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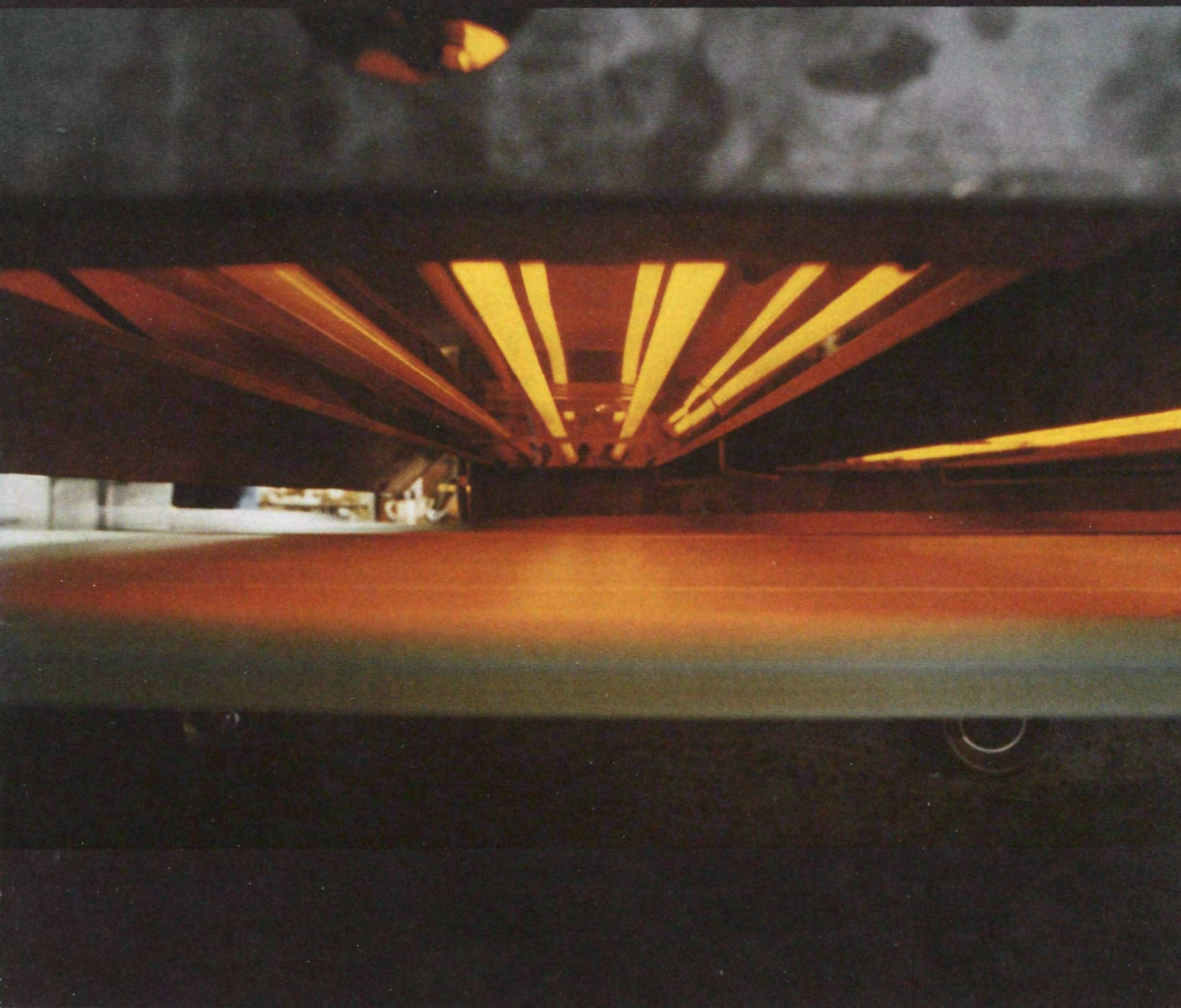
Pollution Prevention

It's a Whole New Way of Doing Business . . . .



