lifestyle.

• Concern about a mounting pollution control bill in a period of national economic squeeze. Innovative thinkers have produced the notion that there might be less expensive ways to achieve the same environmental goals.

• The emergence of globe-spanning environmental problems that cannot be dealt with by controls issued by any one nation's agencies. In one response, many of the countries of the world have launched a joint effort to meet the challenge of stratospheric ozone depletion, using a wide range of implementation tools.

These trends don't signal the end of command-and-control regulation. There is a big body of federal law that requires the use of this approach. But alternatives are in the "toolkit" and they are being taken out and actively tried, by Congress, the Administration, and some environmental groups and industry. There are skeptics, but a move towards innovation is clearly afoot.

Some sad news: Our friend and colleague, Assistant Editor Jack Lewis, died on June 21. He will be sorely missed. Among his many contributions to EPA Journal over the years, Jack invented our "Titans in Conservation" feature, and his story on Rachel Carson appears on page 60 of this issue.

John Heritage

Contents



"Tools" to Protect the Environment

A Need for New Approaches by Alvin L. Alm

Jobs at Hand

- 12 Solid Waste: **Incentives that Could** Lighten the Load by Terry Dinan
- **Pesticides:** The Potential for Change by Marcia E. Williams
- **Ozone Loss:** 6 Modern Tools for a **Modern Problem** by David Lee
- 10 The Denver Airport: **Pollution Prevention by** Design by Jack W. McGraw



In the Toolkit ECONOMIC INCENTIVES

- Harnessing the Marketplace by Robert N. Stavins
- **A Skeptic Speaks** by Michael Gartner
- The Market-Based **Approach at EPA** by Richard D. Morgenstern
- An Answer to the **Dilemma on the Front** Line? by Henry Lee
- A Forum: The Los **Angeles** Venture
- **Trades to Remember:** The Lead Phasedown by Lily Whiteman



POLLUTION PREVENTION

Heading Off Potential Problems by Richard Andrews

INFORMATION TRANSFER

Attacking a Problem with the Facts by Caron Chess

ENGINEERING AND TECHNOLOGY

New Davids to Tackle 51 **Environmental Goliaths** by Erich W. Bretthauer

Making the Tools Work

The Institutional Challenge by Terry Davies and Frances Irwin



Departments

- **9** Newsline Newsline
- News and Comment on EPA
- 57 Featuring EPA
- The Mobile Scanner Van **Reports for Duty** by Yasmine S. Khonsary and Colleen F. Petullo
- Letters to the Editor 59
- **Titans in Conservation** 60 Rachel Carson by Jack Lewis
- 62 Cross Currents Taking the Pulse of Our **Renewable Resources** A Book Review by Douglass Lea
- On the Move New Name in a Key Agency Post

EPA is charged by Congress to protect the nation's land, air, and water systems. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions which lead to a compatible balance between human activities and the ability of natural systems to support and nurture life. **EPA JOURNAL** is published by the U.S. Environmental Protection Agency. The Administrator of EPA has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget. Views expressed by authors do not necessarily reflect EPA policy. No permission necessary to reproduce Contents except copyrighted photos and other materials. Contributions and inquiries should be addressed to the Editor, EPA JOURNAL (A-107), Waterside Mall, 401 M Street, SW., Washington, D.C. 20460

Newsline

"Cash for Clunkers" to Cut Pollution

A new EPA plan allows air pollution emissions credits to be earned through scrapping older (more polluting) automobiles. States can design their own programs under the plan. Typically, a smokestack industry that was under the gun to reduce its emissions would buy old cars from the public and scrap them. For each car destroyed, the industry would receive an emissions credit. The amount and lifetime of the credit would depend on the age of the car. To make sure the clunkers were taken off the road and not off the junk heap, they would have to be registered in the same state for the previous year.

Although most stationary sources have already reduced their emissions to a large extent, many will have to go further under the 1990 Clean Air Act. The further they have to go, the more expensive become the controls. In cities where air pollution is severe, and emissions must be reduced substantially, buying and scrapping old cars may be cheaper than clamping down further on smokestacks.

The Washington Post reported: "... The 'Cash-for-Clunkers' program, patterned on a Los Angeles experiment in 1990 by Unocal Corp., an oil company, would pay owners of 1981-model and older cars a yet-undetermined price to turn in their aging vehicles The program ... was announced ... at the White House by Michael J. Boskin, chairman of the President's



Council of Economic Advisers. The ... program, coming in an election year, is viewed by detractors as a sop to industries trying to evade federal clean-air rules. 'It's an ineffective and costly clunker,' said Clarence Ditlow, executive director of the Washington-based Center for Auto Safety. In effect, the program would allow companies to continue polluting the air in return for removing polluting cars, Ditlow said. Such a swap will do little to clean up the environment, but it could do much to hurt poor consumers in an era of escalating new- and used-car prices, he said. **Bush administration** officials disagreed. The 'primary purpose' of the Cash-for-Clunkers program is to implement new federal rules affecting smokestack pollutants 'in a cost-effective way,' said Boskin. The program might also boost new-car sales by encouraging people to trade in old cars for fresher models, some supporters said. But Boskin attempted to play down that possible benefit, saying, 'One would not expect everyone who trades in a clunker to walk

into a new-car showroom and buy a new car.' Auto industry analyst Dennis Virag agreed. 'I seriously question the number of old cars that the government is going to be able to get off the road for \$700,' said Virag, a senior partner at Automotive Consulting Group Inc., an industry research and consulting firm in Ann Arbor, Michigan. The government hasn't set an exact price for cars in the new program, but Unocal paid \$700 each to people turning in 1970-model and older cars in its one-year experiment in Los Angeles. The firm bought 8,400 cars during the year, said Unocal spokesman Michael Riehle. A survey of 800 of the people who ditched their old cars for cash showed that 80 of them did not replace their vehicles. that another 360 already had other cars, and that the remaining 360 used the \$700 as a down payment to buy new cars or used models that were in better condition, Riehle said. The people who bought new or better used cars paid an average of \$5,000 for them, he said "

The Washington Times commented: "... Another controversial announcement-relaxing the required average miles per gallon for autos using reformulated or oxygenated fuel, including ethanol mixtures-is expected soon, according to Michael Boskin, chairman of the President's Council of Economic Advisers. The standard currently is 27.5 miles per gallon. An administration official said there would be a huge environmental benefit from buying and junking old cars. 'Our cash-for-clunkers program ... is just one example of the innovative, market-based approaches to pollution reduction that have been pioneered by our **Environmental Protection** Agency,' Mr. Bush said in a written statement announcing several regulatory changes 'We call it mobile-stationary source trading and emissions control,' [Acting] Assistant EPA Administrator Richard Morgenstern explained with a straight face at a briefing. Mr. Morgenstern said cars built before 1980-representing 38 percent of cars on the road today—produce 86 percent of all hydrocarbons and carbon dioxide spewed out of exhaust pipes. Along with nitrogen oxide, these chemicals become smog when they reach sunlight. 'The dirtiest 6 percent of the cars on the road today emit 50 percent of the hydrocarbons. The cleanest 50 percent of cars emit only 3 percent of these hydrocarbons,' Mr.

Ongoing Enforcement Actions

Close to \$3 Million Sought in Complaint Against Kerr-McGee Coal

In a complaint against Kerr-McGee Coal Company, EPA is seeking \$2,963,579 in penalties for 110 hazardous waste violations at the Jacobs Ranch Mine in Campbell County, Wyoming. The complaint was filed under the **Resource Conservation and** Recovery Act (RCRA). Most of the charges allege that Kerr-McGee shipped wastes to facilities in Wyoming and Colorado that were not authorized to treat, store, or dispose of them; the remaining charges allege the company failed to provide EPA with information required under the law, wrongly labeled some shipments, and stored truck cleaning and degreasing wastes improperly.

Luxury Car Importer Faces Fines

The Department of Justice, on behalf of EPA, is seeking \$170.000 in fines from JBA Motorcars Inc. of Deerfield, Florida, for illegally importing new cars, mostly BMWs and Mercedes Benz. Under the Clean Air Act, all vehicles imported into the United States must be covered by an EPA certificate indicating that a prototype of their emissions control systems has been modified to conform to EPA standards and tested for compliance. An importer must notify the Agency of

any vehicles he intends to import that are representative of the prototype; he must maintain records documenting modifications he has made to emissions systems to bring vehicles into compliance; and he must provide emissions repair warranties to purchasers. The civil suit, which alleges 17 violations of these regulations, arises from an audit of the company by EPA; attempts by the Agency to settle out of court with JBA Motorcars have failed.

Bethlehem Steel Makes \$32 Million Improvements; To Pay \$6.7 Million in Fines

Under agreements with EPA and the Pennsylvania Department of Environmental Resources, **Bethlehem Steel** Corporation (BSC) will bring manufacturing plants at Bethlehem and Johnstown into compliance with emissions standards through a \$32-million capital improvement program. In addition, the company will pay civil penalties of \$6.7 million for past violations of the standards. The agreements, incorporated in two separate consent decrees, were made under the authority of the Clean Air Act.

Under the Bethlehem plant agreement, BSC is taking steps to control gaseous emissions from coke oven doors and to control particulate emissions arising from the transportation of hot coke. The organic soup of carcinogens discharged from coke ovens especially concerns EPA because of risks to public health. Under the Johnstown agreement, BSC will continue to operate improved controls on its electric arc furnaces; the controls, installed at EPA's urging during the settlement negotiations, reduce particulate emissions.

Ship Loses Arsenic Drums in Atlantic; EPA Files Suit

The Justice Department, on behalf of EPA, has filed suit against the Santa Clara I for losing more than 400 drums of arsenic trioxide off the coast of Cape May, New Jersey, and Delaware Bay. Arsenic trioxide is a hazardous substance used as rat poison and as a wood preservative. The ship, which is owned by a Panamanian company and operated by a corporation based in Peru, remains anchored in the harbor at Charleston, South Carolina. The suit prevents her departure, thereby making it possible for EPA to recover the costs of finding the drums and retrieving them. Under the Superfund law, the owner and operator of a vessel that releases a hazardous substance to the environment are liable for the costs of corrective action and for any damage to natural resources.

Corning, Asahi to Pay for Violations of Arsenic Emissions Standards

Under a consent decree. Corning, Inc., and Asahi Glass America, Inc., have agreed to pay \$1.8 million for exceeding arsenic emissions limits at glass manufacturing plants in State College and Charlerol, Pennsylvania. Also party to the agreement is Corning Asahi Video Products, a partnership. The agreement stems from a civil complaint brought against Corning early in 1990; many of the violations occurred before Asahi became a partner with Corning. The arsenic emissions limits were set by EPA under the National Standards for Hazardous Pollutants provisions of the Clean Air Act.

In addition to paying the penalty, the companies have agreed to install computerized equipment to diagnose and prevent problems with the electrostatic precipitators that control arsenic emissions. They have also agreed to write operation and maintenance procedures for the precipitators, and to perform maintenance at least once a year.

NEWSLINE

United States, Mexico to Clean Up Border

EPA and Mexico's environmental agency, SEDUE, have developed a comprehensive plan for cleaning up pollution along the border of the two countries. The plan calls for the expenditure of well over \$1 billion over the next several years by the United States, Mexico, the border states, and private industry. In commenting on the plan, EPA Administrator Reilly said: "Economic growth in the border region this past decade and the prospects for more economic opportunities from a free trade agreement have prompted new attention to environmental issues in that area. Thanks to the initiative of Presidents Bush and Salinas in asking for an integrated border plan, we now have a much better understanding of the environmental problems along the border, we have a joint plan of action for correcting these problems, and we have commitments for the money to get the job done. Never before have two nations made such a commitment and developed so extensive a plan to improve the health and environment along their entire border."

The Los Angeles Times reported: "... Trying to build support for a North American Free Trade Agreement, the Bush Administration on Tuesday unveiled an unprecedented binational effort to clean up the environment along the 2,000-mile U.S.-Mexico border, a region where untreated sewage and dumped chemicals course through waterways, tires



Robert Dawson photo. Copyright 1989. National Museum of American Art.

smolder in landfills and old cars belch leaded-gasoline fumes Among [the improvements] is completion of a long-delayed international sewage treatment plant for Tijuana and San Diego, and a project to heal the New River, one of the world's most polluted waterways, which flows north from Mexicali into California's Imperial County. It also calls for improved drinking water and wastewater treatment systems for the colonias-makeshift settlements in Texas-and increased cooperation between environmental authorities in both countries The joint proposal, however, drew immediate criticism. Environmental activists said it did not go far enough, calling it vague, underfinanced, and difficult to enforce. Although U.S. **Trade Representative Carla** Hills said she expects the plan to improve the free trade pact's chances on Capitol Hill, one legislator

who has been an influential supporter said its weaknesses may hurt the campaign for an open-market agreement Although most lawmakers had not seen the entire proposal, one prominent Democratic legislative aide said U.S. contributions of \$140 million this year and \$240 million next year amount to 'a start,' especially because the Administration had been talking about as little as \$6 million last year However, the legislative aide said it is 'a drop in the bucket when you look at what the needs are down there,' citing studies by the University of Texas that estimated the costs at \$18 billion. Some credible experts, he added, have put the figure at \$50 billion "

The Wall Street Journal commented: "... The millions of people living along the border aren't the One of the world's most polluted waterways, the New River flows from Mexicali into California. This photo is part of an exhibit, Between Home and Heaven: Contemporary American Landscape Photography, which is traveling to Pittsburgh, New Orleans, Albany, Cleveland, and Virginia Beach.

only ones who are vulnerable: Public-health specialists fear sewage contaminants may be coursing through U.S. food supplies as border packing houses ship produce and seafood filled with ice that may be laden with parasites and viruses The report calls on business to play a role. But one analyst familiar with the final document says it offers no new initiatives, such as user fees on plants that strain the region's infrastructure or bonds to fund sewage-treatment plants, and lacks cross-border enforcement mechanisms

.... Sewage, which largely flows from south to north into the U.S., has become one of the biggest problems. What had been a trickle of Mexican sewage has, in recent years, turned into a daily torrent of millions of gallons as armies of Mexican job seekers have flocked to the border area's largely U.S.-owned factories

and assembly plants. The combined population of Ciudad Juarez, Mexicali, and Tijuana has jumped almost fivefold since 1960 to three million. But neither the cash-strapped Mexican government nor the companies-who like the cheap labor and lax environmental enforcement-have installed much basic infrastructure. Water treatment plants in the border region have the capacity to treat only 16 percent of the municipal and industrial wastewater. Many Mexican border cities, such as Ciudad Juarez-which generates 22 million gallons of raw sewage a day-have no sewage system at all American cities, of course, have their share of sewage problems. But concerns about Mexican sewage are greater because of the higher prevalence of disease-causing organisms. Typhoid, for example, is 100 times higher on the Mexican side of the border than on the U.S. side. according to the Pan American Health Organization Eager for solutions, the region's residents propose a variety of alternatives to the official report, including debt-for-nature swaps and a development bank similar to the Eastern European Bank of Reconstruction and Development. Perhaps the most practical solution would be user fees on foreign assembly plants, to be used toward sewage and water treatment plants and other infrastructure. Because Mexico has been eager to attract foreign employers, these plants now pay little tax

Wet Weather Runoff is Nation's Most Serious Water Quality Problem

According to EPA's latest national inventory of water quality, runoff of rain and snowmelt from farms and urban areas is the most serious of the remaining water pollution problems. Runoff from fields, lawns, streets, and parking lots carries sediment and chemicals into waterways, where they can threaten human health and poison or choke the life out of aquatic ecosystems. Over the past 20 years, there has been a marked decline in pollution from sewers and from industry outfalls-the federal government, alone, has invested more than \$58 billion in sewage treatment plants. However, pollution from so-called "nonpoint" sources may be on the rise.

The inventory, which is based on assessments by the states, shows that although two thirds of the waters are good enough to support such uses as swimming and fishing, the remaining waters are impaired to some degree, and the leading contributors are nonpoint sources. In fact, the states report that agricultural runoff is the most prevalent source of water pollution in the country today. The states assessed approximately 36 percent of total U.S. river miles, 47 percent of lake acres, and 75 percent of estuary square miles.

The states indicate that commercial and residential development are the leading causes of the continued loss of wetlands, followed by conversion to agriculture. The United States has lost more than half its original wetlands: 2.6 million acres were reported lost between the mid-1970s and the mid-1980s. Ground water. used as drinking water by more than half the nation's population, is also threatened. The major culprits are underground storage tanks, septic systems, municipal landfills, farming practices, and hazardous waste sites.

The inventory derives from data collected in 1989 and 1990. It is the eighth in a series of reports sent to Congress by EPA every other year beginning in 1975. □



Runoff from farmland after a brief storm.

Tim McCabe photo.

"TOOLS" TO PROTECT THE ENVIRONMENT



Dealing with modern environmental problems, such as acid rain, requires ingenuity and new approaches.

John Shaw photo.

A NEED For New Approaches

Command-and-control is no longer a cure-all

by Alvin L. Alm

Over the last two decades, so-called command-and-control regulations have dominated environmental control efforts and achieved measurable successes. But the nation has reached a critical juncture. In the last decade of the 20th century, we are facing a host of new and diverse environmental challenges—ranging from global climate change and ozone depletion to indoor air pollution in homes and offices—at the same time that we must deal with residual problems that have not been solved over the last few decades.

(Alm, a former Deputy Administrator of EPA, is now Director and Senior Vice President of Science Applications International Corporation in McLean, Virginia. As a member of EPA's Science Advisory Board, Alm chaired the Strategic Options Subcommittee of the Relative Risk Reduction Strategies Committee.)

These new and residual problems cry out for innovative solutions. The traditional regulatory approach—establishing a regulatory limit for a given pollutant or specifying a technology for its control-will no longer suffice. Dealing with the problems of the next few decades will require increased ingenuity and new approaches. Many such approaches have been suggested by EPA's Science Advisory Board (SAB) in its landmark 1990 report, **Reducing Risk: Setting Priorities and** Strategies for Environmental Protection. This article grows out of my participation in the development of that report.

Historically, the U.S. regulatory system was shaped during the 1970s as environmental concerns emerged as major public policy issues. The first pollution control act of the decade, the 1970 Clean Air Act, set a precedent and forged a new direction: It mandated technological standards for all new sources of air pollution, called for the control of toxic air pollutants, and set mandatory deadlines for compliance. The Clean Water Act of 1972 followed in the direction of the Clean Air Act, creating effluent discharge standards for all new and existing dischargers and a permit system to assure compliance with these technology standards. These two acts were successful in most respects. Water quality improved in visible ways throughout the country. Certain forms of air pollution were cut dramatically.

This command-and-control approach was broadened dramatically in hazardous waste legislation—through both the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or "Superfund"). Other new laws followed in the command-and-control mode, so that EPA now operates under 13 different statutes, and rooms full of regulations have been generated under these laws.

Despite many successes, the situation that has evolved is far from optimum. Old-fashioned air and water pollution is still a serious problem in many areas. New problems are heaped on the nation's environmental agenda, with none removed. The total annual cost of environmental regulation is considerably over \$100 billion a year and growing rapidly. And command-and-control measures seem particularly inappropriate to cope with today's more diffuse problems because large point sources of pollution are not the main problem.

In what ways has our traditional system fallen short? Why are we searching out new approaches? Let's get down to basics.

First, command-and-control regulatory systems do not adapt well to changes in population, technology, and economic activity. In many cases, technological change can bring environmental improvement as less polluting and less energy-intensive technologies replace older ones. In general, however, urbanization and population growth create increasing pollution pressures. Since 1970, there has been almost a 20-percent increase in U.S. population and a 160-percent increase in economic output. Given marked increases in pollution-generating activities, the net reductions achieved since then in emissions of most pollutants are impressive. For example, population growth, greater urbanization, and increased vehicle miles traveled tend to cripple our efforts to achieve air quality standards for smog in urban areas. Each new and costly regulation is at least partially offset by the growth in emissions sources.

Second, current regulatory programs are generally organized around single media or single classes of pollution. As we now know, part of the initial success of EPA's air and water pollution programs resulted from shifting air and water pollutants to land. Now that RCRA and CERCLA greatly constrain that option, the danger is that new regulatory actions may have the effect of shifting pollution around, rather than actually reducing it.

Third, as mentioned earlier, many newly emerging environmental problems are ill-suited to command-and-control regulatory systems. Indoor air pollution or global climate change, for instance, are

"TOOLS" TO PROTECT THE ENVIRONMENT

problems that are not very amenable to so that residual risk was driven to end-of-the-pipe solutions. So that residual risk was driven to zero. For example, the 1970 Clean

Fourth, the time-scale of traditional regulation makes it a cumbersome tool During the four to eight years that regulations wend their way through the rulemaking process, a great deal of damage to the environment can occur. Moreover, given such a protracted process, regulations do not lend themselves to fine-tuning if any regulatory action creates an unforeseen result.

Finally, certain types of regulations are extremely costly. With pollution control costs expected to reach \$160 billion annually by the end of the century, any alternative way to reduce costs must be considered. This is why market incentive systems that rely on private sector actions to achieve least-cost solutions represent critical tools for reducing pollution control costs.

In fact, frustration over the timing, inflexibility, and cost of regulations has led to redefining some of the goals of environmental quality. In concept, traditional environmental programs were aimed at reducing contamination so that residual risk was driven to zero. For example, the 1970 Clean Air Act defined ambient air standards in terms of protecting public health with an adequate margin of safety. But over time, it became increasingly clear that eliminating all risk was simply not possible. Moreover, continuing to ratchet down regulatory systems became an expensive and often fruitless exercise.

In the late 1980s, environmental cognoscente developed a new hierarchy of risk reduction goals. Under this revised hierarchy, the number one priority is to prevent pollution in the first place, either by using material substitutes or effecting process changes. Second, where pollution prevention either is not possible or is limited in its applications, every effort should be made to recycle products that cause pollution. Ranked third in the new hierarchy is treatment to detoxify or otherwise lessen the environmental impact of pollutants. The fourth option: isolating contaminants in various ways through proper disposal.

I believe this new paradigm will

have major impacts on how the nation approaches risk reduction. If the major goal of environmental policy is to prevent pollution, then traditional ways of setting ambient and technological standards are less relevant than in the past. In a sense, if this goal truly replaces the previous goal of treating wastes to reduce residual risk, we are faced with a fundamental contradiction. There really is no good way to mandate pollution prevention or recycling through command-and-control approaches. Noncompulsory systems need to be created, whether they are stimulated by market forces, self-interest in avoiding future liability, public relations, or just good citizenship.

What alternatives are there? What sorts of tools can supplement or substitute for end-of-the-pipe regulations? The five kinds of alternative mechanisms to traditional regulations evaluated by the SAB's Strategic Options Subcommittee and discussed in "Appendix C" of *Reducing Risk* provide a good beginning. They are: scientific and

U.S. Population



Vehicle Miles Traveled in the U.S.



U.S. Pollution Control Costs





Environmental legislation of the last 20 years has much improved the environmental quality of places such as Steubenville, Ohio, which suffered from obvious pollution problems in the 1970s.

technical measures; provision of information; market incentives; cooperation with other agencies and nations; and enhanced enforcement of existing regulations. I'd like to focus here on the first four.

Science and technology can play a great role in environmental improvement. The potential here should be obvious. The recent quantum jumps in our ability to discover and monitor environmental contaminants have resulted in a much larger regulatory universe. New technologies tend to be inherently less polluting and less energy intensive. Research and development of new technologies and the transfer of such technologies to the private sector can play an important role in reducing risk. Moreover, sometimes simply sharing R&D information can encourage voluntary efforts by individuals to protect themselves or take action to reduce pollution in their environment, such as recycling.

Providing information, particularly R&D results, has been an important tool used by government to influence private behavior. Historically, the most

Rusty Kennedy photo. AP/Wide World.

important example of government technology transfer has been in agriculture, where R&D from land grant colleges has been effectively conveyed through the extension services to farmers across the nation. Some of this expertise directly or indirectly affects the environment, such as certain technologies and changes in agricultural practices that can reduce pesticide use or slow soil erosion.

Information transfer has tremendous potential to change behavior. Given present levels of concern over environmental issues, industrial firms, citizen groups, and individuals are all searching for sensible ways to reduce environmental stress. For instance, the chemical industry's Responsible Care program represents efforts to establish guiding principles, institute self-evaluating operations in light of those principles, and share information to improve overall industry performance. Green labeling initiatives. of course, can help citizens make environmentally responsible purchases.

There are viable ways for

government to tie information transfer programs to voluntary agreements for action. EPA's "Green Lights" program for energy-efficient lighting is a good example of this. (See page 44.) But information does not necessarily need to be transferred by government to be an effective tool in reducing pollution. The emissions reporting requirements established by the Emergency Planning and Community Right-to-Know Act of 1986 have proved instructive in this respect. When the required data on emissions entered the public domain. plain business sense prompted many large chemical companies to set voluntary goals to reduce their emissions. (See box on the Toxics Release Inventory (TRI) database on page 49.) Taking his cue, EPA Administrator William Reilly set up a voluntary emission reduction program called "33/50" (see page 42).

Market incentives represent potentially the most significant alternative to regulation. The most well-known forms of market incentives—charges (taxes or fees), deposit-refund systems, and marketable permits—all have different effects on the environment and on the cost of compliance. (See article on page 21.)

Until recently, market incentives have been more the province of academic economists than legislators and policy makers. Several proposals have been made to enact pollution or energy taxes in the United States over the years; but frequently such taxes were not even formally introduced and none were passed. The exception here is a tax on CFCs (see article on page 16).

Presently, however, the interest in market incentives has picked up substantially. As the cost of conventional regulatory programs has skyrocketed and their effectiveness increasingly has been called into question, new voices have been raised. Among the early and influential voices: the late Senator John Heinz (R-Pennsylvania) and Senator Tim Wirth (D-Colorado). In the landmark "Project 88" study co-chaired by these two senators, strong arguments were advanced for using a variety of market forces to deal with environmental problems ranging from global climate



Information transfer can be a powerful force in reducing pollution. For example, because of information provided by the North Carolina Alternative Energy Corp., poultry farmers have installed energy efficient lighting.

North Carolina Alternative Energy Corp. photo.

change to preserving open space.

The unprecedented support of the Bush Administration for the most important market incentives yet proposed-the market-based provisions in the recent Clean Air Act amendments-suddenly advanced the concept of market incentives to a realistic policy option. Passed by Congress in 1990, the amendments included, among other market-based innovations, a new system of marketable permits (or tradable "allowances") for sulfur dioxide emissions, which cause acid rain. EPA has estimated that this flexible new system will enable the nation to achieve significant improvements in air quality at compliance costs approaching \$1 billion lower than would otherwise be possible. Unfortunately, however, rigid attitudes and practices by state regulatory commissions may undercut the realization of these savings.

Coping with global climate change represents the current battleground for potential use of economic incentives. A carbon tax has been suggested as a way to reduce emissions of carbon dioxide, which contributes to global warming. Although there are uncertainties about all the ramifications of a carbon tax, it could be a powerful tool to reduce carbon dioxide emissions.

The argument for a carbon tax is compelling. Global climate change clearly poses a threat to long-term ecological stability and potentially to economic viability in many parts of the world. Considering the grave consequences implied, it is not unreasonable to structure a tax system that discourages production of carbon dioxide. Such a tax could be "revenue-neutral." That is, the large proceeds from such a tax could be rebated to businesses or individuals through reductions in corporate income tax, social security, or income taxes. Some portion of the tax could also be used to reduce the federal deficit.

A carbon tax would encourage conservation by boosting energy prices in general, and it would stimulate greater use of natural gas. It would discourage use of petroleum products, thereby reducing our national dependence on foreign oil sources, and help improve the balance of trade. Despite these benefits, it is unlikely that Congress or the administration will seriously consider a carbon tax, at least in the near term. Since even

modest tax increases are currently political anathema in the United States, it is only realistic to consider a carbon tax a very long shot at present.

Finally, substantial risk reduction could be achieved by cooperation among agencies and among nations. A great deal could be accomplished by focusing the efforts of federal agencies on the environmental impacts of activities under their jurisdiction. For example, substantial environmental impacts are associated with agriculture, primarily runoff of sediment and contamination of surface and ground water with nutrients and pesticides. Most air pollution problems and a host of other environmental ills result from the extraction, transport, and consumption of energy. Severe urban air pollution problems result primarily from entrenched living and transportation patterns that require individual vehicles to transport people over great distances.

The Compleat Toolkit

Research and Development. Systemic studies undertaken to establish facts or principles, to discover insights, and to make technological advances.

Innovation. Transform scientific discoveries into beneficial uses.

Consumer Information. Reduce risk to individuals (radon) or damage to society (disposal of pesticides); inform community of potential threat (TRI).

Technical Assistance and Technology Transfer. Measures to spread the word about mitigation techniques; may go to those causing the problem (Best Management Practices to farmers to control runoff) or to professionals assigned to mitigation (training sewage treatment plant operators).

Auditing. Visits by experts to sites where pollution is generated (factory, farm) to observe operations and suggest improvements.

Marketable Permits. Total amount of pollution established by regulation; permits to pollute then allotted among polluters. Those who reduce pollution below their allotment can sell or trade surplus permits to others (under the acid The confluence of environmental and other policies was recognized over 22 years ago with passage of the National Environmental Policy Act (NEPA), which required federal managers to consider the environmental impacts of their actions. In fact, NEPA has never realized its potential to change federal decision making as it relates to the environment.

If federal agencies had, historically, considered environmental quality as an integral part of their responsibilities, the impact could have been tremendous. The contribution of sediment, pesticides, and fertilizer would be much smaller if the Department of Agriculture's technology transfer efforts were focused on environmental improvement. Energy efficiency might have been the major goal of energy policy, and greater efforts would have been directed at environmentally less harmful energy technologies. Transportation and urban policies could have helped shape urban development in a more environmentally satisfactory manner.

There are two major reasons why government policies have diverged so greatly from environmental policy. First, each federal agency considered its main responsibilities to be to its specialized constituencies. For example, the Department of Agriculture saw agribusiness, farmers, and the forest products industry as their main constituents-not environmentalists or the general public. Second, there is really no mechanism to explore how environmental and other policies can be reconciled. While ad hoc legislation and task forces have been created, no sustained effort has been made to determine how changes in current policy could reduce environmental damage.

rain program, TVA has purchased SO₂ permits from Wisconsin Power and Light).

Deposit/Refund. Surcharge on item (soft drink bottle) is refunded when item is returned.

Fees and Taxes. Fee or tax assessed on emissions (SO₂ from power plant) or on product of polluting activity (electricity).

Subsidies and Tax Credits. Measures that reduce the cost of control, rather than recovering it (federal matching grants for building sewage treatment plants).

End-of-Pipe Controls. Regulations prescribing emissions limits (National Pollution Discharge Elimination System permits) or specific technologies (catalytic converters on cars).

Use Restrictions. Limits on the way substances can be used (bans on CFCs in aerosols).

Product Specifications. Standards specify content or performance of products (tolerances for pesticide residues on foods).

Monitoring and Disclosure. Polluters monitor and report emissions to enable government enforcement of rules (SO₂ from power plants). Public disclosure



enhances enforcement through activities of public interest groups and citizen suits.

Cooperation With Other Agencies. Concerted approach to problems through use of other federal, state, or local laws, expertise, delivery mechanisms (EPA and Army Corps of Engineers).

Cooperation With Other Countries. Same as above (Montreal Protocol).

Enforcement. Vigorous enforcement is required if penalties are to be seen as more costly than control. Applies across the board.

—Adapted from 1990 Report of the Strategic Options Subcommittee, EPA Science Advisory Board Relative Risk Reduction Project.

Cooperation between EPA and other agencies represents great potential for risk reduction. For example, EPA could work even more intensively with the Department of Agriculture to reduce nonpoint-source pollution and fertilizer and pesticide use. Working with the Department of Energy, EPA could help pursue ways to promote energy conservation and a more benign fuel mix. EPA could even work with the Departments of Housing and Urban **Development and Transportation on** urban and transportation strategies and their environmental impacts. Historically, however, federal agencies generally have not appreciated help from other agencies.

Hence, concerted efforts by agencies to improve environmental performance in their areas of responsibility will require leadership at the top. For inter-agency coordination of this kind to be successful, the President would need to give his unequivocal support to such an effort and insist that his Cabinet members take it seriously. In addition, some mechanism needs to be created to carry out this policy. For example, a permanent council could be created to promote environmental quality as part of other federal policies, or the responsibility for this function could be given to the Council on Environmental Quality. In either case, some agency must be in charge if environmental concerns are to be given high priority.

In sum, if the United States is to move toward a more flexible and less costly system of environmental improvement, a much wider pool of measures must be employed. This is essential if we are serious about pollution prevention becoming our primary strategy.

The challenge of the next decade and beyond is fundamentally different from that of the last two decades. Yet the necessary policy and programmatic changes may take decades to happen, just as a supertanker does not change direction easily. But, to pursue this analogy, the bow is turning around. We are now seeing the first glimpses of some fundamental and presumably irreversible changes in the way we cope with environmental problems.

JOBS AT HAND



SOLID WASTE: INCENTIVES THAT COULD LIGHTEN THE LOAD by Terry Dinan

Let's balance the costs against the benefits of disposal

A mericans generated four pounds of solid waste per person per day in 1988, and this figure is expected to grow to 4.2 pounds by 1995. Despite increases in the amount of waste incinerated and recycled, the vast majority of this still goes to landfills.

Waste disposal imposes costs on society, including the expense of collecting the waste and building and operating disposal facilities. The possible environmental and health

(Dinan is an analyst at the Congressional Budget Office and has recently authored a report entitled Federal Options for Reducing Waste Disposal.)



Chicago-Sun Times photo.

effects of leakage from landfills and emissions from incinerators are hotly debated, and many communities have encountered strong resistance to siting new disposal facilities. This resistance and the limited capacity of existing landfills in some areas have put a premium on decreasing the amount of waste generated and increasing the amount that is recycled and composted.

Although waste disposal imposes costs on society, the activities that generate waste also provide benefits. For example, packaging keeps food clean and may help in its preparation. Being able to dispose of waste easily is also a valued benefit. Setting out trash for pickup is quicker and easier than

Economic incentives to reduce waste may help ease the growing burden on U.S. landfills.

finding another use for it in the home, composting it in the backyard, or taking it to a recycling center.

Ideally, the costs and benefits of disposal would be taken into account when deciding how much to change consumption patterns to reduce waste, to recycle, or to compost. Economic incentives may play a key role in helping society balance these costs and benefits. Three types of incentives that might be useful in achieving this balance are household charges, combination disposal tax and reuse subsidies, and recycling credit systems.

Most households pay for waste disposal services through their local property taxes or by a fixed fee to a private collector. Under this flat-fee system, they don't have a monetary incentive to change their consumption behavior or to increase their recycling and composting efforts.

Some communities have begun to charge households according to each bag or can of trash that they discard. These "unit-based pricing" programs encourage households to weigh the convenience of waste disposal against the charge for an additional bag or can. Under these programs, households can save money by buying goods with less packaging, or by recycling and composting their waste. A study of three unit-based pricing programs in Perkasie, Pennsylvania; Ilion, New York; and Seattle, Washington, found that such programs may significantly decrease the amount of waste sent to the landfill or incinerator.

Unit-based pricing programs hold much promise, but there are some important concerns. They may, for example, create an incentive to illegally dispose of waste. Tracking illegal disposal is very difficult, and most estimates are tenuous, but anecdotal evidence indicates that some people in unit-based pricing programs

are illegally burning waste, dumping it in vacant lots, and disposing of it at public facilities, private dumpsters, or in surrounding communities. EPA is investigating the effects of unit-based pricing and will provide guidance about the types of communities where it may be effective. For example, suburban communities may be better suited for unit-based pricing than rural areas where illegal dumping would be easier. Communities with predominantly single-family housing may be better suited than areas with multifamily housing, where monitoring the waste generated by individual families is more difficult.

Under these programs, households can save money by buying goods with less packaging, or by recycling and composting their waste.

Under a combination disposal tax and reuse subsidy policy, producers would be taxed according to the cost of disposing of the goods that they produce, and importers would be taxed for the cost of disposing of the goods they import. This would encourage them to reduce the amount or the toxicity of waste associated with their products. In addition, firms that use recycled materials (referred to as end users) would receive a subsidy, thereby encouraging increased recycling.

Idaho has established a combination disposal tax and reuse subsidy program for tires. The state imposes a \$1 surcharge on all tires sold; the revenue is used to subsidize recycling. Firms that retread tires receive up to \$1 per reprocessed tire; other end users of old tires receive \$25 per ton.

A disposal tax would encourage

producers to reduce the amount of waste associated with their products as long as the cost of doing so were less than the tax. Likewise, the reuse subsidy would encourage end users to use recycled materials as long as the cost of doing so were less than the subsidy. Provided that the government set the disposal tax and reuse subsidy so that each were equal to the benefit that society received from reduced waste disposal, this policy would provide an incentive for firms to balance the costs and benefits of waste disposal.

An advantage of this policy is that it would not create an incentive for illegal disposal. However, its application is limited: To administer a set of taxes and subsidies on all consumer products would not be feasible. The policy could be targeted at items that had the potential for increased recycling and were particularly problematic components of the waste stream, such as old car batteries, tires, and used oil.

Under a credit system ... old newspapers would go into whichever products could use them most cheaply.

Under a recycling credit system, the government would set a target for a product, and producers and importers would be responsible for ensuring that the required percentage of the product was recycled. They would do this by buying "credits" from firms that recycled their type of product. For example, if a 50-percent recycling target was set for newspapers, for every ton of newspapers it sold, Hometown Daily would have to buy



TOLES copyright The Buffalo News. Reprinted with permission of Universal Press Syndicate All rights reserved.

half-a-ton's worth of newspaper recycling credits. It would buy them from companies, such as cardboard container producers, that used old newspapers in their production processes. Firms that could use old newspapers in their production process would have an increased incentive to do so.

An advantage of a credit system over one that mandates the recycled content level of individual products is that it produces an incentive for firms that can reuse the old product at the least cost of doing so. For example, a system that mandated content level would require that old newspapers go into making new newspapers. Under a credit system, however, old newspapers would go into whichever products could use them most cheaply. Because of this, a recycling credit system would help to ensure that the recycling target set by the government is achieved at the lowest cost to society.

A recycling credit system guarantees that the recycling rate set by the government will be met. The government must take care, therefore, to set the target at a level where the cost of meeting it is equal to the benefits received. In other words, the increased cost of using the additional amount of recycled materials must be balanced by the decreased cost of disposal.

Congress has considered using a recycling credit system for a variety of items, including tires, used oil, and old newspapers. Like the combination disposal tax and reuse subsidy policy, a recycling credit system would be feasible for a limited number of items. \Box

PESTICIDES: The potential For change

Give the user an incentive to cut back

by Marcia E. Williams

Pesticides are extremely varied. They include products which kill weeds and other unwanted plant life, insects, rodents, and fungi, and products which regulate plant growth. While there are over 25,000 individual pesticide products on the market today, only about 400 chemical compounds actually perform a pesticidal function. These basic ingredients are mixed with each other and with other non-pesticide chemicals to result in the large number of products.

Unfortunately, pesticides can have unintended impacts: health risks to applicators and to farmworkers, as well as to the general public—through residues on foods or through contamination of air or water. Pesticides may also harm non-target plants and contaminate the habitat of fish and other animal species.

Current law requires EPA to evaluate new pesticides and to re-examine existing ones to ensure that the benefits of a given use outweigh any risks associated with the use. EPA does this by looking at the active ingredients in the pesticide and evaluating data on exposures and on health and environmental effects. Needless to say, these reviews are very time consuming.

(Williams is President of Williams and Vanino, Inc., a Los Angeles-based environmental management consulting firm.) The volume of pesticides used in the United States continues to grow. Worker exposure is just one concern.

Earl Dotter photo.

If, for a given use, the risks outweigh the benefits, the Agency can constrain the use by regulating what the manufacturer can include on the pesticide label. In fact, EPA has a number of control options, including limiting the amount of pesticide which can be applied to a particular crop, changing the formulation of the product to result in less exposure, requiring workers to wear protective clothing, and requiring workers to stay out of spraved fields for a specified period after spraying. If EPA can't identify a way to reduce the risk to an acceptable level, it can prohibit the specific use of the pesticide.

The volume of pesticide use in the United States continues to grow, and, while safer pesticides are clearly desirable, less pesticide use would most directly reduce exposure and environmental burden. This can be aided by:

• Providing incentives for farmers to practice "sustainable agriculture" (SA). SA combines biological pest controls

with chemical ones, thereby reducing dependence on chemicals.

• Prohibiting unnecessary use of pesticides.

A broad spectrum of market incentives can be used to encourage reduced use of pesticides. Fees are one. EPA could test imposing fees on particular crop uses, particular geographic areas, or particular high-risk pesticides. For example, once a pilot project was identified, a fee could be charged for each pound of pesticide purchased and applied for a given use. The size of the fee could be based on the toxicity of the pesticide or on its persistence. Alternatively, EPA could charge different fees based on the sensitivity of the location or on the volume of the pesticide which the user applied. By its very nature, such a fee would encourage users to apply lower volumes. At the same time, the

JOBS AT HAND

money collected from the fee could be used to fund other pilot projects.

EPA could also work more actively to prohibit unnecessary use of pesticides. The cosmetic use of pesticides, for example, does not improve the quality of the food crop but only makes it look prettier. As an alternative to direct prohibition, EPA could require users to label food that has been treated purely for cosmetic reasons.

Another approach to reducing the unnecessary use of pesticides would be to require large-volume users to submit data showing that the use is fully effective and is necessary to control the "target pest." Again, a pilot program could focus on a limited number of sensitive geographic areas or pesticides of particular concern.

Such a fund could function like the current Superfund and would be used to clean up contamination or provide alternate water supplies.

Reducing the use of pesticides can also be achieved, in part, through public knowledge and involvement. A knowledgeable community can have a significant effect on locally undesirable environmental practices. Experience has also shown that the mere exposure of a company's actions to public scrutiny can bring them more in line with what is publicly acceptable.

Under a community right-to-know program, major users could be required to report annually on the quantities of pesticides used and the purposes served. The reports would be made available to the public by depositing them at a central location, such as a library, or by publishing portions of them in the local newspaper. Such a program could be phased in by focusing first on large-volume users of pesticides of concern, or on sensitive geographic areas. As part of the reporting, users could be required to share their plans to reduce future use of pesticides. As a supplement to user reporting, retailers and wholesalers

could be required to publish information on sales volumes of the pesticides included in the program.

Yet another category of incentives could be designed to reduce pesticide use, particularly in sensitive locations, by large-volume users. The following are examples of such incentives.

• Require environmental impairment liability insurance to cover third party claims and the costs of cleaning up soil or water contamination.

• Require extra licenses or special training requirements for anyone buying large quantities of pesticides. A variation would require users of certain pesticides or users in certain locations to get a prescription for the pesticides they want to apply. The USDA extension service would be one possible group to write the prescriptions.

• Require large volume users to pay special fees into a ground-water fund. Such a fund could function like the current Superfund and would be used to clean up contamination or provide alternate water supplies. Responsible parties would be expected to reimburse the fund.

• For sensitive environments, require ground-water or surface-water monitoring throughout the period of pesticide use.

• Require stormwater discharge permits for rainwater runoff.

• Require large-volume users to contract with agricultural specialists to perform independent pesticide-use audits, with the goal of minimizing use.