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Front cover: Pollution prevention pays off for Sani-Top, Inc., of Gardena, California, which uses waterborne adhesives and fast, infrared curing to produce 22,000 linear feet—about four miles—of kitchen counter tops daily. This technology helps profits and facilitates compliance with recently tightened Southern California air quality regulations. Southern California Edison photo.

A Magazine on National and Global Environmental Perspectives

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From the Editors

Yes, Virginia, it is possible to protect the environment and save money at the same time. The key is pollution prevention, a new approach that in its infancy has gone by such names as waste minimization and source reduction.

More to the point, pollution prevention is also being called a "win/win" strategy by its proponents at EPA and in industry, state government, and environmental groups. As a number of case studies show, pollution prevention strategies can reduce waste while cutting regulatory compliance and clean-up costs by dealing with pollution "upstream" at its source, rather than at the point of pipeline emissions. Sound too good to be true? There's more. By prompting companies to take a hard look at the overall efficiency of their production processes and make strategic changes to minimize waste and inefficiency, pollution prevention tactics can bolster profit margins, giving environmentally progressive companies a competitive edge. Three case studies presented in this issue of *EPA Journal* suggest how this can work.

So far, so good. But if pollution prevention is demonstrably such a great thing, to touch on a question posed by one of our contributors, why isn't everybody already doing it? In fact, while there are many success stories, such as those compiled by the pioneering research group INFORM, the indications are that industry has barely tapped its potential for pollution prevention. The reasons for this, according to the experts, include institutional as well as financial, technological, and regulatory barriers to preventive courses of action. How do these barriers operate, and what can be done to overcome them? Contributors to this issue of *EPA Journal* grapple with these and related questions. Join us. □

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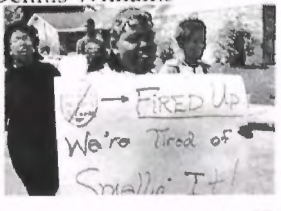

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More Cities Exceed "Action Level" for Lead in Drinking Water

The latest round of monitoring reveals that high-risk homes in 819 out of roughly 7,500 communities served by large and medium-sized public water systems exceed the lead action level of 15 parts per billion (ppb) set by EPA under the Safe Drinking Water Act. Large systems are those that serve more than 50,000 people, medium sized those that serve between 3,301 and 50,000. High risk homes are those whose service or interior pipes were made of lead or whose interior pipes were made from copper with lead-soldered connections and were installed after 1982. A previous round of monitoring gathered test results only on large public water systems. (See last issue of EPA Journal.*) EPA Administrator Carol Browner said: "The reduction of children's exposure to lead is one of EPA's top priorities. While systems with elevated levels are required to reduce their lead levels through corrosion control measures, there are also important steps that consumers can take to help prevent exposure and increase safety."*

The Wall Street Journal said: " . . . More than 10 percent of the U.S. population draws its drinking water from systems containing unsafe levels of lead, according to a study by the Environmental Protection Agency. The survey found that 819 water systems serving 30 million people exceed the legally permissible lead level of 15 parts per billion. The EPA collected data on 6,400 water systems around the country between July and December 1992. Although the findings far exceed the EPA's previous estimates of lead contamination in the nation's water supply, they don't mean that 30 million people are consuming unsafe water. Rather, they mean that 30 million people draw their water from a system which, when tested in certain high-risk residences such as those served by lead service lines or containing lead interior piping, is found to exceed the legal limit more than 10 percent of the time . . . . Nevertheless, the findings are likely to stir further concern about the problem of lead in the water supply, not least because the results don't include an additional 1,100 water systems that failed to report their lead levels to the EPA . . . . The EPA found lead levels especially high in smaller cities, which tend to have less sophisticated treatment for their drinking water. Among the cities with the highest levels were Gross Pointe Park, Mich., found to have 324 parts per billion; Goose Creek, S.C., 257 parts per billion; and Honesdale, Pa., 210 parts per billion . . . . Among larger cities, the highest levels of lead were found in Charleston, S.C., which had 165 parts per billion; Utica, N.Y., 160 parts per billion; and Newton, Mass., 123 parts per billion. Massachusetts fared poorly in the survey, with five cities—Newton, Waltham, Brookline, Medford, and Chicopee—among the top 10 in lead levels for water systems serving more than 50,000 people. In general, lead levels were highest in areas with older housing and public-works systems, in which lead pipes are more common . . . ."