These approaches will require extensive discussions with states, other federal agencies, and Congress. Many cannot be implemented under current law and would require new legislative authority. However, many could be piloted at the state level. While the protection provided by the current registration and re-registration program is important, a balanced approach which focuses on pesticide users as well as pesticide manufacturers may well achieve a greater degree of environmental protection at a reduced regulatory cost. \Box

OZONE LOSS: MODERN TOOLS FOR A MODERN PROBLEM

Market forces are being used to prevent pollution

by David Lee

E PA's market-based strategy for the control of ozone-depleting substances provides a useful example of how a combination of means, other than traditional engineering controls and product-based bans, can serve pollution-abatement goals.

The legal framework for the strategy comes from several sources: the 1990 Clean Air Act: the Omnibus Reconciliation Act of 1990; and the Montreal Protocol on Substances that Deplete the Ozone Layer, the international treaty first signed in 1987 in an effort to limit production and consumption of ozone-depleting chemicals. The strategy has four major components: a marketable permits system; an excise tax; a program to ensure the safety of chemicals developed as substitutes for ozone-depleting substances; and a recycling program.

The cornerstone is the marketable permits system, which is designed to harness free market forces to direct users toward alternative chemicals.

(Lee is Chief of the Stratospheric Ozone Protection Branch of EPA's Global Change Division.)



When the original Montreal Protocol was adopted in 1987, the Agency was charged with limiting production (the actual amount of ozone-depleting chlorofluorocarbons, or CFCs, and halons manufactured) and consumption (the amount of such chemicals produced plus the amount imported minus the amount exported). EPA looked at several options to meet the protocol's requirements before deciding to adopt a marketable permits system.

Initially, the Agency considered imposing controls that would limit emissions of these chemicals by the various users, EPA's traditional Mobile Air Conditioning Society photo.

approach for dealing with pollutants once they have been produced. For ozone-depleting chemicals, however, this would have been unwieldy: There are more than 10,000 different uses for them.

Alternatively, with only five CFC and two halon manufacturers, EPA had a more manageable community to regulate. Market-based incentives could be applied to limit the production and therefore the consumption of these chemicals. After considering several programs, the Agency issued regulations which assigned production and consumption allowances to manufacturers based on their 1986 production and import levels.

There were several advantages to. this approach. Companies were assigned allowances based on the total volume of the five CFC chemicals covered by the regulations, each weighted by its ozone-depletion potential. Under this system, a company could alter its production or import mix to meet the demands of a changing market. For example, a company producing CFC-113 (a solvent in the electronics field) in 1986 could later cut production in response to a decreased demand for CFC-113 and increase its production of CFC-115 (needed by the refrigeration industry) without violating the regulations.

Another advantage built into the marketable permits program was the option of companies to trade allowances. The intent was for the most efficient companies to receive trades from less efficient producers who could not otherwise compete in the marketplace. And in fact, over the past several years there have been many trades among companies as they have made adjustments for shifting markets and relative plant efficiencies.

The marketable permits program serves to ensure that the United States remains in compliance with the Montreal Protocol. Allowances are parcelled out annually to each company based on its imports, exports, and production in 1986 and must be within limits set by the protocol. Since the original protocol schedule required annual reductions amounting to 50 percent by 1998 for CFCs, the Agency revises allowances downward accordingly. As the production of these chemicals decreases, prices increase, creating an incentive for users to switch to less costly alternatives wherever available. The intended result: a more efficient allocation of resources and in turn less cost to society.

The second major component of the Agency's strategy to protect stratospheric ozone is the excise tax mandated by the Omnibus Reconciliation Act. Passed by Congress in 1990, the act imposes an escalating tax on the production for sale of ozone-depleting chemicals ("virgin stocks"). Indeed, the remarkable drop in demand for ozone-depleting

JOBS AT HAND

chemicals over the last two years may have been due, at least in part, to this tax, which amounts to a tariff that pushes up the cost of the newly produced chemicals.

The Agency's safe alternatives program is the third component of the program. The Clean Air Act Amendments of 1990 charge EPA with reviewing the health and safety impacts of all new and existing alternatives to ozone-depleting chemicals. Specifically, the Agency must review alternatives for potential health and environmental effects including ozone depletion, toxicity, worker and consumer safety, and global warming potential. EPA's Office of Air and Radiation, with assistance from the Office of Toxic Substances, is developing the program. Where serious health and environmental problems are identified, chemicals may be stopped from entering the marketplace.

The new Clean Air Act also required the Agency to establish a national recycling program, which is the fourth major component in EPA's ozone-protection strategy. The aim is to recycle used refrigerant for use in air conditioning and in refrigeration-related industries, thus diminishing the need for producing more from virgin materials. Costly retrofit or early retirement of equipment that requires CFC-containing refrigerant is avoided by permitting the continued use of recycled refrigerant beyond the production phaseout of ozone-depleting chemicals. The recycling initiative also allows time for producers to manufacture alternative chemicals.

The various components of EPA's strategy for protecting the Earth's stratospheric ozone layer fit together in an approach that stresses pollution prevention by limiting the production of ozone-depleting chemicals in the first place. These are sound policies which provide environmental protection while minimizing the cost to society through the efficient use of resources.

THE DENVER AIRPORT: POLLUTION PREVENTION BY DESIGN by Jack W. McGraw

When the first of an expected 34 million passengers per year begin flying into America's newest and largest airport in October 1993, the planning that went into it will be obvious in the space-age architecture, the park-like setting, and the smooth flow of travelers and aircraft through its highly accessible layout. Not so obvious, but every bit as revolutionary, will be the environmental planning that went into the facility—a concept called "pollution prevention by design."

For unlike any of its predecessors, Denver International Airport (DIA) will embody features built into it specifically to cut the pollution that might otherwise accompany such a mammoth public works project. In another unique twist that has potential application across a wide range of public projects, EPA's regional office in Denver assigned one of its own scientists to help design those features.

Preventing pollution in the first place simply makes more sense in economic and environmental terms than traditional "end-of-the-pipe" or "command-and-control" strategies. This new thinking was percolating in the regulatory world at the same time that impetus was growing for a new airport in the metro area. The two connected in an Intergovernmental Personnel Act agreement assigning EPA scientist David Duster to a one-year tour of duty at DIA.

Duster's first obstacle would be to overcome the single-focus approach

(McGraw is the Acting Regional Administrator for EPA's Region 8, headquartered in Denver, Colorado.) that regulators develop when they work in specific programs such as air, water, waste, and toxics. Building pollution prevention into a \$2.7 billion facility on a 53-square-mile parcel of land obviously calls for a "big picture" view---what EPA now calls "multi-media."

Planned during an economic downturn, when air travel trends were flat, the project was not without critics. The expected economic benefits figured prominently in successful election campaigns to secure local approvals and to approve the sale of bonds to fund the construction. The project and ancillary development promised jobs in an area still suffering from contractions in the energy industries, which boomed here in the 1980s.

State and civic planners see Denver as an aircraft hub to the world. Equidistant to Tokyo and London, the airport is ideally positioned to handle the flow of goods and people between the economic giants of the Pacific Rim and a renewing Europe. Airport boosters see DIA as assuring Denver and Colorado a preeminent role in the global economy of the next century.

While most futurists see continuing struggles with pollution in the next century as well, conscious design choices such as those made for DIA should help substantially. Here are just some of the impact-reducing measures slated.

• Embedding some 180,000 tons of fly ash (unburned fuel particles from nearby coal-fired energy plants) in concrete, rather than sending it to landfills, will save enough space to accommodate the solid waste



MGA, Inc., photo

generated by a city of 40,000 over nine years. The fly ash also helps strengthen the concrete and make it more durable.

- Collecting 760 tons per year of glycol de-icing fluids and reusing them both for de-icing and reformulation will mean a 95-percent reduction in the amount going to wastewater treatment.
- Installing ultra-low flow toilets (currently being tested at the area's existing airport, Stapleton International) throughout DIA should conserve 130 million gallons of water annually, enough to supply the yearly water needs of 1,570 families.
- Irrigating, starting in 1999, airport and surrounding development landscaping with reclaimed wastewater (not treated to drinking water levels) from the city of Denver. This is expected to save 542 million gallons per year.

• Conserving energy through measures built into the facility, from a Teflon-coated fiberglass roof to take advantage of natural light to the use of natural gas chillers for air conditioning and energy efficient lighting consistent with EPA's "Green Lights" program (see page 44). This will mean the local utility, Public Service Company of Colorado, will not have to significantly increase its power supply capabilities (or air emissions) to serve DIA. • Controlling "volatile organic compounds"—vapors—via floating roofs on fuel storage tanks and capturing those vapors during fuel transfers will keep some 52 tons per year of smog-forming chemicals out of the metro area's atmosphere.

- Designing parking to take advantage of natural ventilation to disperse carbon monoxide, and offering employees staggered shifts, compressed work weeks, and shuttle services to cut their contribution of auto-related emissions by an estimated 7,000 pounds per year.
- Landscaping with a heavy reliance on the West's own water-stingy plants, especially prairie grasses, will yield water savings in the hundreds of millions of gallons per year.

• Building an energy-saving power plant for airport operations. Even with all these conservation measures built in, DIA will have to maintain its own central power plant for heating and cooling. But even here, pollution prevention will be built in: Low nitrogen-oxide boilers and flue gas recirculation will mean that 90 tons per year of nitrogen oxide will not be going into metro air.

• Driving fleet vehicles fueled by natural gas, rather than gasoline, thereby cutting both emissions of carbon monoxide and nitrogen oxide. • Designing a solid waste plan aimed at cutting waste at its source, and reclaiming and recycling a variety of materials with a preliminary goal of reducing solid waste disposal by 16 tons per day.

Pollution prevention features at Denver International Airport will include a

Teflon-coated fiberglass roof to take advantage of natural light.

Air. Water. Waste. These are the three basic pollution problems for any new facility, no matter how carefully planned.

Critics make the point, in fact, that the largest airport in the United States with its ancillary development will ultimately cause more pollution than it can ever mitigate. Those arguments were present when Denver and Colorado voters went to the polls on two occasions. Since voters supported going forward with the airport, EPA decided to get involved early on with the project planning. This enabled us to employ the latest tools to minimize the impact of the project.

It has been an excellent experience for this Agency. Not only have we learned to apply new thinking and tools to technical challenges, but we have learned a new way to relate to the regulated community. There have been so many winners in this process—including the environment—that I believe we can expect to see "pollution prevention by design" become the normal way of doing business through the rest of this century and into the new one. □

IN THE TOOLKIT ECONOMIC INCENTIVES



Deposit-refund

market-based mechanisms.

systems for cans are one example of successful



HARNESSING The Marketplace

We have to do more with less

by Robert N. Stavins

(Stavins is an Associate Professor of Public Policy and a Senior Research Associate, Center for Science and International Affairs, at the John F. Kennedy School of Government, Harvard University, and a University Fellow of Resources for the Future. He is the Director of Project 88 and a member of the Environmental Economics Advisory Committee of EPA's Science Advisory Board.) f there was ever a time when the United States—or any other nation for that matter—could afford to consider environmental protection in isolation from costs, those days have ended. According to EPA figures, the nation now spends well over \$100 billion annually to comply with federal environmental laws and regulations.

Heightened concern over the economic impact of these regulations has fostered increased caution about the regulatory burdens placed upon businesses and individuals. More than a decade of high budget deficits, sluggish productivity growth, and intensified foreign competition has spurred serious interest in alternative environmental approaches that can lower compliance costs and regulatory burdens. Citizens and policy makers have not lost sight of the benefits of environmental protection. However, they are giving greater attention to cost-effective environmental policies.

In this context, political leaders are now giving more consideration to a promising set of new environmental policies that recognize market forces not only as part of the problem, but as potentially part of the solution. Such "market-based" or

"economic-incentive" policy mechanisms can, in many cases, enable environmental goals to be achieved effectively and at lower aggregate cost to society. For EPA and other federal, state, and local regulatory agencies, an important task is to do "more with less," wherever possible. Devising ways to deal with both ongoing and new environmental problems by harnessing, rather than obstructing, market forces is consistent with this goal.

The purpose of this article is to provide an overview of the major types of cost-effective, economic-incentive policy instruments that can be used to harness market forces on behalf of environmental protection. But first let's take a look at conventional environmental regulation, since any policy must be considered in the light of feasible alternatives. How does the traditional command-and-control approach work?

Conventional regulations tend to force all firms to shoulder identical shares of the pollution-control burden, regardless of the relative costs to individual companies. In effect, these regulations typically set uniform standards for firms, the most prevalent being technology-based and performance-based standards.

Technology-based standards, as the name suggests, specify the method, and sometimes the equipment, that firms must use to comply with a regulation. For example, every firm in a particular industry might be required to use the "best available technology" to control water pollution. As a more extreme example, all electric utilities might be required to employ a specific

The right technology in one situation may be wrong in another.

technology, such as electrostatic precipitators, to remove particulates.

A performance standard, on the other hand, sets a uniform control target for firms while allowing them some latitude in how they meet it. Such a standard might set a limit on the allowable units of a pollutant that can be released per time period, but no limit on the means by which this goal is achieved.

Holding all firms to the same target can be expensive and in some circumstances counterproductive. Uniform standards can effectively limit emissions of pollutants, but they typically exact relatively high costs to society in the process by forcing some firms to resort to unduly expensive means of controlling pollution. The reasons are simple: The costs of controlling emissions may vary greatly between firms, and even within the same firm, and the right technology in one situation may be wrong in another. Indeed, the cost of controlling a given pollutant may vary by a factor of 100

or more, depending on the age and location of the plants involved and the control technologies available.

Possibly an even more serious drawback: Conventional regulations tend to freeze the development of technologies that could provide greater levels of control. When the focus is on conforming to standards, little or no financial incentive exists for firms to exceed their control targets. In fact, a firm that successfully tries out a new technology may be "rewarded" by being subsequently held to a higher standard of performance, with little opportunity to benefit financially from its investment. As a result, dollars that might have been invested in technology development are diverted to legal battles over the definition of acceptable technologies and standards of performance.

On the other hand, some environmental problems are highly localized and attributable to pollution from individual sources. In such cases, a command-and-control approach, such as a source-specific emission limit, may be the preferred policy.

Command-and-control regulations target the individual polluter. Let's now consider market-based policies, which characteristically aim at what is often the real target of concern: the overall amount of pollution for a given area. What we care about most, after all, is not how much pollution the local factory emits, but the quality of the air we breathe.

Incentive-based approaches seem virtually tailor-made for aggregate pollution problems over a large area (for example, acid rain). Under a market-based approach, the government establishes financial incentives so that firms in an entire industry or region are driven to take the necessary steps to reduce the aggregate level of pollution to a desired level. Then, as with any regulatory system, the government monitors and enforces compliance.

In policy terms, market-based instruments achieve the same aggregate level of control as might a command-and-control approach, but they permit the burden of pollution control to be shared more efficiently among firms. In economic terms, they provide market incentives for the greatest reductions in pollution by those firms that can do so most cheaply. The result is cost-effective because fewer total economic resources are used to achieve the same level of pollution control—or, alternatively, more pollution control is obtained for the same level of resources.

Theoretically, the government could achieve a similarly cost-effective solution by setting different standards for individual firms, so that the costs of additional increments of pollution control would be distributed "equitably." However, this would require detailed information about the control costs each firm faces-information that the government lacks and could obtain only at great cost, if at all. Market-based policies provide a way out of this impasse because by their very nature they lead to the cost-effective allocation of pollution-control costs among firms.

By forcing firms to factor environmental costs into their decision making, market-based policies create powerful incentives for firms to find cleaner production technologies. Such policy instruments can also help elucidate the environmental debate for the general public by focusing attention on environmental goals rather than on technicalities, which become primarily the worry of the firms involved.

But market-based systems do not represent a laissez-faire approach to solving pollution problems. A market-based approach recognizes that environmental problems can be traced to market failures-cases where the decision-making processes of firms and consumers do not reflect the consequences of those decisions for society. Incentive-based policies reject the notion that such failures justify "scrapping" market forces and dictating the behavior of firms or consumers. Instead, they provide businesses and consumers with freedom of choice in determining the best ways to reduce pollution.

Market-based mechanisms come in a variety of forms: pollution charges; tradeable permits; deposit-refund systems; removal of government barriers to market activity; and elimination of government subsidies. Each of these warrants serious consideration.

Pollution Charges

Producers of pollution can be charged a fee or a tax on the amount of pollution they generate (not simply on their pollution-generating activities). This makes it worth their while to reduce pollution to the point where their expenditures for additional increments of pollution control are equal to the pollution tax rate. As a result, firms will attain different degrees of control, depending on whether their control costs are high or low. An effective pollution charge system minimizes the aggregate costs of pollution control and gives firms ongoing incentives to develop and adopt newer and better pollution-control technologies.

Pollution charges potentially offer an additional advantage over conventional environmental-policy mechanisms: They can generate substantial revenues for government. Applied together with proportionate reductions in other taxes, they can be used to introduce revenue-neutral policy changes-revenue-neutral in that the total revenues paid to government remain the same. The important point here is that government can reduce taxes that discourage desirable activities, such as labor and the generation of capital, and rely more heavily on taxes that discourage undesirable behavior, such as environmental pollution.

> Critics say below-cost timber sales and other government subsidies promote economically inefficient and environmentally unsound resource use.



In economic terms, this policy option involves a gradual movement from "distortionary" to "corrective" taxes. Thus, pollution charges offer the possibility of a double dividend: first, environmental protection at minimum cost, and second, increased efficiency in the tax structure.

The downside of pollution charges is that in some cases, an effective system can impose a significant monitoring burden on government. Further, it is difficult to estimate in advance how large a charge will be required to obtain a desired level of pollution reduction. It may also be difficult, in a political context, to establish charges large enough to achieve given environmental objectives.

Air and water pollution charges have been adopted in France, the

Netherlands, Sweden, Norway, Denmark, Finland, Italy, and West Germany. However, these countries' charge schemes have been designed primarily as revenue-raising devices rather than as environmental policy instruments. More recent European Community initiatives with energy charges are closer to true "green taxes." Potential applications in the United States include a carbon dioxide (carbon or BTU) charge to help curb greenhouse gas emissions; 'environmental costing" at electrical utilities, whereby environmental impacts are factored into choices among various power-generation sources; and unit charge ("pay-as-you-throw") systems for pickup and disposal of municipal solid waste.

Tradeable Permit Systems

Unlike a charge system, a system of tradeable permits allows the government to specify an overall level of pollution that will be tolerated. This total quantity of allowable emissions or discharges is parceled out, or allotted, in the form of permits among polluters. Firms that keep their emissions levels below the allotted level may sell or lease their surplus allotments to other firms or use them to offset excess emissions in other parts of their own facilities. Such a system tends to minimize the total societal cost of achieving a given level of pollution control. Like pollution charges, permit systems can be used to improve environmental quality, not just to maintain the status quo.

Continued on next page



If the number of regulated sources of emissions is great, the administrative (transaction) costs of tradeable permit systems can be very high. On the other hand, if very few sources are involved, certain firms may heavily dominate the permit market, and the result may be noncompetitive behavior and consequent inefficiencies. Finally, regulators must decide how to allocate permits among sources. Should they be given away as an endowment, or should they be sold through an auction? If they are distributed free of charge, what criteria should be used in the allocation?

Tradeable permits have been used primarily in the United States under EPA's emissions trading programs, in the nationwide phasedown of lead in automotive fuel, and in chlorofluorocarbon (CFC) reduction initiatives. Most recently, of course, Congress has enacted a sulfur dioxide tradeable allowance system for acid-rain control, expected to save the economy up to \$1 billion per year. Other potential applications for

For Further Reading

The following publications provide more thorough overviews of the potential use of market-based mechanisms for environmental protection:

Anderson, Robert C., Lisa A. Hofmann, and Michael Rusin. The Use of Economic Incentive Mechanisms in Environmental Management. Washington, DC: American Petroleum Institute, June 1990. Available by contacting the American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005.

Moore, John L., et al. Using Incentives for Environmental Protection: An Overview. Washington, DC: Congressional Research Service, June 1989. Available to government employees from the Library of Congress' Congressional Research Service at (202) 707-5700. Members of the general public must make their requests through their U.S. Senator or Representative.

Stavins, Robert N., ed. Project 88—Harnessing Market Forces to Protect Our Environment: Initiatives for the New President. A Public Policy Study sponsored by Senator Timothy E. Wirth, Colorado, and Senator John Heinz, Pennsylvania. Washington, DC, December 1988. Available from either Senator Wirth's office, 380 Russell Senate Office Building, Washington, DC 20510, (202) 224-5852; or Robert N. Stavins, Assistant Professor of Public Policy, John F. Kennedy School of Government, Harvard University, 79 John F. Kennedy Street, Cambridge, MA 02138, (617) 495-1820.

Stavins, Robert N., ed. Project 88—Round II, Incentives for Action: Designing Market-Based Environmental Strategies. A Public Policy Study sponsored by Senator Timothy E. Wirth, Colorado, and Senator John Heinz, Pennsylvania. Washington, DC, May 1991. Available from (see above).

U.S. Environmental Protection Agency. Economic Incentives: Options for Environmental Protection. Office of Policy, Planning, and Evaluation, Economic Incentives Task Force, 21P-2001. Washington, DC, March 1991. Available from EPA's Public Information Center, 401 M Street, SW, Washington, DC 20460, (202) 260-7751.

U.S. Environmental Protection Agency. Reducing Risk: Setting Priorities and Strategies for Environmental Protection. Science Advisory Board, SAB-EC-90-021. Washington, DC, September 1990. Available from EPA's Public Information Center (see above). tradeable permits include point- and nonpoint-source water-pollution control; control of global climate change through international trading in greenhouse gas permits; and recycling credits (which combine recycling targets with tradeable permits).