Steve Delaney photo.

The Washington Post reported: " . . . Last fall, EPA reported on its first round of monitoring of the nation's largest municipal water systems, finding that 130 of the 660 systems exceeded the agency's "action level" of 15 parts per billion (ppb) in 10 percent or more of households at high risk because of lead pipes, joints, or solder. Such use of lead was banned in 1986. The report issued yesterday includes results of a second round of testing in the largest systems—serving 50,000 or more people—plus new information on medium-sized systems. Water systems cited by the EPA do not pose risks to all water users because the agency requires testing only of those households believed to be at high risk. Exposure to lead is considered the nation's most serious environmental threat to children, and exposure from water is the second largest source after ingestion of lead-based paint. Lead causes a variety of health problems in children and adults, including impairment of mental abilities in children . . . ."

EPA Launches *Natural Gas Star* Program

In the latest of its *green* partnerships with industry, EPA has signed agreements with 14 natural-gas transmission and distribution companies under which they will voluntarily accelerate programs to reduce methane leaks to the atmosphere. Methane, the primary component of natural gas, is 20 times more powerful than carbon dioxide in trapping heat in the Earth's atmosphere. EPA estimates that by the year 2000 *Natural Gas Star* will reduce methane emissions by one million metric tons, the equivalent of taking three million cars off the road. The original partners to the program represent about 30 percent of the industry; they have agreed to expand the use of new equipment to recover fumes during pumping operations and to repair leaking pipes and equipment more quickly. They are expected to save about $50 million worth of gas a year. The 14 companies are: Tenneco Inc., Southern California Gas, Pacific Gas and Electric, Brooklyn Union Gas, Atlanta Gas Light, Washington Gas, Citizen's Gas and Coke Utility, ANR Pipeline Co., Consolidated Edison Co. of New York, Louisville Gas and Electric Co., Natural Gas Pipeline Co. of America, MidCon Texas Pipeline Corp., Public Service Co. of North Carolina, and Transcontinental Gas Pipe Line Corp.

Oxygenated Gasoline Cuts Winter Emissions of Carbon Monoxide

In 20 cities where for the first time gasoline was required to be oxygenated last winter, preliminary data show that carbon monoxide (CO) levels exceeded the health standard on only two days—one each in Provo, Utah, and Missoula, Montana. The year before, CO exceeded the standard a total of 43 days in the 20 cities. Some motorists have complained that pumping the new gas has caused them dizziness or headaches. EPA is working with the Centers for Disease Control, the state of Alaska, and with industry to conduct additional research on the effects of the fuel; the Agency expects to have the results of the research before the 1993-94 season.

The Wall Street Journal reported: " . . . A new federal program to cut carbon monoxide emissions from automobiles has sharply reduced the number of days on which various cities failed to meet air quality standards, the Environmental Protection Agency said. The program, initiated under the 1990 Clean Air Act, requires that 39 metropolitan areas dispense specially blended "oxygenated" fuels at gas stations during the winter months. By improving engine combustion, the fuels reduce carbon monoxide emissions, which are generally highest in winter because of slow-starting cars and stagnant air . . . . Although weather can be a factor in the amount of carbon monoxide in the atmosphere from year to year, environmentalists attributed much of the change to the new program. 'It certainly is consistent with what we had hoped would occur,' said Blake Early, a Washington representative of the Sierra Club. But doubts remain about the health effects of one of the oxygenated fuels used in the new program, methyl tertiary butyl ether. The National Centers for Disease Control and Prevention is investigating reports that MTBE has caused headaches and dizziness among motorists in Alaska. The EPA is studying the problem and expects its research to be complete by the end of October . . . ."

The Times (Trenton, New Jersey) commented: " . . . Carbon monoxide air pollution in eight of New Jersey's southern counties, including Mercer and Burlington, has stayed below federal standards for the second consecutive winter, but the improvement is attributed to gasoline that contains a chemical suspected of causing health problems . . . . Carbon monoxide can cause headaches, nausea, fatigue, and similar ailments when levels exceed the federal standard of 9 parts per million. There have been numerous complaints from service station attendants and others exposed to gasoline fumes, including commuters routinely stuck in traffic jams, that MTBE (methyl tertiary butyl ether), the key ingredient in oxygenated gasoline, causes the same problems. The oxygenated gasoline, which federal law requires be sold during the winter in New Jersey and 39 other regions where carbon monoxide exceeds health standards, contains 15 percent MTBE. The additive increases the oxygen level in the gasoline, making it burn more completely during the winter when cold weather causes engines to run less efficiently. 'It's a curiosity to us why New Jersey motorists would be exposed to the oxygenated fuels during the winter,' said John Holtz of the New Jersey Petroleum Council. 'There are no self-service sales and there are vapor capture nozzles to capture the fumes. It just seems unlikely that New Jersey motorists would be exposed to enough fumes to make a difference . . . .' Further studies are under way but there is no immediate prospect that MTBE will be taken out of gasoline. Gasoline sold since 1979, when lead was phased out as an additive, has contained about 3 percent MTBE, Holtz noted. 'It's not a new additive,' he said, noting that the American Petroleum Institute has commissioned its own studies . . . ."

Steve Delaney photo

New Rules to Reduce Diesel Bus Emissions

EPA has set new standards to reduce toxic particulate emissions from both new and existing diesel buses. Particulates, or soot, are small carbon particles that can lodge in the most sensitive tissue of the lungs and boost incidence of respiratory infections, bronchitis, and asthma attacks.

For new buses, 1994 and 1995 model engines must meet a 0.07 gram standard. Bus engines manufactured in 1996 and later will have to meet a 0.05 gram standard. The current particulate standard for new buses is 0.10 gram. Engine manufacturers are expected to use trap oxidizers or catalytic converters to control the particulates. They are also producing bus engines that use clean alternative fuels like compressed natural gas or alcohols.

For older diesel buses, EPA has set new emissions standards that reflect the best retrofit technology achievable for engines being replaced or rebuilt. These standards, which go into effect in 1995, will affect cities with populations greater than 750,000—80 percent of the country's bus fleet. Operators may choose between installing equipment certified to meet a 0.10 gram particulate emission standard or use a fleet averaging program. The fleet averaging program requires that average emission levels meet a specific target level for each year based on the distribution of engine age, engine model, and an EPA estimate of when the engines will be rebuilt. EPA estimates that the program will cost $37 million annually in the early years, but that the cost will decline rapidly as older buses are retired.

EPA rules also require that low-sulfur fuel be used in all diesel vehicles beginning in October of this year. The low sulfur fuel contains 80 percent less sulfur than diesel fuels currently available and makes it possible to use catalytic converters and trap oxidizers to reduce engine emissions. The use of low-sulfur fuel will also extend engine life.

Ongoing Enforcement

Circle K to Pay $30 Million to State UST Trust Fund

Under a bankruptcy court settlement with EPA, the Department of Justice, and the National Association of Attorneys General (coordinating litigation for numerous states), the reorganized Circle K Corp. will pay $30 million into state trust funds set up to compensate the states and landowners for the potential costs of cleaning up contamination from underground storage tanks at the more than 1,000 convenience store/gas stations the company operated before filing for bankruptcy. The combination stores and gas stations are located in 30 states and two Indian reservations; the majority are served by older tanks, up to half of which are estimated to leak. Under the settlement agreement, the reorganized Circle K will also be fully responsible for complying with all state and federal environmental laws at the outlets the company will continue to operate.