Deposit-Refund Systems

Nine states, several Canadian provinces, and a number of European nations have enacted bottle bills to reduce littering with beverage containers. In effect, purchasers of potentially polluting products pay a surcharge, which is refunded when the product is returned to an approved center for recycling or proper disposal. Deposit-refund systems eliminate or reduce the incentive for illegal "midnight dumping," which admittedly exists under a pollution charge system.

Deposit-refund systems could be used for containerized hazardous waste and for some other forms of solid waste. Lead-acid batteries, used motor-vehicle oil, vehicle tires, and industrial solvents are potential candidates. Rhode Island and Maine have enacted deposit-refund systems for automobile batteries, and Maine has a system for commercial-size pesticide containers. Denmark has such a plan for mercury and cadmium batteries, and Norway and Sweden have implemented deposit-refund systems for car bodies.

Removal of Government Barriers to Market Activity

In some cases, environmental protection could be improved simply by removing existing government-mandated barriers to market activity. Measures that facilitate the voluntary exchange of water rights, for example, can promote more efficient allocation and use of scarce water supplies while curbing the need for expensive and environmentally disruptive water supply projects.

A major market-oriented water exchange has recently been initiated in Southern California based on this

Proponents argue that a charge on sources of carbon dioxide could help reduce greenhouse emissions.

Mike Brisson photo.

approach. In 1988, the Metropolitan Water District of Southern California. serving much of the Los Angeles-San Diego region, reached agreement with the Imperial Irrigation District on a \$233 million water conservation and transfer arrangement, based largely upon a 1983 proposal by the Environmental Defense Fund, Similarly, properly designed comprehensive least-cost bidding at electrical utilities can promote economically rational energy generation and consumption by encouraging electric utilities to consider both conventional, supply-side augmentation of generating capacity and demand-side reductions in energy use through conservation.

Elimination of Government Subsidies

Many government subsidies promote economically inefficient and environmentally unsound development. A major example is the U.S. Forest Service's "below-cost timber sales," which recover less than the cost of making timber available for harvesting by private lumber companies. The result: inefficient timber cutting on government lands, which has led to substantial losses of habitat and damages to watersheds.

Gradual removal of these subsidies would foster environmental protection and, additionally, increase net federal revenues. Other examples of programs that may be both economically inefficient and environmentally disruptive include some U.S. Bureau of Reclamation water supply projects and certain U.S. Army Corps of Engineers flood-control projects. The Corps projects have the effect of providing unintended incentives for private landowners to convert their forested wetlands to dryland agriculture, bringing a host of environmental concerns, including degraded water quality.

Choices We Face

In many cases, market-based approaches will allow a given level of environmental protection to be achieved at lower total cost than would be possible with conventional policy approaches. By imposing a cost on pollution-causing activities, incentive-based systems allow individual firms to decide how they will achieve the required level of environmental protection. In a competitive market economy, market forces tend to drive these decisions toward least-cost solutions.

Incentive-based policies can also stimulate the private sector to develop new pollution-control technologies and expertise. Because investments in pollution control can improve firms' profits under incentive-based systems, firms will be encouraged to adopt superior pollution-control technologies. This in turn creates incentives for research and development of cheaper and better pollution-abatement techniques.

Market-oriented policies, however, will certainly not fit every problem. Moreover, practical problems may make it impossible to implement incentive-based environmental policies successfully, even if they are appropriate on theoretical grounds. Such implementation problems can render even the best policy idea quite useless. To build appropriate market-based programs, it will be necessary, in some cases, to adapt present approaches—in other cases, to abandon them.

Of course, no single policy approach is likely to be appropriate for all environmental problems. The policy agenda ought to be shaped by its objectives-presumably including the reduction of environmental risk to acceptable levels. The choice of the most effective mechanisms for achieving this and other legitimate objectives will need to draw upon the broadest possible array of potential instruments. Market-based mechanisms, along with conventional command-and-control policies, education programs, and a host of other instruments, belong in the policy maker's toolkit. The real challenge is to choose the right tool for each. \Box

ECONOMIC INCENTIVES

A SKEPTIC Speaks

by Michael Gartner



here must be something about this that I don't understand.

The way I read it, if you own a factory that pollutes more than the law allows, and I own one that pollutes less, I can sell you my excess pollution "rights." You can keep polluting the heck out of the place, and get by with it, and I can make money on the deal. We can both feel really good about the arrangement.

This is being praised by some businessmen and by some environmentalists. They think it's dandy. All in all, they say, it keeps pollution at an acceptable average, on a nationwide basis. And I'm sure it does.

But here's what I haven't heard any businessman or environmentalist talk about:

(Gartner is president of NBC News and editor/co-owner of the Ames, Iowa, Daily Tribune. This article originally appeared in USA Today.) What about the people who live around the plant that bought the rights to foul up its neighborhood to excess? Is it OK if they get emphysema or cancer or something because someone else didn't get emphysema or cancer? How do you explain that to them? How come no one is asking that question?

Here are the facts:

Under the Clean Air Act of 1990, industries are ordered to cut their pollution by 1995. But if they go below TVA Energy Conservation & Solar Institute photo.

the standards, they'll be able to sell that excess—it will sell in dollars per ton—to companies far away that decide not to meet the standards by 1995.

Some states are doing the same thing, letting a polluter in one neighborhood buy smogging rights from a non-polluter in another neighborhood. There is talk of a global market, a market in which a whole nation can buy or sell pollution rights....



The Paradise Fossil Plant of the Tennessee Valley Authority. TVA bought rights to emit sulfur dioxide from the Wisconsin Power and Light Company.

Already, deals are being made. Wisconsin Power and Light Company has sold the Tennessee Valley Authority and Duquesne Light Company the right to spew an additional 25,000 tons—tons—of sulfur dioxide into the air. Sulfur dioxide is that foul-smelling stuff that helps cause acid rain.

What do the people of Pennsylvania and Tennessee and Alabama and Kentucky think of this deal? Do they understand it?

Let's change the example. Let's say every restaurant in town has a no-smoking section. Let's say a couple of restaurants decide to ban smoking entirely. Let's say the law then allows them to sell their smoking "rights," so another restaurant suddenly lets you smoke wherever you sit. And let's say that that smokers' restaurant is the only one in your neighborhood, the only place you can get to for evening dinner.

Would you want to go to that restaurant, to chance sitting next to a couple who smoke like chimneys, who blow it your way, who ruin your meal—and perhaps your lungs?

I doubt it. You'd raise Cain. So would your local politicians.

Clean air is not a commodity like baseball cards or pork bellies. If you own a factory and you cut pollution, you should be praised and rewarded—with tax breaks, perhaps, or some other true economic incentive. If you own a factory and you overpollute, you should be penalized—fined, or, for the worst offenders, put out of business.

But being able to buy the right to pollute? That's ridiculous at best. Dangerous at worst.

Why is everyone saying it's such a great idea? \Box

THE MARKET-BASED APPROACH AT EPA

Economic incentives have recently entered the Agency's mainstream

by Richard D. Morgenstern

Environmental policy in the United States is evolving—perhaps more rapidly than most people realize-from an almost exclusive reliance on command-and-control regulation to the use of economic incentives. Economic incentives are not a cure-all. However, used appropriately, they can achieve environmental goals at lowest possible cost, more effectively reduce pollution from large numbers of small dispersed sources, and provide a greater stimulus for innovation and technological change. A new consensus is emerging-among the Bush administration, Congress, industry, and environmental groups-that market forces can play a key role in addressing a wide range of environmental problems.

History

The idea of harnessing market forces for environmental protection is not new; economists have been advocating it for more than 40 years. EPA adopted its first economic incentives program in 1976 and has progressively expanded its use of market-based approaches since then. Only recently, however, have economic incentives

(Morgenstern is EPA's Acting Assistant Administrator for Policy, Planning and Evaluation.) entered into the mainstream of EPA's regulatory activities.

Emissions Trading. EPA's oldest economic incentive programs entail four variations of air emissions trading: offsets, netting, bubbles, and banking. Each of these programs involves the creation of "extra" reductions at one emissions point and their compensatory use at another.

• Offsets allow a firm to construct a major new emissions source (or expand an existing one) where the source would otherwise cause or contribute to air quality problems. Under this program, firms must secure sufficient extra reductions from other sources in the same vicinity to compensate for any new emissions they will add.

• Netting allows a firm to construct or modify a major emissions source in an existing plant without triggering special requirements for new sources, as long as the firm reduces emissions from other sources in the same plant by a corresponding amount.

• Bubbles (which involve placing an imaginary enclosure around a group of existing sources) allow firms to increase their emissions where control costs are high, in exchange for extra reductions where costs are low—so

long as each trade is enforceable and produces air quality results equivalent to the original requirements.

• Banking allows firms to "save" credits for extra emissions reductions for future use in emissions trading transactions.

More than 2,500 offsets have been approved throughout the country, along with thousands of netting actions. Both programs continue to be actively used.

Use of the bubble program has been more limited. Approximately 50 bubbles have been approved by EPA, and many more have been authorized by states under EPA-approved rules. Projected compliance savings from the bubble program exceed \$400 million. Relatively few bubbles have been adopted in recent years. However, the Clean Air Act Amendments of 1990 will greatly expand future opportunities for using bubbles.

Banking has also received limited use to date but may have greater potential under the 1990 amendments.

Lead Phasedown. The lead phasedown program, which allowed trading and banking of lead credits, was probably EPA's largest, most dramatic early success in the use of economic incentives. (See article on page 38.)

Truck Emissions Averaging. Since 1985, EPA has permitted manufacturers of heavy duty trucks to average nitrogen oxide and particulate matter emissions across different engine lines produced by a single company. Such averaging has enabled companies to optimize their emissions control strategies. Beginning in 1990, companies were also allowed to bank and trade emissions reduction credits. which further extended the benefits of averaging and allowed manufacturers with a limited number of engine lines to benefit from the program. Cost savings from averaging and trading have been estimated at \$130 million per year.

CFC Trading. EPA's 1988 stratospheric ozone protection program phased down the production and use of chlorofluorocarbons (CFCs) in accordance with the schedule in the 1987 Montreal Protocol, which the United States ratified in 1988. This program includes a marketable permits provision, under which at least 80 trades between 23 entities have occurred to date. (See article on page 16.)

Recent Developments

In the 1990 Clean Air Act Amendments. Congress authorized the broad use of economic incentives in state and local air quality plans, as well as in federal rules for reducing emissions of hazardous air pollutants. acid rain precursors, and ozonedepleting chemicals. While the acid rain program's sulfur dioxide allowance-trading provision, with expected compliance savings of \$0.7 to 1.0 billion per year, is the largest and most prominent economic incentive program specifically mandated in the amendments, other programs are also important.

The new air toxics program, for example, which represents about a third of the projected compliance costs under the new amendments, is expected to include trading involving more than one pollutant as well as other economic incentive approaches to reduce costs and assure strong and early compliance. The new stratospheric ozone protection program, which requires the complete phaseout of CFCs and other ozone-depleting chemicals, continues EPA's 1988 marketable permits program by permitting allowance trading at national and international levels; it also provides for the use of consumer education to influence market behavior. Both the reformulated gasoline and the oxygenated fuels programs contain averaging and trading provisions expected to reduce costs by \$75 to 85 million per year.

Spurred in part by the recent 90-Day Review of Regulations announced by President Bush, EPA has developed or expedited additional economic incentive proposals. For example, a new accelerated vehicle retirement program would give localities and companies in nonattainment areas the option of taking high-polluting, older cars off the road (by purchasing them) as one way to meet clean air requirements.

Except for some experiments with trading between point sources and between point and nonpoint sources of water pollution in the mid-1980s, EPA's use of economic incentives has been very limited outside of the air program. But here, too, the situation is changing. Under the 90-Day Review of Regulations, EPA has advanced a number of initiatives that will apply market-based incentives to water. waste, and pesticide control programs. Specific examples include a watershed management program that will promote trading as a cost-effective compliance tool and a safer pesticides program that will consider waiving certain fees and registration requirements to lower the cost of bringing "low-risk" products into the marketplace.

As these examples illustrate, a variety of economic incentive programs have been established and are working. Many others are currently being developed. Regulators are gaining valuable experience in designing and administering such programs, and the public is gaining confidence in them. The jury is still out on just how extensively policy makers will adopt additional economic incentives for pollution control, but the prospects look bright. □





Mike Brisson photo. MAY/JUNE 1992 EPA's new watershed management program will encourage trading between point and nonpoint sources as a cost-effective compliance tool.

ECONOMIC INCENTIVES

AN ANSWER TO THE DILEMMA On the Front Line?

Help is needed if states and cities are to change some old traditions

by Henry Lee

en years ago, Seattle's average single-family household brought three-and-one-half 30-gallon cans of trash to the curb for weekly pickup. Concerned about its dwindling landfill capacity and eager to increase recycling efforts, the city embarked on an innovative unit-pricing program that offered residents incentives for reducing the amount of trash they generated: Instead of assessing a flat fee for garbage pickup on each household, regardless of how much it produced, the city began charging for trash collection services in proportion to the amount of refuse left at the curbside. The result has been a dramatic reduction in the amount of refuse generated. By 1989, 87 percent of participating Seattle households subscribed to a program allowing them to have one 32-gallon container or less picked up each week.

In a similar effort to introduce market-based incentives to environmental regulation, the public utilities commissions of 26 states have either implemented, or are considering implementing, rules designed to help them incorporate the monetary cost of environmental damages into their decisions about meeting future electricity needs. Their idea, borrowed from economics, is to internalize the full costs—the private costs to the firm, plus those external costs of damage to human health and the

(Lee is the Executive Director of the Environment and Natural Resources Program and an Adjunct Lecturer at the John F. Kennedy School of Government, Harvard University.) environment—into the price of doing business. The result will be to put an end to any bias in favor of cheaper, but more polluting, energy sources.

These two efforts signal a major shift in how state and local governments approach the task of reducing pollution and improving environmental health. Historically, environmental regulators at both the federal and state levels have relied almost exclusively on command-and-control mechanisms. Today, there is a growing interest in expanding the menu of options to include market mechanisms, such as Southern California's permit trading scheme (see Forum feature on page 32), that can provide greater environmental protection at a lesser cost to the economy. This article provides an overview of the opportunities and obstacles to expanded use of these tools by state officials.

Although press coverage of environmental regulation usually focuses on Congress and various federal agencies, enforcement and implementation of most national environmental laws occur at the state level. States implement and enforce regulations to meet national standards for water pollution, drinking water, toxic materials, hazardous waste, facility siting, noise, solid waste, and air pollution.

While EPA provides broad guidance to the states regarding which state initiatives might be acceptable and which might not, states are left with considerable flexibility. They are required to produce formal implementation plans which, when accepted by EPA, provide the vehicle by which the federal government formally delegates enforcement authority to the states. State regulatory actions can have a significant impact on both regional and national economies—in many cases more so than federal regulatory initiatives whose costs are presently the target of much debate between Congress and the administration.

In the past 15 years, Congress has dramatically increased the scope of responsibility delegated to the states. The Clean Air Act Amendments of 1990 are the best example of this trend. Over the next three years, states will have to develop and implement dozens of new regulations ranging from limiting the emissions of air pollutants from motor vehicles to limiting the amount of sulfur and nitrogen oxides emitted by power plants.

For state governments, implementing these new regulations could not have come at a worse time: Their resources are limited and their economies are in a recession. Tight budget constraints will prevent state environmental agencies from hiring hundreds of additional rule writers and inspectors. Furthermore, as Congress seeks to reduce ambient pollution to lower and lower levels, states must begin to regulate hundreds of smaller sources. It is much easier to monitor and enforce emissions restrictions at 15 large power plants than at 5,000 small businesses.

Confronted with these constraints, states are finding that traditional command-and-control regulation is a cumbersome and expensive tool which often is insufficiently flexible to meet the diverse requirements of literally thousands of additional sources. In particular, state governors find themselves caught in a troubling political bind. Their constituents expect them to be environmental leaders and to fully implement the regulations. Yet, they also expect them to promote economic growth and job creation, especially during recessionary periods. As regulators in Los Angeles are about to find out, cost-effective market mechanisms may provide an answer to this dilemma.

State environmental officials have traditionally looked at economic tools with suspicion. Economic analysis was



South Coast Air Quality Management District photo.

perceived as a methodology used primarily by industry lobbyists striving to maintain the status quo. The message from today's proponents of market-based mechanisms is different. The need for pollution reduction is not questioned. However, once Congress has set environmental standards, proponents argue that they should be met in the most cost-effective manner.

Incentive-based tools like tradeable permit systems, emissions fees, and charge and deposit-refund systems can significantly improve the efficiency of efforts to reduce pollution. Many states are already using some of these tools. Witness the deposit-refund system on beverage containers in the Northeast and the deposit system on lead-acid batteries in Maine and Rhode Island.

While the potential benefits of pursuing market mechanisms may be great, substantial obstacles remain. Over the past 20 years, state environmental agencies have built an organizational culture around the use of command-and-control regulation. Most agencies are populated almost exclusively by engineers and lawyers, and with the exception of two or three states, none have the in-house capability to do serious economic analysis. If market incentives are to be a part of the arsenal of tools used by state agencies, their organization and infrastructure must change in order to alter the existing bias toward command-and-control regulation.

In the short term, states will need help from EPA. Simply issuing directives and telling states to do more will not help. States will need guidance, information, and access to additional funding. Guidance can take the form of identifying opportunities to effectively use market incentives and pointing out likely implementation problems. Information about cost-effective policies derived from successful demonstrations in other areas of the country would be enormously useful.

For example, empirical information about which aspects of Southern California's emissions trading scheme are working, and which are not, would be very valuable to the states. EPA must be much more aggressive in getting this type of information out to the states, while simultaneously taking great pains to allow states to reach their own determinations regarding where and when to use market mechanisms.

The latter point should not be ignored. Each state faces different problems. We should not expect Wyoming to adopt the same plan as Ohio. Market mechanisms are not all-purpose panaceas; in some instances, they can have high administrative and transaction costs and may be inferior to command-and-control options. Some states will embrace incentive mechanisms, while others will need more time to educate their relevant constituencies.

The federal government should also avoid the temptation to pressure states to reassess their existing regulations and implementation plans. Given states' inexperience with most incentive-based policies, the task



Operators of small businesses, such as this California picture framer, increasingly are affected by state environmental regulations.

of developing a cost-effective plan to implement the many facets of the Clean Air Act Amendments will be a sufficiently daunting challenge. Furthermore, Congress is likely to pass legislation in the next four years which will amend most of the other major national environmental laws, thus providing ample opportunity for states to explore possibilities for greater use of market incentives in areas other than air pollution.

Finally, the federal government should provide financial support to start the process of building an in-house capacity to evaluate and compare the cost effectiveness of regulatory and market-based options. Without this support, existing budget constraints will not allow states to move quickly enough to build any measurable familiarity or expertise with economic incentives prior to the submission of their Clean Air implementation plans.

In fact, states' environmental agencies are stretched so thin that some are actively considering the possibility of returning authority for one or more of the major environmental laws to the federal government. Although generating support in Congress and EPA for increased funding for a state grant program will be difficult, it is justified by a cost-benefit principle we can all understand: The costs of assisting states will be measured in the millions of dollars, while the potential benefits to the national economy will be measured in the billions.

It is only through building this capacity that the traditional cultural bias of state agencies to favor command-and-control regulation will be replaced by a willingness to aggressively pursue cost-effective market incentive approaches. □

ECONOMIC INCENTIVES

A FORUM: The Los Angeles Venture

The same geography and weather patterns that make Southern California a warm and inviting place to live also conspire to give it the nation's worst air pollution problems. Over the years, the region's methods for dealing with pollution problems have been a fairly accurate barometer for the nation's evolving approaches to pollution control.

Recently, Southern California's South Coast Air Quality Management District (SCAQMD) created the Regional Clean Air Incentives Market—known as RECLAIM—to enlist market incentives in the battle against air pollution. The goal is to use market forces to cut air pollution levels at the lowest possible cost to society. EPA Journal asked the executive director of SCAQMD for his overview of the program. We also asked a number of people who will be affected by the plan for their points of view. The overview and commentaries follow.



The Plan





On March 5, 1992, Los Angeles regional air quality officials approved a historic shift in the way they will manage urban air quality by approving in concept the RECLAIM program.

RECLAIM seeks to harness the profit incentive to clean up the nation's dirtiest air. It substitutes emissions trading for traditional command-and-control regulations.

The shift to emissions trading comes at a time when command-and-control regulations have become increasingly numerous and specific for our region's businesses. Over the past 40 years, we have made considerable headway in reducing pollution under these regulations. Peak pollution levels have been cut in half since the 1950s, despite a 170-percent increase in our region's population and a 290-percent increase in motor vehicles.

Recent legal and policy shifts at the state and federal level, however, have opened new market-based options that allow us to surpass existing programs for air pollution control. These new market-based options promise to

(Lents is the Executive Director of the South Coast Air Quality Management District, the air pollution control agency in California for Los Angeles, Orange, and Riverside counties and the non-desert part of San Bernardino County.)



RECLAIM will mark the first time that emissions trading will be used on a large scale to clean up urban air pollution. SCAQMD analyses show that it will achieve equivalent public health protection at a lower cost and with less impact on jobs. By tapping the profit incentive, RECLAIM will also spur technological innovation.

Under RECLAIM, emissions will continue to decline, but firms will gain flexibility in the timing and method of emissions reductions.

RECLAIM initially may cover more than 2,000 businesses: those that emit more than four tons per year of either volatile organic compounds (VOCs), nitrogen oxides, or sulfur oxides. Smaller sources will remain under traditional regulations for the time being.

Each business under RECLAIM will be relieved of emissions limits on individual pieces of equipment and placed under a facility-wide permit that specifies a mass emissions limit for the whole plant. In no circumstances will this facility-wide limit be greater than what would otherwise be allowed under existing or adopted rules.