Louisiana-Pacific to Pay $11.1 Million in Penalties, $70 Million for Controls

Under a settlement agreement, Louisiana-Pacific Corporation of Portland, Oregon, a leader in the wood products industry, will pay $11.1 million in civil penalties for failure to comply with permitting procedures under the Clean Air Act. This is the largest penalty ever paid under that Act and the second largest paid under any federal environmental laws. (Texas Eastern Natural Gas Pipeline paid $15 million in 1987 for violations of the toxic substances and hazardous waste laws.) Under the agreement, Louisiana-Pacific will also install state-of-the-art control equipment at 11 of its facilities in nine states. The equipment is valued at approximately $70 million. Under the laws, a company that intends to construct or modify a major facility that will emit air pollution must first obtain a permit. The permit application must describe the nature of the emissions. Louisiana-Pacific failed in some instances to obtain permits and in others obtained them using misleading information. Inspections of a number of facilities that manufacture oriented strand-board, a wood panel product, found high levels of particulates, carbon monoxide, nitrogen oxides, and sulfur dioxide. Eleven state agencies, eight EPA regional offices (as well as headquarters), and the Justice Department put the case together.

$900,000 Penalty for Inaccurate Ear Plug Labels

Under a consent decree filed in U.S. district court in Boston, Cabot Safety Corporation of Southbridge, Massachusetts, and Siebe North Inc. of Charleston, South Carolina, will pay a $900,000 civil penalty for labeling hearing protection devices inaccurately. Tests performed by Cabot under the supervision of EPA and the National Institute of Occupational Safety and Health revealed that protectors manufactured by the companies provided only 50 percent of the noise reduction claimed on the

Uniform Water Quality Standards Proposed For Great Lakes

In a cooperative effort with the Great Lakes states and Indian tribes, EPA has proposed uniform standards of water quality that would protect human health, aquatic life, and wildlife throughout the Great Lakes Basin. The proposal, culminating four years of work by the Agency and the states—Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin—includes detailed requirements for achieving the standards through permits issued under the National Pollutant Discharge Elimination System. In announcing the proposal, Administrator Carol Browner said: "The special nature of the Great Lakes ecosystem requires our full attention. The lakes are extremely vulnerable to persistent pollutants that accumulate in the food chain. As a result, the ecosystem's wildlife has reproductive defects and tumors; human health is threatened through consumption of fish and shellfish . . . ."

The Chicago Sun Times reported: " . . . A single, tougher set of limits on toxic pollution of the Great Lakes could lead to the end of warnings about eating lake fish . . . . The voluminous package of regulations, called the Great Lakes Water Quality Initiative, will replace the current mixed bag of standards set by each of the eight Great Lakes states. That has meant that industrial or municipal pollution levels that are illegal in one state might be legal in an adjacent state, despite the fact that lake water flows freely across state lines. The proposed water-quality initiative, announced in Washington, DC, by Environmental Protection Agency Administrator Carol Browner, targets 38 chemicals that are known or suspected to "bioaccumulate" in the Great Lakes ecosystem. Tiny amounts that are eaten by small fish accumulate in the tissue of the larger fish that eat them and which are in turn eaten by humans and wildlife. The chemicals, including mercury, polychlorinated biphenyls (PCBs) and some now-banned pesticides such as DDT, have been linked to lowered birth weight and slower mental development in human infants and birth and reproductive problems in wildlife . . . ."

The Cleveland Plain Dealer commented: " . . . The federal government, compelled by a judge to end four years of delays, yesterday proposed sweeping new limits on the discharge of poisons into the Great Lakes. The pollutants show up in water supplies, endanger swimmers, make fish unsafe to eat, and threaten numerous species of wildlife, environmental officials say . . . . The rules primarily are aimed at curtailing discharges of 31 pollutants from factories and sewage treatment plants. In Greater Cleveland, the steel and chemical industries, along with municipalities and average property owners, are likely to be most affected. Higher taxes or sewer rates are possible: In Lima, Mayor David Berger estimated a $134 million pricetag to government and industry. To upgrade the city sewer system, annual rates could zoom from $200 to $800. In setting new restrictions on toxics, the government is for the first time taking into account an entire ecosystem—the eight-state, Minnesota-to-New York watershed from which 23 million people obtain drinking water. The EPA estimates the new limits would exact costs on some 3,800 communities and companies now discharging toxic chemicals in lakes Erie, Huron, Ontario, Superior and Michigan . . . ."