Under this "bubble" approach, SCAQMD will establish an emissions baseline for each pollutant based upon historical factors, such as the business cycle and previous history of emissions control. Then firms will have to reduce emissions by 6 percent per year for VOCs, 8 percent per year for nitrogen oxides, and 8.5 percent per year for sulfur oxides.

Firms that do not or cannot reduce emissions by these percentages will have to obtain equivalent credits from other firms that make excess reductions. For example, by switching to a less-polluting paint, a company that paints boats might be able to reduce emissions of VOCs below its



target at a cost of \$2,000 per ton. But a silicon chip manufacturer may have to spend \$30,000 per ton to meet its target reduction of the same pollutant. So the chip maker could buy credits from the boat firm at \$15,000 per ton, cutting its cost in half, while the boat company makes a \$13,000 profit.

In essence, businesses will be able to reduce pollution where it is least expensive to do so, rather than having to reduce it where and when they are told to by regulators. Under the command-and-control rules, industries have no incentives to go beyond the letter of the law to reduce pollution. Under RECLAIM, they will.

An SCAQMD economic analysis shows that businesses in the South Coast Air Basin will save more than \$400 million in compliance costs in 1994 alone.

One of the most crucial elements of the program is to verify that emissions reductions are actually being made. These reductions must be real and verifiable to satisfy the Clean Air Act and a skeptical public.

Fortunately, new technologies are at hand that will allow SCAQMD to electronically monitor emissions. For instance, continuous emissions monitors will be used to monitor nitrogen oxide emissions on large sources, such as power plants and refineries. Meters will measure fuel use and allow computerized calculation of nitrogen oxide emissions on smaller sources, such as boilers and stationary internal combustion engines. Solvent use will be monitored and reported electronically as well, using bar codes and scanners on paint containers.

Data from all these devices will be fed directly into SCAQMD's central computer where violations will be detected instantly. This electronic monitoring system, already in use on a smaller scale, will be backed up with random emissions audits.

Further safeguards are built into the program:

• Backsliding, or increases in emissions, will be prevented by requiring that all existing pollution

ECONOMIC INCENTIVES

control equipment remain in place and be kept operable.

• Good housekeeping and regular maintenance will continue to be required to minimize emissions.

• Toxic pollutants will continue to be controlled under existing rules and laws and will not be eligible for trading under RECLAIM.

• SCAQMD will verify all emissions credits claimed under the program. However, to keep the market truly free, SCAQMD will not require that trading of verified credits be approved.

SCAQMD's staff is working with a broad-based, community advisory committee to develop a detailed set of rules that will implement RECLAIM. Numerous public workshops have been and will continue to be held; rules will be adopted only after public hearings. Startup is expected in 1994.

Among the major issues to be worked out are: Will small businesses be affected, and how? Will some businesses abandon our region for other areas to profit from selling pollution credits? Can the reduction of VOCs be adequately monitored to the public's and EPA's satisfaction?

We hope RECLAIM will be the ticket for clean air in the 1990s and beyond, as well as a program offering renewed opportunity for businesses.

In Response

Michael M. Hertel



outhern California Edison is the major supplier of electricity in Southern California's SCAOMD. Our business depends directly on the health and well being of the community in which we operate. The nonattainment status of our region is a direct threat to the health and well being of our community. Yet, bringing this basin into attainment must be achieved in a manner consistent with the economic realities and the needs of our customers. For that reason, we support the concept of replacing traditional "command-and-control" air quality regulation with market trading approaches. The RECLAIM program has the potential to reduce and control the costs of the emissions reductions necessary to clean up our air by as much as 25 percent.

For RECLAIM to realize its potential, certain key principles must guide the rule development that is now underway at the SCAQMD.

• The market-based approach must replace the command-and-control regulations. We can't have both. Micromanagement of market segments distorts the market and limits overall gains. Some are calling for daily

(Dr. Hertel is the Manager of Environmental Affairs for Southern California Edison.) emissions limits to be placed on some sources; the SCAQMD should turn a deaf ear to these requests.

• More sources must be allowed to participate in RECLAIM than presently proposed. The broadest base of sources opens up the most opportunities for lower costs in a market-based system. In addition to the cutoff at four tons per day that is currently proposed, we suggest adding a "willing trading partners" concept. Trades would be allowed between any sources so long as the SCAQMD pre-approves a contract that specifies the emissions base, the methods of reduction, and the enforcement mechanism for the sources involved.

 The program must have a reasonable start point, rates of reduction, and end point. The baseline, or initial allocation of emissions to sources, is under debate. We are pleased that the SCAQMD is operating on the principle that initial allocations must be at least as large as each source's present actual emissions. The proposed "discount rate" (rate of reduction) for sources has been increased several times since the program was first announced. We are concerned that the temptation will be great to set discount rates that are too steep. The end point is not yet clear. Only 15 percent of the basin's emissions inventory will be part of the initial market. Should they be required to continue to reduce, no matter what the cost, until attainment is achieved. whether or not other sources are reducing emissions at similar rates?

If the end point and rates of decline exceed what can be achieved by employing best available control technology, then the only way the basin can continue with emissions reduction would be through shutdown of business and consequent loss of jobs. We believe the program should establish preset "off ramps" that would halt the downward decline in emissions if the market cost rises too high to be economically tolerable.



• If needed, RECLAIM should permit short-term special incentives to foster new pollution-reduction technology. These incentives can give the program a long-term focus. Some effective solutions might otherwise be unable to compete in the climate of short-term cost decisions and trading rules.

• Finally, the program must insure that all sources be treated equally. Some are calling for certain sources to be given lower than average allocations, or otherwise treated in ways that would unreasonably distort the market. We support the SCAQMD's view that, in order for the market to work, all sources must be treated equally.

Mary D. Nichols



he RECLAIM plan will replace all existing and proposed regulations limiting emissions of sulfur oxides, nitrogen oxides, and reactive organic gases from over 2,000 stationary sources. These sources are in a four-county region with a marketplace in which companies will buy and sell quarterly emissions allowances. Like weary consumers in the former Soviet Union, environmentalists wait apprehensively to see what will be in the shops when the doors open; what we fear is not shortages, however, but a permanent surplus in pollution.

RECLAIM assumes current permit holders will be given initial allotments which will then be automatically discounted by a fixed percentage each year until federal air quality standards are met. We question whether a plan designed to achieve long-term, area-wide reductions can also assure attainment of hourly or daily standards, prevent creation of toxic hot spots, and avoid shifts in emissions to more reactive compounds or more problematic areas. The SCAQMD's proposal lacks any safeguards to prevent trading of low-reactivity solvents for more reactive products, or to discourage the substitution of toxic for less toxic organics. RECLAIM must be designed to assure that in terms of air quality, it is at least as protective of

(Nichols is a Senior Attorney for the Natural Resources Defense Council.)

the health of residents of all parts of the air basin as is the current air quality management plan.

The danger inherent in such a clean air bazaar is much greater than a slight rearrangement of today's pollution problem. By launching a free-for-all among all types of industries competing for a newly valuable commodity, RECLAIM runs a risk of discrediting the very concept of market-based alternatives to regulation. Already the regulated industry is squabbling over the allocation of the original pie. More disturbing, industry is now demanding that the pool of stationary source emissions-which is already much too big-be enlarged by tweaking the inventory-for example, by adding in previously uncounted fugitive emissions. All these efforts to find cheaper substitutes for cleaning up existing industrial pollution are great if they are used to clean the air faster or better than current regulations. But to the extent these new emissions credits are used to delay or eliminate the existing reduction requirements, we are simply trading one type of control for another.

The trading of emissions allocations requires a degree of precision and confidence in data far beyond anything in use today. Enforcement based on auditing of companies' trading records will also generate new kinds of reporting requirements and new penalty structures. All of this accounting, tracking, and monitoring will take some time to develop and certainly will involve some trial and error.

For these reasons, environmentalists prefer to begin the trading experiment with a smaller universe, thereby reducing the damage from the mistakes that will certainly be made and allowing the launch of a meaningful trading program at an earlier date. We propose a nitrogen oxide trading program to start. With 700 permitted sources, there would be ample opportunities for trading, but the commodity would be much less variable and much more easily measured than would be reactive organic gases.

Continued on next page

1

ECONOMIC INCENTIVES

Verne Wochnick



C leaning the air in Los Angeles has not been a simple task. It has been costly and, at times, disruptive to the economy. This has become even more acute as the recession continues to place ever-tighter burdens on every company's working capital. The historic command-and-control regulatory process has become too inflexible, and it appears to be incapable of achieving compliance with the 1990 Clean Air Act.

This situation has led many in government and the business community to search for alternative methods of regulating air quality. The SCAQMD's RECLAIM program appears to be the solution; however, it will require sacrifice.

Under any program, emissions reductions of 85 percent will force a number of companies to leave the L.A. basin. The district's goal, therefore, should be to develop a regulatory system that not only cleans the air but does it in a cost-effective manner. The system should be broad enough to establish the lowest possible allocation price, and it should minimize the administrative burden. These factors can help mitigate or at least reduce much business flight from the basin.

(Wochnick is the manager for government affairs for the Hughes Aircraft Company.) If kept simple, RECLAIM offers that promise. While there are many issues to be debated as the program develops, none will be more critical than the establishment of an adequate baseline and the need for a simple trading system.

In establishing a baseline, the SCAQMD will not only be setting an emissions limit but will be laying the framework for the region's economic future. To that end, emissions allocations must not penalize firms for current economic downturn. If the forecast is for the economy to rebound. then the district should establish an emissions baseline that represents a period of economic health. Likewise, firms must not be penalized for their historical offsets or reduced onsite emissions that have been obtained under existing permit levels. By combining both historical and permitted emissions levels, a fair foundation can be achieved. That base must be established before any workable trading system is developed.

If a trading system is to work, it must be simple. A trading program cannot be viewed as a seasonal control mechanism. It is merely a means of buying and selling entitlements. To make it anything other than that, to break it down into quarterly or monthly markets, makes it too costly and cumbersome. Problems resulting from seasonal emissions can and should be dealt with through a facilities permit. That way, the trading system can remain fluid and simple while the permit program preserves the environmental review process.

Let us recognize that RECLAIM will fundamentally restructure the region's economy. However, if done correctly, RECLAIM will minimize job losses and negative economic impact far better than the existing system.

Kelly Candaele



The SCAQMD has embarked on an ambitious program that could clear the air but inadvertently reward business flight from a Los Angeles already economically weakened by job losses and cuts in defense spending.

By establishing a market for emissions, the SCAQMD would create value for a

commodity—pollution—that previously was the antithesis of value. The problem is what kind of incentives such a system would bring into play.

If a company decided to move to New Mexico, it could sell its emissions credits to another company that needed them to continue operating or expand production. The departing company would, in effect, make an immediate profit by shutting down production—a golden parachute for bailing out of Los Angeles. The company rents a U-haul trailer with the money earned from its emissions credits and heads for New Mexico to start over.

Back in Los Angeles, workers would be left in need of retraining, health care, and income to sustain their families. They would face the prospect of finding other jobs in a recessionary

(Candaele is a political representative for the L.A. County Federation of Labor, AFL-CIO, and is a member of the SCAQMD Marketable Permits Committee.)



economy. The region's tax base would be undermined, its social services further strained by the ills associated with unemployment.

If there is any doubt that the money earned from selling emissions credits is sufficient to support a business change of address, consider this: In 1990, two medium-sized Shell Oil refineries in Carson, California, were permitted to emit 1,900 tons of reactive organic gases and 1,400 tons of nitrogen oxides, annually. Based on SCAQMD staff estimates, credits for these emissions would be worth about \$17.4 million. That kind of money can move quite a bit of furniture.

Companies that leave Los Angeles should not get off so easily, or be so richly rewarded. There is a social character to business enterprise that must be recognized. The SCAQMD should structure the trading market to help workers and establish a disincentive for business flight. The district should create, if you will, a "social market."

Here's how the process might work. If a company decides to close shop in Los Angeles, let it sell its credits in the marketplace. This would avoid distortions in the smog-for-sale market that might set back business activity and job creation. But once the trade is made, a portion of the money earned from the sale should go to help workers left in the economic lurch by business flight. The money could be easily channeled to already existing worker retraining programs or be put in a fund to provide health insurance or supplemental unemployment insurance.

In the United States, moving from job to job is a jarring, often devastating experience. If workers bear the major burden of environmental cleanup, they will rightfully ask, "Why should we be the ones who sacrifice for other people's ideological enthusiasms?" The SCAQMD can help preempt this economic discrimination. Gary L. Stafford



The SCAQMD is developing what has been called a revolutionary market-incentive program to achieve emissions reductions from stationary sources. Some claim that there is gold in the smog that blankets the district. That gold, however, may look more like red ink to manufacturers.

One area of critical concern to furniture manufacturers is the allocation of the initial baseline. Under RECLAIM, a manufacturer will be assigned an annual emissions allocation which will then have to be reduced by a percentage each year. Currently proposed methods of assigning the initial allocations are based on historical emissions for the years 1989 to 1991. The district will have to take into account additional factors to provide an equitable baseline for furniture manufacturers.

First, furniture manufacturers have made significant reductions since 1988 as a result of SCAQMD command-and-control regulations. If they are allocated baseline emissions based on historical emissions, they will be penalized relative to industries that have not been as severely impacted by those regulations. Furniture manufacturers that have

(Stafford is Vice President/Chief Financial Officer for Terra Furniture, Inc., and a past president of Western Furnishing Manufacturing Association.) reduced their emissions beyond average levels need to be given a larger initial baseline allocation.

Second, furniture manufacturers' emissions have been reduced since 1988 as a result of industry recession. RECLAIM needs to recognize that these reductions are temporary and assign an allowance that will compensate for them during the baseline period.

Finally, the initial allocation needs to provide an allowance for exempt solvents. In the past, the district has encouraged the use of these solvents in paint formulations because they did not cause smog. We now know, however, that they deplete the ozone layer and are likely to be phased out. When they are phased out, they will have to be replaced with reactive organic gases (ROGs). Unless industry receives credit for the exempt solvents in its initial baselines, it will have to purchase large amounts of ROGs later on.

This is what makes an equitable baseline allocation so important. Without it, as production recovers from the recession, as exempt solvents are phased out, and as the 5-percent annual reduction in ROG emissions begins, furniture manufacturers will be net purchasers of ROG emissions.

The SCAQMD has projected that the cost of a ton of ROG emissions in 1987 dollars will exceed \$10,000 in 1994 and will rise to \$40,000 by 1997. That equates to a tax of \$110 per gallon on today's compliant lacquers, which would be prohibitive to the furniture manufacturer.

One way to resolve the questions of fairness would be to assign the baseline at existing permit limits. Trading could be restricted to reductions in actual historical emissions. This would preclude the increases in emissions that could result from the trading of previously unused permitted emissions. This simple method of allocating the initial baseline could determine whether furniture manufacturers and many other small businesses find gold or red ink in the RECLAIM program. \Box

ECONOMIC INCENTIVES TRADES TO REMEMBER: THE LEAD PHASEDOWN

The carrot approach achieved the standard and saved millions of dollars, too

by Lily Whiteman

The 1979-to-1988 phasedown of leaded gasoline proved that market incentives could do what conventional command-and-control regulations could not: hasten the nation's retreat from the leaded gasoline market at the lowest possible cost.

But just what was lead doing in gasoline, why did EPA want to remove it, and how did this effort succeed? Since the 1920s, refineries had been stoking gasoline with lead, the cheapest source of octane, in order to reduce engine knock and improve engine performance. But the latter half of the 20th century saw a steady accumulation of evidence linking lead exposure to mental and cardiovascular disorders. The urgency of the problem was underscored by studies from the 1970s showing that blood lead levels of sample populations immediately reflected changes in the lead content of gasoline.

By the latter half of the 1970s, lead consumption began to decline. During this period, manufacturers began equipping new cars with pollution-cutting catalytic converters in order to meet tightening emissions standards for various pollutants. Because catalytic converters are poisoned by lead, their proliferation meant reduced lead consumption and increased availability of unleaded gasoline. Despite such progress, leaded gasoline remained quite concentrated, averaging about 2.0 grams per gallon in 1975.

(Whiteman is a policy analyst with EPA's Office of Mobile Sources.)

High lead levels, coupled with the gathering storm over health effects, inspired EPA during the late 1970s to take quick and direct action to hasten the decline of leaded gasoline.

But there was a problem: Although many of the nation's newer refineries had been equipped to handle new octane boosters, other less modern facilities had not yet been retrofitted for the conversion. This older segment of the refining industry would have been shut down by an immediate ban on lead. Balancing heterogeneous industry capabilities against health considerations, EPA initiated a series of successively more stringent lead limits.

Lead Use in Gasoline and Average Blood Lead Levels



Early regulations demanded equal progress from all facilities at the same time. However, EPA eventually speeded the transition to unleaded gasoline by adopting trading and banking options that offered older facilities alternatives for meeting standards otherwise beyond their reach.

Through trading, facilities could pay other producers to compensate for their excesses. Consider, for example, a refinery that wasn't ready for the 1.10 grams per leaded gallon (gplg) standard set in 1982. That facility could still legally produce a given amount of gasoline at 1.30 gplg if it purchased credits during the same calendar quarter from more modern facilities that produced an equal amount of gasoline at 0.90 gplg.

Under a banking program begun in 1985, credits gained by early achievement of phasedown limits could be spent through 1987 to delay adherence to tougher, more stringent standards. For example, suppose that after the 1.1 gplg limit was set in 1985, a company pumped out a given amount of gasoline at 0.8 gplg. This "overcompliance" could entitle either that facility or another trader with credits to produce the same amount of gasoline at 0.4 gplg even after the standard dropped down to 0.10 gplg in 1986. Between 1985 and 1987, up to 20 percent of total lead consumed passed through banking deals.

By squeezing timely lead sacrifices from modern facilities without strangling older ones, trading and banking programs helped preserve the refining industry's economic viability.



Market incentives helped EPA speed the transition to unleaded gasoline.

Moreover, because the phasedown was implemented earlier than conventional standards could have been, it produced health benefits from reduced lead consumption years earlier than otherwise would have been possible.

The market-based phasedown also allowed for the physical properties of lead. Here's how: As the lead concentration of gasoline decreases, the octane power of each unit of lead increases; the more dilute the gasoline mixture, the more work each unit of lead accomplishes, and the greater is its value. Because of these principles, lead removal from concentrated gasoline mixtures is easier and cheaper than lead removal from dilute mixtures; each step in a lead phasedown is incrementally more difficult and expensive than the preceding one. Of course, the health benefits of removing a given quantity of lead are the same whether it is taken from a concentrated or dilute mixture.

By allowing refineries that possessed lead credits for overcomplying with the 1.10 gplg standard to slow their transition into the tough 0.10 standard, banking and trading programs-in effect-encouraged modern facilities to exchange cheaper, early reductions for more costly, later ones. Such trade-offs saved money. Due entirely to banking alone, the phasedown cost industry \$220 million less than conventional regulations would have. But because market incentives did not permit increases in total lead consumption, such savings were achieved without compromising health benefits.

For the sake of a few old farm



Everett Johnson photo. Folio, Inc.

engines that may still need residual lead levels for valve protection, limits currently remain at 0.10 gplg. Nevertheless, market forces have already driven leaded gasoline out of most urban areas. A complete ban will take effect in 1996.

Although EPA worked hard to develop enforceable regulations, according to John Holley of the Office of Mobile Sources, it would have been impossible to foresee and preemptively eliminate every potential scamming opportunity. Simply because of their complexity, banking and trading programs incorporate numerous cracks, murky boundaries, and shadowy folds that can be manipulated to obscure illegal activities. Unintended loopholes permitting environmentally harmful actions that violated the spirit—if not the letter-of the law posed other vexing problems.

The lead phasedown hinged upon a self-reporting system similar to that underlying IRS tax returns. EPA checked refiners' reports of lead consumption against lead manufacturers' records, and also cross-referenced refiners' reports of banking and trading transactions against the records of other participants in such deals. In addition, refiners' reports of gasoline output were selectively verified by sleuthing through often complicated paper trails, and by conducting site audits where necessary.

EPA investigators did uncover a number of operations that exaggerated gasoline sales in order to artificially dilute lead concentrations into compliance. In a celebrated 1986 case, EPA fined a company \$40 million for spiking 800 gallons of gasoline with an excess of 135 grams of lead. This violator, like many others, was turned in by legitimate refiners who resented the unfair competitive edge gained by illegal operations. Other scammers were betrayed by their own transparent reports to EPA, or by audits.

EPA has recently written trading mechanisms into other clean fuels programs. Because these programs vary with location and apply to a variety of gasoline properties, they will likely pose new challenges. Armed with lessons from the lead phasedown, EPA is gearing up for the next evolutionary phase of market incentives. \Box

IN THE TOOLKIT POLLUTION PREVENTION



American Wind Energy Association photo.

Using less harmful forms of energy, and using them less wastefully, is an important form of pollution prevention.



HEADING OFF Potential problems

It's not as easy as it sounds

by Richard Andrews

(Andrews is the Director of the Environmental Management and Policy Program at the University of North Carolina at Chapel Hill.)

hich makes more sense-throwing away waste materials and paying higher and higher rates to bury or burn them, or using them in byproducts? Buying expensive equipment to treat toxic wastewater before discharging it, or using a non-toxic substitute in the first place? Paying for materials when you buy them and then paying again to dispose of them when you throw them away, or buying only what you need? Polluting ground water and then spending millions of dollars trying to clean it up, or avoiding contamination through careful operation and maintenance? Mining large amounts of coal and oil, polluting the air by burning them, and then using the resulting energy wastefully-or using less harmful forms of energy, less wastefully, in the first place? As these examples suggest, pollution

prevention in principle is just common sense. Over the long run, and even for the economy as a whole in the short run, it is the most effective and the cheapest tool we have for environmental protection. And it is an essential feature of a competitive and sustainable economy as well. As President Bush pointed out in 1990, "Environmental programs that focus on the end of the pipe or the top of the stack, on cleaning up after the damage is done, are no longer adequate. We need new policies, technologies, and processes that prevent or minimize pollution—that stop it from being created in the first place."

But if that is true, why aren't we already doing it? The answer is that in some cases we are. But in many other situations, pollution prevention is hard to define and hard to measure, and its real benefits and costs are often distorted by both prices and policies that do not accurately reflect them.

Pollution prevention means actions that minimize the wasteful use of natural resources and the generation of harmful materials that would otherwise be released into the environment. Carefully maintaining equipment to eliminate leaks is pollution prevention. Training employees to avoid spills and wasteful cleaning practices is pollution prevention. Recycling residual materials and energy more completely within manufacturing and farming processes is a major form of pollution prevention. And substituting nontoxic ingredients for toxic ones, so that less hazardous materials are dug out of the ground and put in circulation in the first place, is arguably the most basic kind of pollution prevention.

There is already a large and growing record of examples of pollution prevention success stories, many of which were initiated voluntarily by businesses that recognized that pollution prevention pays. Over 20 years ago, fruit canneries began recycling their wastewater to capture more of the juice in byproducts, dramatically reducing discharges to streams. Some metal plating firms have now redesigned their rinsing tanks to recapture far more of the toxic and expensive metals used in their processes. Previously these metals were simply released into the rivers causing serious pollution and wasting money.

Since fuel prices rose in the 1970s, energy conservation by both businesses and households has drastically slowed the growth rate of U.S. energy consumption. This has prevented pollution from a significant number of additional power plants (and associated coal and oil extraction) that would otherwise have been needed. Since publication of the annual Toxics

POLLUTION PREVENTION

Release Inventory several years ago, more and more businesses have found ways to dramatically reduce emissions of the especially hazardous chemicals that must be reported.

EPA itself has developed two high-visibility pollution prevention initiatives: the "33/50 Program" for reducing toxic emissions and the "Green Lights Program" for energy-efficient lighting (see boxes).

In many other real choices, however, defining pollution prevention is not as easy as it sounds. For instance, should you use paper or plastic grocery bags? Both are now recyclable; paper does biodegrade, but not in most landfills, and it is both bulkier and heavier to handle; plastic-making has an image as a pollution-intensive industry, but papermaking is too. Suppose a manufacturer reduces the use of a toxic chemical, but substitutes one that produces a much larger discharge of non-toxic organic material in wastewater. Is that pollution prevention, or just substitution of a different kind of pollution? Suppose that manufacturer continues to use the toxic material, but invents a way to incorporate it more completely into the product itself. Is that pollution prevention, or just pollution displacement to a different time and place—when the product is discarded?

Suppose the manufacturer simply stops making the product: Will its consumers buy an alternative that pollutes less—or more? Most

A pollution prevention success story: Kryptonics, Inc., a Colorado manufacturer, invented a process that eliminates the company's need for CFCs.



EPA's 33/50 Program

When EPA Administrator William Reilly asked 600 companies in January of last year if they would voluntarily reduce their environmental releases and off-site transfers (amounts sent to other facilities) of certain toxic chemicals, nobody was quite sure what would happen.

As it turns out, EPA's 33/50 Program—so called because of the two-tiered reduction goals of 33 and 50 percent—is going strong. By January 1992, nearly half of those companies had committed to substantial reductions over a seven-year period. And now, with the invitation to participate expanded to more than 6,000 companies, almost 800 companies have joined the program. The result: a projected reduction of over 300 million pounds of chemical releases by 1995.

The program sets two voluntary



important, can the consumer or manufacturer even determine which choices really prevent pollution best? In some cases this can be determined, especially where the stakes are high enough to warrant detailed analysis. In many others, however, the answers remain frustratingly ambiguous, because they require complex comparisons of products with their substitutes over their entire life-cycles—mining, manufacturing, use, re-use, and disposal—involving many assumptions and uncertainties.

Even when the scientific choices are clear, the economic ones often are not. From an environmental standpoint, less pollution is always preferable to more—but how much more preferable, and at what cost? Many pollution prevention actions make sense for both business and environmental reasons, and these are what we are now seeing. The only reasons they were not done years before was that no one stopped to think about them. The problem was simply old habits and routines, thoughtlessness, or just lack of engineering attention to designing more efficient alternatives.

For some other situations, pollution prevention-from the polluter's perspective-pays now but did not pay before because the real costs of environmental damage were simply being ignored. For instance, rising energy costs in the 1970s focused people's attention on conservation, and in the 1980s, new landfill and incinerator safety standards have raised the cost of waste disposal. And many more pollution prevention actions would pay now except for perverse policy incentives that actually reward environmentally damaging as well as uneconomical actions. Examples include below-cost logging of national forests, artificially cheap prices for public water and mineral and energy resources, subsidies for

wasteful overproduction in agriculture and some military industries, and even some environmental regulations that require expensive end-of-pipe treatment facilities rather than preventive alternatives.

But what about preventing pollution when it really does cost the business—or you or me—more to do so than to throw it away? Should we promote pollution prevention only to the extent that it really does serve the individual's own self-interest? Or at the other extreme, should we seriously pursue a goal of total pollution prevention—that is, zero pollution discharge? Or is there some reasonable compromise between these two positions that should guide pollution prevention choices?

In principle, the answer is that everyone who causes pollution should be charged its full costs when they buy the products that cause it. These costs include the costs of extracting,

reduction goals for 17 targeted chemicals: a 33-percent reduction for 1992 release and transfer totals from 1988 levels, and a 50-percent reduction by 1995. In 1988, there were 1.4 billion pounds of releases and transfers of the 17 targeted chemicals. The 33/50 program aims to cut the figure in half—a 700-million-pound reduction—by 1995.

The 17 chemicals were chosen because they meet three criteria: They all pose serious health and environmental concerns; they are high-volume industrial chemicals with substantial releases; and they can be reduced through pollution prevention. They include chemicals like lead—a pervasive chemical that has had especially harmful effects on children—benzene, and toluene.

The data on the chemicals are taken from reports that companies

are required to file with EPA under section 313 of the Emergency Planning and Community Right-to-Know Act. This information is compiled and released annually by EPA as the Toxics Release Inventory.

Many companies have reported deriving tangible benefits from their participation in 33/50: improved community relations, improved employee morale, and monetary savings from cutting waste management costs and potentially avoiding future costly liabilities associated with waste. The companies also benefit from being recognized publicly by EPA as voluntarily reducing their pollution levels. And an awards program is in the works to reward companies for technical innovations and other pollution prevention measures.

EPA is helping companies with

the technical problems associated with the 33/50 Program. The Agency is offering workshops explaining the 33/50 Program and providing industry-specific information on pollution prevention. EPA has also set up a **Pollution Prevention Information Clearinghouse** and a Pollution **Prevention Information Exchange** System (PIES). Both the Clearinghouse and PIES information are available via computer modem. To learn how to access either, call (703) 821-4800. For more information about the 33/50 Program, call EPA's Toxic Substance Control Act (TSCA) Hotline at (202) 554-1404, Monday through Friday, between 8 a.m. and 5 p.m. (EST), or write to TSCA Hotline, Environmental Assistance Division, U.S. EPA (TS-799), 401 M Street SW, Washington, DC 20460. -Eds.

manufacturing, and disposing of the products as well as the full costs of preventing or restoring the environmental damage caused during the process. Moreover, these funds should be spent to prevent or restore the damage, not simply be reallocated to other uses. This tenet does not require zero pollution discharge or any other unrealistic goals. It simply states clear principles of stewardship, that we leave the Earth in at least as good condition as we found it; of economic efficiency, that each economic transaction should reflect the true costs involved; and of fairness, that those costs should be borne by those who in fact cause them. These principles are absolutely consistent with both environmental protection and mainstream principles of free-market economics.

There are policy tools that we could

use to move a long way toward implementing these principles, but there is great resistance to them. Those who should pay pollution charges would rather avoid them, and no one speaks for the new businesses and jobs that would be created if the full environmental costs were charged to promote proper pollution prevention. Budget officials resist earmarking revenues to pay the actual prevention and clean-up costs; both polluters and environmental groups have deep stakes in the status quo and are apprehensive about the uncertainties of a new approach; and domestic polluters argue that if they pay the full costs of pollution they cannot compete against foreign firms that do not. It is also hard to establish precisely the "right" level for such charges.

Five immediate steps would help us to move toward more effective progress

in pollution prevention:

• Ask these questions in all choices by businesses, governments, and individuals: Am I preventing pollution by the decision I am making? Could I prevent pollution better by making a different choice? Could I prevent pollution better by persuading someone else to provide me with additional options?

• Take obvious steps to move in the right direction. Systematically identify the materials and energy you use (as a business or a household), eliminate waste and leakage and unnecessary use, substitute less harmful alternatives, and invest in changes that have reasonable payoffs. In government, eliminate policy incentives that are both environmentally and economically perverse.

"Green Lights"

Created in 1991, EPA's "Green Lights" program encourages major U.S. corporations, state and local governments, and other organizations to install energy-efficient lighting. The response has been positive—more than 525 corporations and governments have signed on as of late April, yet another indication that a pollution prevention ethic is beginning to take hold in the business world. Here's how Green Lights works.

A company interested in joining the program must become a "Partner" or an "Ally." "Partners" are companies not in the lighting business that agree to survey their existing lighting and work toward a reduction of energy used for lighting in 90 percent of their buildings within five years. They also agree to document the changes they make, use energy efficient lighting in any new buildings, and educate their employees about ways to cut lighting costs.

"Allies" are lighting-related companies—such as power companies, lighting manufacturers, and lighting consulting companies—that agree to the same energy-saving surveys and actions for their own lighting systems as "Partners" do, but they also assist EPA in promoting energy efficient lighting and in providing technical information to their customers and other Green Lights participants.

EPA, for its part of the deal, agrees to provide state-of-the-art expertise and technical support, to recognize participating companies for their public service in preventing pollution, and to promote public awareness about lighting efficiency.

The Green Lights program is

being promoted in a number of ways. There is Update, EPA's monthly Green Lights publication; there are Green Lights buttons, Green Lights slide shows, Green Lights newspaper and magazine advertisements, and even a Green Lights video. It all ties in with a key element: the use of a "Green Lights" logo by the companies involved. The logo is a seal of participation that the company can use in its advertising, although not on specific products, to promote its role in pollution prevention. All uses of the lighting logo by industry-"Allies"-must be approved by the EPA Green Lights staff.

The Agency is also offering technical reports—called Light Briefs—about specific energy-saving devices, performance evaluation guides, software to help companies in making assessments of their existing lighting and options for • In every situation possible, charge the full costs of both disposal and environmental damage, and commit the revenues to environmental restoration.

 Seriously evaluate pollution prevention opportunities in costly long-term decisions: capital investments in facilities and infrastructure, new product lines, major construction or other land- and water-transformation actions, and other similar choices. These are the choices in which the long-term benefits and costs of pollution prevention are most likely to be distorted by perverse short-term incentives-the outcomes of which will most powerfully shape future pollution prevention or damage. Therefore, these decisions must be carefully analyzed to be sure that the full costs are reflected in the decisions.

changes, technical workshops, and financial assistance through public and private sources to help companies get the systems in place.

Among the more than 525 Green Lights "Partners" and "Allies" are companies like Boeing, L.L. Bean, The American Louver Company, 3M, and Nike; utilities like the **Puget Sound Power & Light** Company, Central Power of Maine, and Tampa Electric; non-profit organizations like the World Resources Institute, the Environmental Defense Fund, and the Natural Resources Defense Council; universities and colleges; 11 state governments; five cities; a couple of counties; a school district; a town; and the Virgin Islands.

If you're interested in finding out more about the Green Lights program, call the Green Lights Hotline at (202) 775-6650.

-Eds.



With Unicoat, a new paint developed by the U.S. Navy Exploratory Development Program, VOCs and hazardous waste from the painting process are reduced by 67 percent.

A "pollution prevention impact

statement," along with clear and

benefits and costs of pollution

businesses and governments.

prevention, would be a valuable

innovation in the analysis of these

special kinds of decisions-by both

Finally, identify and document

their causes. To paraphrase the

National Rifle Association,

pollution causes, or on the

and programs in creating better

technologies don't cause

pollution prevention successes and

pollution—people cause pollution. Yet

EPA has almost no budget for research

either on the human dimensions of

effectiveness of the Agency's policies

incentives for pollution prevention.

effective economic incentives to make

such decisions based on long-range

EPA clearly needs to understand environmental conditions and control technologies, and it needs research to justify its regulations. But most of all, it needs to understand what factors affect individual and business decisions to pollute or prevent pollution, and which of its own

In short, pollution prevention may be hard to regulate, but it is only common sense as a principle and a strategy. The opportunities are real, and the basic principles are clear, fair, and consistent with both environmental goals and free-market economics. Debate will continue about its details, but we can and should be moving in the right direction while we continue the debate. \Box

actions help or hinder pollution

prevention.

U.S. Navy photo.

IN THE TOOLKIT INFORMATION TRANSFER

ATTACKING A PROBLEM WITH THE FACTS

Government and industry must take communication seriously

by Caron Chess

(Chess is the Director of the Environmental Communication Research Program, Cook College, Rutgers University. The program has developed a variety of risk communication publications. For information, please write to the Environmental Communication Research Program, Cook College, Rutgers University, Box 231, New Brunswick, NJ 08903.)

call from a homeowner about oil Ain her well prompted the Wood County Health Department to launch a communication campaign for the largely rural Ohio county. Testing of the well showed concentrations of polychlorinated biphenyls (PCBs) that had leaked from the well's malfunctioning submersible pump. So Larry Sorrells, the county director of environmental health, turned to the Wisconsin Department of Natural Resources, which had been tracking the problem in that state for years. Then, following Wisconsin's lead, he attacked the problem with information.

Although the likelihood of PCBs being drawn into homes was low, the potential consequences—permanent contamination of entire plumbing systems—were serious. Since PCBs are suspected of causing cancer in humans, Sorrells decided that telling people about the problem was the only responsible way to go: "My job was to give people facts so that they could make up their own minds."

His budget didn't allow him to solve the problem—or even pay for water testing. But he could afford to send news releases to the local media and notification letters to plumbers and water-system contractors. The information he sent out included a list of suspect pumps, a method for cleaning up a contaminated well, and a way to dispose of the PCB-contaminated waste.

The result was the identification of nearly 200 wells at risk and six already

contaminated. Furthermore, the first successful effort in 70 years to levy taxes for the health department's programs grew directly out of the success of the department's modest program to alert homeowners about the potential threat to their wells.

It's not news that information can help reduce risks—and even save lives. Witness the number of smokers who have quit, prompted, in part, by the knowledge that smoking is hazardous to their health. What is news is that environmental officials are becoming increasingly aware that not all headlines are bad news.

Communication can be as essential to solving environmental problems as laws and science. Reducing solid waste, water pollution, and air pollution will require not only market incentives and technological changes, but also changes in our collective behavior. Making these behavioral changes will require not only providing information but also putting more effort into communication.

Breaking the environmental gridlock that stalls resolution of critical issues—from dealing with Superfund sites to land-use planning—requires better understanding of the communication problems that commonly develop between scientists, regulators, and laypeople. And resolving these impasses requires experts to listen to the concerns of nonexperts as well as to deliver information.

Obviously, dialogue about

Right to Know A U.S. Report Spurs Community Action By Revealing Polluters Northfield, Minn., and Others Are Shocked to Discover Who's Discharging What

State Firms Polluting Less Toxic Chemical Releases Down

The PINS Hotline (Prompt Inquiry and Notification System) can send information and safety alerts to neighbors of Sybron Chemicals in Pemberton Township, New Jersey.

environmental problems is only one step toward resolving them. Acting as if communication is the solution to our environmental ills may be as unwise as treating communication as irrelevant.

For communication to be part of the solution, environmental problem solvers have to plan for it. Because everyone communicates everyday, we take it for granted. It is often the last item on the agenda and the first to be dropped-if communication makes it to the agenda at all. Take the agency officials who spend months, if not years, conducting a scientific study. Two days before the scheduled release of the report, they call in a public affairs person to make hasty arrangements-often with predictably mediocre results. No wonder the communication doesn't convey the importance of the science.

Just like good science or good environmental policy, good communication takes some forethought. The Wood County example provides some basic lessons about communicating effectively:

• Releasing information. Instead of cringing from releasing potentially bad news, Sorrells grappled with how to release it responsibly-and how to handle public response. Rather than trying to field all the questions himself, he gave homeowners enough information to begin dealing with the problem themselves. Communities rarely "panic" from the release of information-even if it's bad news.



Environmental Affairs Institute photo.

Agency officials are more likely to panic about being messengers of bad news.

• Timing. The health department released the information shortly after learning of the concern. Imagine the headlines if Wood County officials had decided to duck the issue, and the homeowner had gone to a reporter. Sorrells might have been swamped with phone calls from people asking why their health department didn't alert them about the potential-albeit potentially small-risk.



• Agency learning. The agency avoided reinventing the wheel. Sorrells drew heavily on the Wisconsin Department of Natural Resources' research and adapted the informational materials to suit Wood County's needs.

• Targeting information. Information was directed at key audiences. Agencies which try to communicate with "everyone" are doomed to failure. Even advertisers with budgets bigger than the total funding of many environmental agencies don't try to reach "everyone." Wood County targeted plumbers and certified water-system contractors because they were most likely to identify the routine pump failures that lead to leaking oil. Effort went into notifying these professionals rather than attempting the massive-and ultimately less productive-job of mailing to every homeowner in the county.

• Listening. The communication was two-way. A homeowner alerted the health department to the problem, and the health department took her call seriously. Too often such calls get bounced around endlessly in government agencies.

• Using the media. Reporters were contacted to alert people to the problem, but media attention wasn't expected to solve the problem. Instead, the media attention was more likely to encourage contractors to pay attention to the notification letters sent to them by the health department.

Continued on next page

Environmental Council **Ranks Air Polluters** in State, Nation

Texic Emissions Cut in Northfield

Anti-Pollution Power

Starts With Knowledge

• Providing guidance. The

information told people what they could do. The fact sheet put out by Wood County posed two questions: First, is there oil in your well? Second, if you have a submersible pump, is it on the suspect list? Sorrells said he was often asked by homeowners about the risk of cancer but was leery of "the numbers game." He suggested that if homeowners were concerned, they could replace a suspect pump and stop worrying.

• Dealing with uncertainty. The uncertainty of the risk was acknowledged and put into perspective. Sorrells knew that the risk of drinking PCB-contaminated water probably was not high—and he said so. But he also told contractors and homeowners that it was a risk that could be easily avoided.

• Planning. The agency planned its communication effort. The health department not only considered what to say but also critical details—like who would answer the phone. Too often environmental problem solvers contend there is not enough time for communication—let alone communication planning. As a result, they end up putting out a lot of communication fires that might have been avoided.

The Wood County effort undoubtedly wasn't perfect. Some might question whether the risk merited Sorrells' attention at all, given the range of environmental problems on the county's agenda. According to Sorrells, the issue warranted his concern because of the potential of a homeowner needing to replace PCB-contaminated plumbing if the problem went too long undetected.

Certainly, the Wood County case raises additional questions: What would have happened in a county where homeowners were too poor to pay for their own water testing? What if the contamination had occurred in an area where English was a second language to many? What if the risks were more serious—or more immediate? Or what if Sorrells had to reassure people about a risk they were already frightened of—as opposed to alerting them to a risk they hadn't heard of?

None of these concerns would obviate the need to communicate. They would only change the communication.

When environmental officials do consider communication, they most often think of dealing with reporters or the elusive "general public." But communicating with businesses can be at least as important. Effective implementation of existing environmental statutes may depend on the regulated community understanding ways to fulfill its obligations—not just effective enforcement. Pollution prevention efforts may hinge on government agencies better understanding industrial constraints and incentives.

Information can also indirectly pressure industries to improve their environmental practices. Take, for example, the federal right-to-know law that requires manufacturers to make public information about releases to the environment, the so-called Toxics Release Inventory (see box). This legislation may be as important for encouraging corporate self-policing as for conveying information to communities.

Innovative companies are even reducing environmental risks as a result of improving their communication with plant neighbors, according to Rutgers' research of corporate communication efforts. Sybron Chemicals Inc., a small, New Jersey-based specialty chemical manufacturer, literally made a stink in the surrounding community when it accidentally released ethyl acrylate one October morning at 2 a.m. The resulting community outcry led the plant to couple major changes in plant operations with a crash course in community relations. As part of this effort, the plant also installed a sophisticated telecommunications system to call neighbors in the event of an emergency.

More importantly, plant neighbors now can contact plant operators through this two-way system. Anyone with a complaint is encouraged to call the plant 24 hours a day. Plant operators can quickly link the location of an odor complaint with meteorological and other data to track the source and get it under control. The system is working so well that Sybron has trained volunteers in the neighborhood to literally sniff out releases that have wafted over operators' heads.

Urged on by a skeptical public and difficult environmental problems, government agencies and businesses are looking to improve communication. But for communication to improve environmental problem-solving, agencies and industries must take it seriously.

Public affairs staff in government and industry too often have limited access to senior officials. Research is devoted to solving technical issues, not to resolving communication questions. Yet, funding technical efforts generously while scrimping on communication is false economy. And putting communication towards the bottom of every "to do" list is a way to guarantee that there is never enough time to communicate effectively. Instead, communication must be part of resolving environmental problems, rather than sugarcoating them. \Box



Toxics Release Inventory

How much lead was released into the U.S. environment in 1990 from manufacturing facilities? How much benzene? Chloroform? And just how much of these toxic chemicals was released in Nebraska? In California? In my hometown?

Anyone who wants to find answers to questions such as these can do so through EPA's Toxics Release Inventory, also known as TRI. The database, maintained by EPA and first made available in 1989, is required under Section -313 of the Emergency Planning and Community Right-to-Know Act, passed in 1986. The data are taken from reports manufacturers must file annually estimating the amount of more than 300 toxic chemicals they have released, either as routine emissions or accidental releases, into the environment. The companies must also report the amounts they have transferred to other facilities-for any purpose, including further treatment or incineration. The 1990 data, released to the public earlier this year, were culled from more than 80,000 reports from about 22,000 facilities.

The database is released "as is," unedited by EPA, though quality control measures for the data are strict. This format allows citizens, public interest groups, state and local governments, and other interested parties the same access that EPA has to the raw numbers. Numerous groups have used TRI data to lobby for more stringent state and federal regulations governing toxic chemicals and to exert pressure on local industries to decrease their releases of these toxics. In addition, many companies, upon reviewing their own release reports, have voluntarily adopted pollution prevention measures to reduce their chemical emissions. And whether it is due to the lobbying efforts by citizens or public relations and cost-cutting measures of companies, the results are the same: fewer toxic chemicals released into the environment.

While a key concern is making the data available to the public, EPA also uses TRI data as a basis for pinpointing problems in specific geographic areas or industries that might merit further investigation. The database figures are used for other projects like the voluntary 33/50 Program (see page 42). And the 1991 reports, for the first time, will require companies to document any pollution prevention policies currently in use or planned. This information will be available when the 1991 data are released next year.

The TRI database is available on computer diskettes, microfiche, compact disc (CD-ROM), and standard paper format, or it can be accessed through phone lines via computer modem. To find out more about access to the TRI data you can contact the Emergency Planning and Community Right-to-Know Hotline at 800-535-0202 (in Virginia: 703-920-9877) or write to the TRI Reporting Center, P.O. Box 70266, Washington, DC 20024-0266, Attn: Public Inquiry.

-Eds.

Toxics Release Inventory Percent Changes in Releases and Transfers



*Three quarters of the 1989 - 1990 decrease is due to a change in EPA's reporting guidance for one chemical and does not represent an actual decrease in the amount of the waste injected underground.
** POTWs ~ Publicly Owned Treatment Works

IN THE TOOLKIT ENGINEERING AND TECHNOLOGY



Alaska Bioremediation Project photo.

Oil-eating microbes helped clean up this beach contaminated by the Exxon Valdez spill.



NEW DAVIDS TO TACKLE Environmental Goliaths

Using microorganisms to give nature a helping hand

by Erich W. Bretthauer

ook at it as an environmental version of the David and Goliath story: To tackle a big challenge, think small—even microscopically.

In its 1990 report Reducing Risk, the EPA Science Advisory Board recommended that the Agency "substantially broaden its kit of environmental protection tools." One of the tools that the Board suggested the Agency give serious consideration to was innovation in pollution-control technology. The recommendation underscored a principle that EPA had already embraced: As environmental problems become more complex and costly, it becomes increasingly necessary to look for fresh technological solutions that everyone can use.

In the Office of Research and Development (ORD), this thinking has already been carried to the laboratory

(Bretthauer is EPA's Assistant Administrator for the Office of Research and Development.) bench: Engineers and other specialists are developing and testing a variety of innovative technologies, from a cleaner, less-polluting, wood-burning stove to portable devices for quicker, less costly detection and measurement of heavy metals and toxic compounds at hazardous waste sites.

In this search for new ways to tackle environmental Goliaths, EPA has also begun recruiting its own Davids: the bacteria, fungi, and other microorganisms that live everywhere around us. The Agency is in the forefront of efforts by scientists in the government, private industry, and the academic community to find new ways to use naturally occurring microorganisms to clean up environmental contaminants.

It is well known that microorganisms are the key players in certain biochemical processes that convert complex organic compounds into simpler materials. In nature, these processes help clear the environment of dead matter; for example, fungi help decompose dead trees by feeding on cellulose in the wood, thereby promoting the breakdown of the wood fiber. Scientists are trying to apply similar principles to convert hazardous chemical wastes to non-toxic or less-toxic materials. This approach is called bioremediation.

In general, bioremediation simply amounts to giving nature a helping hand. By establishing conditions in which everyday microorganisms can flourish—for example, by adding nutrients or moisture to contaminated soil—scientists stimulate faster reactions in which toxic organic compounds are converted into water, carbon dioxide, and other safe materials.

Similar principles have been used for many years in treating waste water, and the potential for their wider application began to be recognized in the 1980s. The technology moved into the public spotlight in 1989 when Exxon and EPA worked together to assess the effectiveness of biological treatment in cleaning up the Exxon Valdez oil spill in Prince William Sound, Alaska.

Continued on next page

Traditional methods called for spraying hot water at high pressure onto the rocky shoreline to wash the spilled oil back into the water, where it was collected by skimming and vacuuming. EPA scientists supplemented this treatment by applying fertilizer to parts of the coast to stimulate natural oil-degrading bacteria. In some locations, this application visibly cleared oil from some rocky surfaces in a matter of two to three weeks. Subsequent studies showed that this treatment caused oil to degrade approximately twice as fast as the oil in untreated areas.

This was truly pioneering work. Its success encouraged new interest in existing EPA bioremediation programs and led to further efforts to advance the technology. Research in bioremediation has increased three to four times over pre-Valdez levels. At the invitation of Administrator Reilly, scientists from EPA, other agencies, industry, and the academic community met in February 1990 and again in June 1991 to explore the potential of bioremediation. From these meetings came the Bioremediation Action Committee, a forum in which industry, the government, and the scientific community can come together to identify current research needs and promote wider use of bioremediation.

ORD has established a Bioremediation Research Program to organize and focus its own work in this area. Under a five-year strategic plan, ORD is working to:

• Conduct research and demonstration projects

• Identify the status of bioremediation technology, and note current gaps in knowledge

• Find effective technology-transfer systems for quickly moving new discoveries from the laboratory into the field.

ORD scientists also are conducting their own research on bioremediation techniques. In one recent study, they applied white rot fungus, a common wood-degrading fungus, to soil samples contaminated with pentachlorophenol (PCP) and other toxic compounds.

The researchers laid out 11 plots of soil from a waste sludge pile at a site where a company had treated

Nutrients were added, centrifugal pumps were used to emulsify the wastes, and subsoil was mixed in with a hydraulic dredge.

telephone poles with PCP and creosote from 1946 to 1986. They then applied three species of white rot fungus in a statistically based experimental design and added wood chips as a food source for the fungi. Preliminary results from the study show that PCP concentrations of up to 1,000 parts per million (ppm) were reduced by 85 to 90 percent. Some reduction from natural degradation was found in plots that had not been treated; however, the fungus accounted for the significantly greater share of the reduction in the treated plots, converting the PCP to carbon dioxide and non-hazardous organic matter.

At a Texas site, researchers treated petrochemical wastes with a process that began with the injection of air into the liquid to encourage aerobic degradation—that is, reactions involving bacteria that function in the presence of oxygen. Nutrients were added, centrifugal pumps were used to emulsify the wastes, and subsoil was mixed in with a hydraulic dredge.

Within 120 days, volatile organic compounds in the waste were reduced from 3,400 ppm to 150 ppm, benzene concentrations from 300 ppm to 12 ppm, and vinyl chloride levels from 600 ppm to 17 ppm. The process cost \$47 million, in contrast to estimated costs of \$63 million to \$167 million for other options evaluated.

At a U.S. Coast Guard air station in Michigan, EPA treated ground water contaminated with benzene, toluene, and xylene from an aviation fuel spill by adding hydrogen peroxide as an oxygen source to stimulate indigenous microbes. Within six months, the ground water was brought within EPA drinking water standards.

As the experts readily admit, the current techniques have drawbacks. They do not destroy heavy metals that may be present in many sites, such as areas around former mining sites. Unlike incineration, bioremediation is a slow process, and it does not remove all quantities of a contaminant from treated soil.

On the other hand, the technology has a number of attractive features. It provides a less costly alternative to traditional clean-up methods, in which tons of soil have to be excavated and either incinerated or otherwise processed to remove contaminants. In addition, by converting toxic chemicals to other materials, bioremediation actually removes those toxics from the environment, rather than merely separating them for disposal in a later step.

"Bioremediation has the potential to be a dominant treatment technology for site clean-up in the future," Administrator Reilly said in 1991. The Agency's initiatives and a budget that has shown significant growth in the past two years—\$10.6 million proposed for extramural research in fiscal year 1993, \$3.5 million over the 1991 level—are evidence that EPA is committed to fulfilling that potential. □

MAKING THE TOOLS WORK



Construction can cause serious environmental damage. Too often, environmental impacts are not considered in development decisions.

THE INSTITUTIONAL CHALLENGE by Terry Davies and Frances Irwin

The environment should be a factor in all of society's decisions

urrently, environmental laws and programs are largely isolated from the individual, corporate, and governmental decisions that cause pollution and habitat destruction. The institutional challenge of the next decade will be to root the environmental factor as firmly as the economic factor in these decisions. If we are to build a sustainable world. the environment must become a positive force in an individual's choice of where to live and how to get to work, a manufacturer's selection of what materials and processes to use, and a congressional member's vote on an agricultural, transportation, energy, or other economic sector bill.

Today, most pollution and protection laws and programs are constructed to mitigate the effects of a project after it is designed or to treat waste after it is generated. Environmental practitioners are engineers, lawyers, and scientists who try to control these impacts and wastes. A very small proportion of the public and private resources spent on the environment is used to change our agricultural, energy, manufacturing, or transportation technologies so that they are fundamentally less polluting and damaging to begin with. For example, only 2 percent of governmental agricultural research funds go to research on sustainable farming systems. The product and process designer is just beginning to become as involved in company environmental decisions as the engineer at the end of the pipe or stack.

As the 20th century ends, we can see a doubled population and a quintupled economy on the horizon. To deal with them will require

(Davies is Executive Director of the National Commission on the Environment and a Senior Fellow at World Wildlife Fund. Irwin is Director of World Wildlife Fund's Pollution Prevention Program.)

USDA photo.

MAKING THE TOOLS WORK



South Florida Water Management District photos.



Before (above) and after (below): Channeling Florida's Kissimmee River resulted in great ecological damage. The economic and ecological penalties of failing to factor environmental issues into public policy decisions are very real.

> simultaneously inculcating an environmental perspective at the heart of all decisions in economic sectors and strengthening environmental agencies. From the view of an environmental agency, this means external integration into agricultural, energy, transportation, and manufacturing decisions, and it means internal integration of its own decisions around these sources of pollution as sectors and facilities, as well as around geographical regions.

Putting the environment at the core of decisions in economic sectors means rethinking goals, broadening constituencies, gaining new skills, gathering new kinds of data, and considering longer time frames. Traditionally, for economic sectors, cheap and abundant supply-increasing production-has been the goal. Shifting emphasis to product quality and to efficiency in using materials offers new goals for some manufacturers. Power companies, for example, are learning to use conservation as a "source" of energy.

Achieving new goals means dealing with different people, arranging new training programs, and developing new databases. For instance, neither the sector's own data nor EPA's may be adequate for putting the environment into decisions at the source. Environmental data have been gathered for compliance or protection purposes. By way of example, the Department of Energy surveyed EPA and other sources to support a research initiative on industrial waste reduction technologies and practices to reduce energy use. The researchers found that combining EPA's air, water, and waste data was difficult, because definitions as well as methods of collection, analysis, and access varied. The Toxics Release Inventory was limited to data about releases of a small subset of chemicals, while their project required looking at production data as well.

Thus, "external" integration of environmental concerns into a sector such as energy may, in turn, encourage EPA to integrate and expand its databases around pollution sources and regions.

At least four approaches show promise for integrating the environmental factor into economic sectors.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) was adopted to ensure that federal agencies incorporated the environmental factor in their decisions. To implement this provision, federal agencies established environmental offices which, often for the first time, introduced environmental skills and perspectives into cultures trained to build dams or highways or increase agricultural production. Much of NEPA's success can be attributed to these offices. Although they were weakened in the 1980s, they can provide starting points for a reinvigorated "fifth column."

The environmental impact assessment process has mitigated damage from major development projects, but it has been less successful in changing basic goals and approaches of programs. NEPA requires that "all agencies of the federal government shall ... include in every recommendation or report on proposals for legislation a detailed [Environmental Impact Statement] by the responsible official" Court interpretations of this provision are mixed, however, and programmatic impact statements continue to be rare. They could be a potent force for incorporating environmental considerations into federal programs if political pressure can be built to support such an initiative. NEPA could also be broadened to inject environmental factors into other governmental decision-making processes, particularly budgeting.

"... Governments' general response to the speed and scale of global changes has been a reluctance to recognize sufficiently the need to change themselves. The challenges are both interdependent and integrated, requiring comprehensive approaches and popular participation.

"Yet most institutions facing those challenges tend to be independent, fragmented, working to relatively narrow mandates with closed decision processes. Those responsible for managing natural resources and protecting the environment are institutionally separated from those responsible for managing the economy. The real world of interlocked economic and ecological systems will not change; the policies and institutions must"

-From Our Common Future, The World Commission on Environment and Development, 1987.

Amending Economic Sector Laws

The environment also needs to work its way into legislation governing transportation, agriculture, energy, and uses of resources such as forests and fisheries. Sectors are at various stages of this often contentious process. As the following examples from transportation and agriculture demonstrate, preventing pollution and protecting the environment are becoming stated goals in some economic sector laws. The hard work of bringing environmental concerns from the periphery to the center of these sectors comes in changing the budgets and actual practices, of course, and is a lengthy process.

The Intermodal Surface Transportation Efficiency Act of 1991 received little attention from environmental specialists or the press, but it may harbor a revolution. The environment is incorporated as an equal goal: The Act's purpose is to

develop a transportation system that is "economically efficient and environmentally sound" Although still dominated by highway building, the law now provides for research and planning of "systems" that include other modes of transportation, from pedestrian walkways to bicycles and trains. Developing a system that reduces energy consumption and air pollution while at the same time promoting economic development and international commerce, will depend to a large extent on a broadened constituency, including the groups concerned about air quality, community land use, and energy efficiency that got these provisions into the law.

The 1985 Food Security Act is a landmark example of addressing environmental concerns in agriculture. Under the Conservation Reserve Program, farmers have shifted millions of acres of cropland to vegetative cover for 10-year periods in exchange for annual payments. Additionally, "sodbuster" and "swampbuster" provisions protect vulnerable lands. The 1990 Food, Agriculture, Conservation, and Trade Act shifted the goal of agricultural research and education programs from productivity to long-term sustained productivity, profitability, and ecological soundness. It also set up a program to train all extension agents in sustainable agriculture within five years. Changes in goals must be followed by changes in budget if they are to make a real difference. The National Academy of Sciences has recommended a 10-fold increase in sustainable agricultural research.

The debate over the energy bill exemplifies the struggle to mesh energy and environmental goals. The wrangling over whether the Health and Environment Subcommittee or the Energy Subcommittee should have jurisdiction over the global warming

MAKING THE TOOLS WORK

issue in the House illustrates the congressional version of the structural difficulties posed by integrating these goals into a coherent policy.

Getting the Prices Right

Federally supported and regulated activities are a small part of the economic activity in the United States. We need to use the marketplace to integrate the costs of environmentally damaging activities into decisions by consumers, corporations, and governments. The cost of using environmentally dangerous products should reflect the damage they cause. Gasoline, pesticides, and solvents are three examples of products whose prices do not reflect their social costs. A carbon dioxide tax may well prove one of the most effective ways of dealing with global warming.

Focusing EPA Regulatory Functions on the Sources and Resources

Integrating environmental agencies themselves around the sources of pollution and the resources to be protected may be one of the most effective ways of encouraging external integration. EPA can become more "user-friendly" by establishing offices to work with the major economic sectors. The Agency is beginning to do this through its pollution prevention work. EPA and USDA signed a Memorandum of Agreement in April aimed at reducing agricultural pollution. The Office of Pollution Prevention and Toxics is developing a "Design for the Environment" program.

The Pollution Prevention Act of 1990 provides a way to focus both technical assistance and regulatory requirements on improving industrial technologies upfront. The act requires EPA to review regulations for their effect on source reduction. EPA's Source Reduction Review Project is introducing analysis to identify opportunities for source reduction and avoiding cross-media impacts during the development of air, water, and waste regulations.

Internally integrating information around sources and geographical regions or protected areas is a critical step in providing the public with the types of information it needs to make choices. The Toxics Release Inventory is a tool that provides publicly accessible multimedia data about pollutants linked to their source at a facility. States and private groups, as well as EPA programs, are analyzing the data by region as a basis for targeting sources where changes are needed.

One measure of whether integration works will be the extent to which environmental agencies begin to find their strongest allies in other agencies, companies, and citizens who recognize the need for environmental research, improved data, and strong enforcement. \Box



FEATURING EPA The Mobile Scanner Van The Mobile Scanner Van Reports for Duty

But for the logo, it could have passed for a bakery truck



EPA photo.

by Yasmine S. Khonsary and Colleen F. Petullo

(Khonsary is an Environmental Protection Specialist and Petullo a Health Physicist with EPA's Office of Radiation Programs in Las Vegas, Nevada.) Pennsylvania, a suburb of Philadelphia, in the fall of 1991. A modified 1979 Ford commercial delivery van cruised slowly up and down neighborhood streets. Sometimes it stopped, and people gathered around, talking among themselves and to the van operators. Except for the EPA logo and lettering on its side, the van could have passed for a bakery delivery truck. But its business was not delivering bread; it was looking for radioactive contamination—and in many cases, finding it.

Earlier in the year, a local citizen, using a simple radiation detection instrument, had discovered radioactive contamination on the premises of a Lansdowne house adjacent to the old Cummings Chemical Company radium processing factory. She reported her finding to state and federal radiation officials. Pennsylvania and EPA radiation personnel followed up with a radiation survey performed with hand-held instruments. Their findings confirmed the citizen's discovery.

Information obtained by EPA showed that the Cummings factory had operated from 1915 to 1922. The radium processing operation had closed down 70 years ago!

Further investigation revealed a complicated chain of events. During the time of the factory's operation, thousands of tons of raw uranium ore were shipped to Lansdowne from Colorado and Utah. It took approximately 90 tons of raw ore to produce just one ounce of pure radium, and the radium was extracted almost literally grain by grain. The radium was then used in the treatment of cancer and in luminescent paints for watches and aircraft instrumentation. Because of the ore-to-product ratio (3 million to 1), a thimbleful of radium cost \$100,000-a lot of money in an age when a Model T Ford cost \$360.

The arduous extraction process left behind tons of sandlike tailings laced with tiny amounts of radioactive particles. Since no one realized the dangers of radium or radiation at that time, the sandlike tailings were used by local residents for gardening and construction purposes. Building contractors also used this aggregate in concrete, stucco, and plaster in homes in the Lansdowne area. Contrary to an initial belief that most of this material would have been placed in landfills, these tailings had been built into peoples' houses.

Enter EPA's mobile scanner van. In September 1991, the van, which is operated by the Office of Radiation Programs' Las Vegas Facility, was enlisted to assist Region 3 personnel in determining the magnitude of radium contamination.

In concept, the mobile scanner van was born in Colorado in 1970, when EPA was tasked with locating potential radioactive uranium mill tailing sites around the Grand Junction area. The first mobile scanner van was actually a station wagon. After this first project, the station wagon was judged too small for EPA's purposes. Several vehicles and detector systems later, the final version was developed and is used to this day.

The core component of the scanner system mounted in the van is a very sensitive gamma radiation detector that is surrounded on three sides by lead. The detector can "see" out of only one side of the van and is sensitive enough to pick up increased radiation levels in structures up to 200 feet away. Air conditioning is provided to keep the electronic equipment cool. The roof of the van is high enough to allow room for a winch, which is needed to raise the four-foot, 1,000-pound detector assembly to its operating height. In addition to a driver, the van requires a skilled operator at the rear instrumentation console to examine the detector printout and spot any abnormalities in radiation levels.

To report for duty, the mobile scanner van was driven from Las Vegas, Nevada, to the Lansdowne, Pennsylvania, area. The van was used to monitor radiation levels within a two-mile radius (a 12-square-mile area) of the old factory. This survey included Eastern Delaware County and Southwest Philadelphia.

Roger Shura, chief operator of the scanner van, worked six days a week, sunup to sundown, for five weeks. During this period, over 100,000 buildings were scanned. Shura recalls surveying as many as 3,500 buildings per day.

Within Philadelphia (a small portion of the 12-square-mile area), the van traveled under police escort. There were two reasons for this: First, since the detector can "see" out of only one side of the van, the police provided traffic control when it was necessary for the van to drive the wrong way on one-way streets. Second, for accurate scanning, the van must not travel faster than 10 miles per hour, well below the posted speed limit, and the escort served to alert other drivers to the slow-moving vehicle.

In addition to working overtime to ensure that each street was scanned thoroughly, part of the job was being sensitive to people's concerns—answering questions, taking time to explain what was going on. If the van stopped for any reason, many residents would rush over, worried that the mysterious van had found their home to be contaminated. On the whole, however, most people expressed relief at knowing that their home was being surveyed.

In cases where radium contamination may be located in the foundation or underground basement of a house, the surrounding dirt can sometimes provide enough shielding to prevent the detector system from seeing the elevated radiation levels. For this reason, in addition to deploying the scanner van, EPA recommended that radon tests be performed in area houses built or remodeled between 1915 and 1925. Since radon is a radioactive decay product of radium, elevated levels of radon-if not from natural sources such as granite rocks or phosphate in the building materials-could indicate the presence of radium.

By the end of January 1992, 28 residences were discovered to have radiation levels greater than



This radium processing factory was closed in 1922 but left a legacy of radioactive contamination.

EPA-recommended guidelines. Eight of the 28 homes had levels high enough to cause the immediate temporary relocation of the families.

If radiation levels in a house indicate the need for relocation, residents are compensated from EPA "Superfund" monies. These funds come from a federal surcharge placed on the chemical industry. The fund pays for hotel accommodations and per diem expenses. This allows time to locate replacement housing for the affected families while further assessment of their present house takes place.

Moving for such a reason can be extremely traumatic, especially since there are many unknowns at the time of relocation. In an effort to lessen the anxiety of the families affected, EPA attempts to find comparable housing in the same community, neighborhood, and school district, whenever possible. Superfund pays the cost of rental housing until a family returns to their home or until they are permanently relocated. EPA also pays for the family's moving costs and the utilities on the vacated dwelling.

The house is repaired if further assessment determines that needed repairs are feasible and cost effective. In some cases, repairs may extend to jacking up the house and replacing the foundation.

However, if the radioactive contamination is spread throughout the house, making repairs impractical, the dwelling is dismantled and shipped to a licensed low-level radioactive waste disposal facility. Previously, in a similar situation elsewhere, EPA and the state compensated homeowners for the loss of their homes. EPA is attempting to negotiate a similar agreement with the state concerning those houses that are irreparably contaminated.

In February 1992, the factory and 28 residences were formally placed on EPA's National Priorities List (NPL) for Superfund cleanup. The NPL identifies the most hazardous sites in the United States. In most cases, once a site is listed on the NPL, the next step is a remedial investigation, a carefully designed assessment which includes extensive sampling and laboratory analysis. The results provide decision makers with detailed information to be used in selecting the best clean-up strategy.

After the remedial investigation, the next steps are the feasibility study and the actual cleanup. Since clean-up actions have to be tailored to the needs of each house, the feasibility study serves the practical purpose of analyzing those needs and evaluating alternative clean-up approaches in terms of their effectiveness and cost.

And where is EPA's mobile scanner van today? It has returned to Las Vegas but it has by no means retired. It is slated for further field assignments in conjunction with the Superfund program. In addition, other federal and state agencies are exploring prospective uses of the scanner van. You can expect to hear more about it. \Box

LETTERS TO THE EDITOR

From time to time EPA Journal receives and publishes letters to the Editor, which are always welcome. Our March/April 1992 issue, which focused on race, poverty, and the environment, elicited an unusual number of responses from readers. Letters responding to the March/April issue are printed below.

Here the Buck Stops

Your March/April issue of EPA Journal is an excellent first step toward increasing awareness among your readers of a new dimension and field of activity for environmental activists.

Some of us have been working in this field for some time and are familiar with multiple opportunities for "mainstream environmental professionals" to practice their preaching. Here the buck stops. We surely must all be painfully aware by now that without justice, including environmental justice, there can be no peace in our communities.

We look forward to policy changes in facility sitings, enforcement actions, and new funding priorities for environmental education with a watershed scope. We look forward!

Robert E. Boone, Executive Director Anacostia Watershed Society College Park, Maryland

Slanted Political Rhetoric?

I have just finished reading "Expanding the Dialogue: Have Minorities Benefited ...? A Forum" in the March/April 1992 issue of EPA Journal. I found the treatment of this issue totally biased and one-sided.

I grew up on the southside of Chicago in a working class neighborhood in the 1950s through the 70s. Our first home was just blocks away from the stockyards, which filled the air with their own special aroma. In the late 50s we moved farther south (to escape the gang wars), to the edge of Chicago. After about a year at this home, a former clay quarry located about a block to the north was converted into a garbage dump. To the south about two blocks, the Chicago Copper Chemical plant belched out air so polluted that it hurt to breathe, literally. When the winds blew from the northerly direction the stench of putrefied garbage filled the air. When the "lake breeze" would greet us from the east, the air was thick with graphite and sulfur from the mills. I grew up playing by factories which later became Superfund sites. The high school I attended (D. D. Eisenhower) was located within a block of the Clark Oil Refinery-which made the air barely breathable many days of the week.

In the 70s the first environmental laws came into being and the effects were dramatic. Chicago Copper Chemical was forced to close. The dumps ceased activity and the mills no longer darkened the skies. Today this neighborhood enjoys clean air and is no longer threatened with toxic chemicals falling from the sky. No, it's not Beverly Hills, and factories and railroads still ring the area and the hammer from the mill may still be heard at night. The Clark refinery is still located a block from my high school. But the air no longer is filled with its awful smell.

My point is that to portend that minorities have not benefited from the environmental movement is a patently false statement. Those with fewer options (to live where they would like to have lived, for example) may have benefited even more than those who could afford to live and work in areas not threatened by pollutants.

Please, keep your publication free of this slanted political rhetoric, or at least present all sides of an issue.

Richard Rupert Phoenix, Arizona

Building Bridges

Just a short note to congratulate the Journal staff for the outstanding portrayal of the web of race, poverty, and the environment. The many issues spun into that web were presented comprehensively and with sensitivity.

National environmental groups are now confronting the fact that their agendas too often reflect the interests and concerns of the affluent. Local environmental groups tend to address issues and problems defined by land use and greenspace. Now, both can see the issues that people of color and the poor care about.

Let's hope this issue is remembered as EPA's successful effort to build bridges between all races and economic groups concerned about their global and local environment.

John L. McCormick, Commonweal Washington, DC

Get Real!

Having just finished reading the article entitled "Innovative Housing in Atlanta," I was very impressed that someone out there had a great idea to provide housing for the poor, while safeguarding the environment. Home ownership means that you take interest in the community you live in, and it provides a sense of pride, as well as an investment in the future. One flaw is that these homes have only one bedroom for an entire family. However, as the article states, additional bedrooms can be easily added.

Finally, the article states that "the first cottage home has been completed, and eight more are planned this year." Nine homes per year—what fantasy world are you living in? Get real! We need thousands of these homes, and communities built around them. Why is it that in this country, the greatest on Earth, adequate housing is provided to only the upper and middle classes?

Christopher Crigler Denver, Colorado

A Timely Issue

I have today read the March/April edition of the EPA Journal. It is excellent.

Both scientists and non-scientists who want to raise their level of awareness about the broader dimensions of environmental protection in the United States will find the collection of papers in the Journal extremely valuable.

I commend you for having the foresight to devote the March/April edition to such a timely issue.

Bailus Walker, Jr. Professor, Environmental Health and Toxicology Dean, College of Public Health University of Oklahoma

TITANS IN CONSERVATION Rachel Carson by Jack Lewis



Rachel Carson by Una Hanbury, on view at The National Portrait Gallery, Washington, DC.

achel Carson did not live to see the banning of DDT in 1972 or the passage of such landmark legislation as the National Environmental Policy Act. the Clean Air Act, the Clean Water Act, and amendments to the Federal Insecticide, Fungicide, and Rodenticide Act. Yet historians have credited Carson with providing an impetus for all of these groundbreaking laws. The namesake for a new EPA award mandated by the National Environmental Eduction Act of 1990. Carson proved through her writings just how powerful the right blend of professionalism and passion can be.

Rachel Carson was a literary and scientific unknown when she published her first bestseller. The Sea Around Us. The work resulted in a National Book Award for Carson, who by then had spent 16 years at the U.S. Fish and Wildlife Service, many of those years as Editor-in-Chief of its many publications. Today, few people realize that it was this book about the world's oceans and their multitudinous life forms that won Miss Carson global fame, financial independence, and a place in the American literary and scientific establishment. In 1952. Carson quit her job at the Fish and Wildlife Service, and thus ended long years of burning the midnight oil writing in her modest home.

The Sea Around Us was a glorious piece of research, synthesis, and poetic inspiration. Here is Carson's description of changes observable in the world's vast oceans:

"The face of the sea is always changing. Crossed by colors, lights, and moving shadows, sparkling in the

(Lewis was an Assistant Editor at EPA Journal for eight years.) sun, mysterious in the twilight, its aspects and its moods vary hour by hour. The surface waters move with the tides, stir to the breath of the winds, and rise and fall to the endless, hurrying forms of the waves. Most of all, they change with the advance of the seasons. Spring moves over the temperate lands of our Northern Hemisphere in a tide of new life, of pushing green shoots and unfolding buds, all its mysteries and meanings symbolized in the northward migration of the birds, the awakening of sluggish

Milestones

1907 Born in Springdale, Pennsylvania, on May 27th.

1929 Received her B.A. from the Pennsylvania College for Women.

1932 Earned her M.S. in biology at Johns Hopkins University.

1936-1952 Worked as a biologist and editor at the U.S. Fish and Wildlife Service, Department of the Interior, Washington, DC.

1941 Published her first book, Under the Sea Wind, which was respectfully reviewed but not widely popular.

1951 Published The Sea Around Us, which was number one on the U.S. bestseller list for 39 weeks.

1955 Published The Edge of the Sea, another successful book about the world's oceans.

1962 Published Silent Spring, which sold millions of copies throughout the world.

1964 Died at age 56 on April 14th.

Rachel Carson and colleague Robert W. Hines collect specimens in the Florida Keys.

amphibian life as the chorus of frogs rises again from the wetlands, the different sound of the wind which stirs the young leaves where a month ago it rattled bare branches. These things we associate with the land, and it is easy to suppose that at sea there could be no such feeling of advancing spring. But the signs are there, and seen with understanding eye, they bring the same magical sense of awakening."

The Sea Around Us proved that Carson was a poetic and well-informed nature writer. The book that cemented her fame as a scientist, however, was Silent Spring, her world-famous study of pesticides and their harmful effects on human and animal health as well as on the vitality and balance of ecosystems. Thirty years ago this June, *The New Yorker* published selections from the manuscript that had tormented and obsessed Carson for nearly five years, a book that she would have preferred not to attempt, as her health was beginning to fail.

By the time Silent Spring appeared in book form, in September 1962, Rachel Carson was in the eye of a veritable hurricane of acclaim. derision, and controversy. Powerful industry voices ridiculed her concern for dead spring songbirds and attempted to undermine public confidence in her scientific expertise. Time and time again, scientific experts backed up Carson, whose 1932 Master's thesis at Johns Hopkins was entitled "The Development of the Pronephros During the Embryonic and Early Larval Life of the Catfish (Inctalurus punctalus)." Rachel Carson was not daunted by scientific complexity, and her exhaustive research into pesticides has stood the test of time remarkably well.

No American book since Uncle Tom's Cabin won more true believers in such a short time than did Silent Spring. It became the Bible of environmental activists and conservationists of the 1960s, and in the brief two years between the publication of the book and her death from cancer, Carson received more honors and testimonial dinners than her failing health and her native shyness could accommodate.

Silent Spring introduced many readers to the concept of ecological balance. In the book, Carson explained why she believed that pesticides threaten the ecological balance of nature:

"From all over the world come reports that make it clear we are in a serious predicament. At the end of a decade or more of intensive chemical control, entomologists were finding that problems they had considered solved a few years earlier had returned to plague them. And new problems had arisen as insects once present only in insignificant numbers had increased to the status of serious pests. By their very nature, chemical controls are self-defeating, for they have been devised and applied without taking into account the complex biological systems against which they have been blindly hurled. The chemicals may have been pretested against a few individual species, but not against living communities.

"In some quarters nowadays it is fashionable to dismiss the balance of nature as a state of affairs that prevailed in an earlier, simpler world-a state that has now been so thoroughly upset that we might as well forget it. Some find this a convenient assumption, but as a chart for a course of action it is highly dangerous. The balance of nature is not the same today as in Pleistocene times, but it is still there: a complex, precise, and highly integrated system of relationships between living things which cannot safely be ignored any more than the law of gravity can be defied with impunity by a man perched on the edge of a cliff. The balance of nature is not a status quo; it is fluid, ever shifting, in a constant state of adjustment. Man, too, is part of this balance. Sometimes the balance is in his favor; sometimes-and all too often





through his own activities—it is shifted to his disadvantage

"The trouble is that we are seldom aware of the protection afforded by natural enemies until it fails. Most of us walk unseeing through the world, unaware alike of its beauties, its wonders, and the strange and sometimes terrible intensity of the lives that are being lived about us. So it is that the activities of the insect predators and parasites are known to few \ldots ."

Note: Quotations from Silent Spring (Houghton Mifflin, 1962) and The Sea Around Us (Oxford Univ. Press, 1951) are reprinted by permission.

Remembering Rachel

Shirley A. Briggs, President of the Rachel Carson Trust for the Living Environment, has provided these memories of Carson:

"I met Rachel Carson shortly before the end of World War II, when I took a job at the Fish and Wildlife Service as a writer/artist and had an office adjoining hers. where she and Lionel Walford, then Editor-in-Chief, shared space and duties. (Rachel soon became Editor-in-Chief herself.) Rachel and I quickly found that we liked to go bird-watching and otherwise exploring the wild habitats near Washington, and her mother sometimes joined us. Not only were she and Walford remarkably enjoyable people with broad interests in literary and similar fields, but they brought in a variety of engaging people to join us for lunch-sandwiches and tea concocted in the closet. There was always a good deal of merriment on these occasions, with Rachel herself especially good at finding wry humor or downright hilarity in the workings of the bureaucracy, especially coping with the Government Printing Office.

"Editing government reports for publication can be a tedious business, but she cheered us on with humor and a determination to improve the quality of our government publications. Chandler Robbins recalls being a young scientist there then, and how much they learned from her about being accurate and writing with complete clarity, for the public as

well as other scientists. She also believed that government publications should be as attractive and interesting as those from the private sector, and that this does not require more expense, just good design and planning. She devised and got published the Conservation in Action Series, beginning in the 1940s, to explain and make the public appreciate the National Wilderness Refuges. (Compare these with the format of then current GPO design, if you can, to see the difference.)

"Rachel's government job was essential to support her family-her mother and two nieces-so her ambition to write more broadly, combining her talent for writing with her knowledge of science, left her writing on weekends and late at night. Her second book, The Sea Around Us, published in 1951, gave her the broad recognition as both a scientist and a writer of remarkable ability, and also the income for financial independence. She could then resign from Fish and Wildlife, to the dismay of many people, and devote herself to writing.

"Without the reputation The Sea Around Us gave her, and enough money to be invulnerable to the rough tactics of the commercial interests that opposed her, Rachel would not have been able to write Silent Spring. EPA has often credited this book and the environmental movement it launched for the existence of the Agency."

Taking The Pulse Of Our Renewable Resources

A Book Review by Douglass Lea

"H ow am I doing?" asked a former mayor of New York City at virtually every opportunity a few years ago. In both public and private spheres, it seems, the human species exhibits a characteristic preoccupation with taking our own temperature and measuring our surroundings.

In that most public domain of all-the environment-essentially the same question is increasingly asked: "How is it doing?" Government agencies and environmental organizations alike devote a great deal of effort to producing answers to that very question-and to many others far more arcane. International organizations, especially those associated with the United Nations and with national agencies engaged in foreign aid, have mounted an impressive array of global monitoring programs to report on the status of everything from local habitats and flora and fauna to population growth, agricultural production, and isotopes in precipitation. Many of these activities suffer from certain chronic problems: insufficient funds; conflicts with vested interests; security and proprietary concerns; red tape; tardiness; incompleteness; and incompetence.

(Lea is a contributing editor to EPA Journal.)

CROSS CURRENTS

In the data-gathering sector, the Third World, understandably, trails the richer countries. The World Resources Institute (WRI) recently urged the latter to provide "a data tithe" to help the former "improve statistical operations and generate information of immediate use both to them (the developing countries) and to the world community."

The U.S. Council on Environmental Quality, based in the Executive Office of the President, is known to the world mainly through its annual report on the status of selected environmental problems. The European Community (EC) has authorized the establishment of an environmental agency to gather data and generate similar reports. However, the start of the agency's operations has been delayed while the French try to secure a guarantee from the other member countries that the EC parliament will continue to meet on French territory, in Strasbourg.

Both WRI and the Worldwatch Institute in recent years have conducted a worldwide trade in their periodic pronouncements on the state of the world. Less ambitious, perhaps, are the publications of other environmental groups with more specialized interests. But the underlying drive remains the same—to make an authoritative statement, to attract attention to the organization itself, and, of course, to spotlight looming problems. Seldom do such publications bring good news.

An exception is America's **Renewable Resources: Historical** Trends and Current Challenges, edited by Kenneth D. Frederick and Roger A. Sedjo (Washington, DC: Resources for the Future, 1991; 296 pages). It says that conditions are not so bad after all. at least not in certain categories of renewable resources: forests. rangelands, water, and some varieties of wildlife. The team of distinguished researchers brought together by Resources for the Future (RFF) does find, however, that wetlands are in bad shape and that erosion continues to threaten soil productivity.

In contrast to the data mania that marks most state-of-the-environment publications, this book reads like history. The editors chose a historical approach for sound methodological reasons: It allows them to produce a book that describes in sweeping terms how the quantity and quality of America's forests, waters, rangelands,



soils, croplands, and wildlife have changed over the last century and how human intervention has contributed to changes in the resource base. "As such," write the editors, the book "is a record of one country's experience with the ingredients of sustainability that will be instructive in managing future demands on the resource base, in the United States as well as in other parts of the world."

The premise here is that much can be learned about current and future problems in renewable resources through a better understanding of past changes in the condition, use, and management of each resource. Popular perceptions tend to be strongly influenced by short-term conditions. Media reports of crop failures, droughts, fires, blights, floods, and other problems are likely to be accompanied by dire forecasts of impending catastrophe. Such reports can seriously distort rational policy making.

The RFF writers are aware of this danger: "Differentiating between long-term trends driven by fundamental conditions and largely ephemeral events that place a nation's food, timber, or water resources under stress is not an easy task." Nevertheless, they insist that the effort must be made and that the distinction is important to the making of good resource policy. "Understanding past trends in the condition and use of the resources and how society has responded to prior resource stress." they write, "is an important step in making that distinction."

The authors write that, at the beginning of the European occupation, the continent had been little marked by the subsistence farming and hunting of the two million Native Americans then living in the area. Even two centuries after European exploitation began, the land's material resources were still enormous compared to the demands being placed on them. Abundant resources were there for the taking, and early settlers, of course, had no choice but to take.

This habit persisted. When bustling commercial centers began to depend on the agricultural and forestry products of the interior, these habitual practices became destructive. Large areas of forest were gradually converted to cropland and to pasture for grazing domestic animals. By 1920, according to the authors, "about 384 million acres or 40 percent of the indigenous forest and the attendant wildlife habitat had been cleared." Meanwhile, a public outcry, led by the founders of the conservation and environment movements, ushered in the era of modern management techniques.

The good news in this volume derives largely from the eventual success of some of those techniques. including specific programs aimed at preserving and protecting important portions of the country's resource base. changes in federal land management practices, and recent legislative initiatives in environmental regulation. To claim victory (or at least partial success), it helps, of course, to confine one's terrain to an area where success is most likely-that is, it helps to focus on resources which are, by definition, renewable. Fortunately, the country's renewable resources have displayed considerable resilience and a capacity to restore themselves once abusive and exploitative uses are removed or sharply curtailed.

Resource uses have also changed. More efficient technologies have enabled managers to consume fewer resources and stretch them farther. The forest industry, for example, has reduced processing wastes and increasingly used a greater range of wood types, residues, and fibers. Unintended side effects and byproducts are constant hazards of high-technology management of natural resources. The chemical fertilizers and pesticides employed by modern agriculture to generate high yields carry the unfortunate cost of widespread contamination of water supplies and aquatic habitats.

America's Renewable Resources: Historical Trends and Current Challenges is a significant contribution to the environmental debate on at least three counts. First, it demonstrates convincingly that the good news about the sustainability of renewable resources is not really possible without self-conscious management and compatible institutions that "establish the economic incentives for producing or conserving resources and that impose a set of constraints on these activities." Second, by building on the historical context of environmental policy, the book is a healthy reminder of the importance of scale and time in understanding the intersection of phenomenon and policy. And finally, this book shows that an account of the state of the environment can be credible and informative without being boring, routine, or self-serving.

ON THE MOVE



Leon Hampton, Jr. is the new Director of the Office of Small and Disadvantaged Business Utilization (OSDBU).

His leadership comes at a time when the office faces important challenges. To meet them, he plans to identify opportunities for better service for the small disadvantaged businesses which seek an opportunity to participate in EPA procurement grants and other requirements, to produce greater productivity through quality management, to improve ties to other offices and programs in the Agency, to build on an already good record in placing even more set-aside funds with minority- and women-owned firms, and to strengthen the office's role as an advocate and ombudsman for small businesses in all EPA activities.

For the past three years Hampton served as Program Advisor to the Director in EPA's Office of Civil Rights. He spent eight years at the Department of Commerce in the Minority Business Development Agency—the last four years as the assistant director for external affairs, which involves overseeing that agency's congressional and legislative program, the public affairs and public information office, and the advocacy program.

From 1979 to 1980, he was a consultant to Resources, Inc., a Washington, DC-based, minority-owned research and management firm specializing in minority business and equal employment opportunity issues. Before that, he served as deputy executive director for the National Bankers Association and as assistant to the administrator at the U.S. Small **Business Administration. Hampton** began his federal career as a legislative aid to former U.S. Senator Marlow Cook of Kentucky, specializing in federal activities in Kentucky, including EPA programs. He has received awards from several Kentucky communities for assistance in using federal grant programs and from minority business groups, including the Martin Luther King award for advocacy presented by the Greater Cleveland Roundtable and an outstanding service award from the Nevada Black Chamber of Commerce.



South Coast Air Quality Management District photo.

The pollution clean-up challenge is no longer restricted to a few large sources. In the Los Angeles metropolitan area, manufacturers have reformulated charcoal lighter fluid to comply with a rule designed to limit emissions of hydrocarbons.

Back Cover: Relic from an earlier era—an old gasoline pump that dispensed leaded fuel. See article on page 38 explaining how EPA's phasedown of lead in gasoline helped usher in new approaches to environmental protection.

Photo by Everett Johnson for Folio Inc.