The Wall Street Journal said: " . . . The eagerly awaited rules, which would be enforced by the states and, as a last resort, by the EPA, are designed to protect human, animal and plant life. Implementing them is expected to cost industries and municipalities that discharge water pollutants in the region $230 million, according to the EPA. Among the industries likely to be hardest hit are paper, petroleum, chemicals, and steel. Karen Neale, executive director of the Great Lakes Water Quality Coalition, which represents industrial and municipal dischargers of waste water, said she had 'major concerns' with the initiative, which she said would bring 'minimal improvement' to water quality while placing 'very expensive' new burdens on industry. But Rebecca Shriner, an activist with the National Wildlife Federation, hailed the release of the rules, which was delayed during the Bush administration, 'as a victory for the public and the health of the Great Lakes.' The proposed rules, which will be published in the *Federal Register*, aren't expected to be made final for two years. Once in place, states would have two years to enact procedures in accord with the rules; if they don't act by then, the federal government will assume responsibility for enforcement. Under the proposal, violators would be punished by either the states or the federal government with fines of $25,000 per day per violation. Under the proposed regulations, states would be directed to enforce limits on emissions of 20 pollutants that are threatening to human health, including mercury, dioxin, PCBs, and dieldrin. They will also set limits on 16 pollutants threatening to aquatic life, and four pollutants threatening to wildlife . . . ." □

label. EPA regulations, issued under the Noise Control Act of 1972, require that manufacturers of hearing protection devices test their products under protocols specified by the Agency and label the products accordingly.

Pollution Prevention Takes Center Stage

by Carol M. Browner

No longer confined to special projects, the new approach will be integrated into all programs

Steve Delaney photo

(Browner is Administrator of EPA.)

The Pollution Prevention Act established a new national policy for environmental protection: "that pollution should be prevented or reduced at the source whenever feasible . . . ." This deceptively simple statement heralds a profound change in how EPA meets its obligations to protect human health and the environment. In the past, we emphasized "end of pipe" treatment of waste after it was produced. Today, we must move upstream in the manufacturing process to prevent the waste from being generated in the first place.

By now, the arguments for this change in emphasis are widely accepted as common sense. Improvements in treatment and disposal techniques have led to dramatic reductions in pollutant loadings, but they have proved costly, and they have barely kept pace with traditional problems, let alone managing new ones. Perhaps most disturbing, some of the investments driven by our single-media decision-making process have simply shifted waste from one part of the environment to another.

For example, wastewater treatment plants built to satisfy federal water quality requirements are now among the biggest source of toxic air emissions at industrial facilities and in some urban areas. With environmental spending approaching 2 percent of gross national product by some estimates, it has become critical to ensure that our investment is as efficient as we can make it.

Wastewater treatment plants can be major sources of toxic air emissions. Pollution prevention promises a way to avoid transferring pollution from one environmental medium to another.

Pollution prevention is the answer. Reducing waste at the source not only minimizes the cost of treatment and the transfer of pollution, it can actually strengthen our economic competitiveness through more efficient use of raw materials. For example, the 1992 study by the nonprofit organization INFORM, Inc., documented savings of $21.8 million from source reduction activities at 14 chemical plants. Preventing pollution, then, offers the exciting possibility of reconciling economic growth with environmental protection to enhance the quality of life for ourselves and our children. What can EPA do to achieve the Clinton-Gore Administration's commitment to prosperity and a clean environment, two deeply held American values?

It is critical to ensure that our investment is as efficient as we can make it.

Actions always speak louder than words, and we have already taken steps to reflect our commitment. For example:

- The Administration's budget request for the 1994 fiscal year includes a $33 million increase in spending for pollution prevention programs at EPA.
- On Earth Day, the President announced his commitment to an Executive Order establishing voluntary source reduction goals for procurement and requiring federal agencies to comply with Right-to-Know reporting requirements for toxic chemical wastes.
- On May 25, I released new Pollution Prevention Act data on the type and amount of toxic chemicals generated as waste and announced my intention to expand Right-to-Know to include additional chemicals and sources of pollution.

We can be proud of these accomplishments, but they are only a starting point. We must go further by integrating pollution prevention into all of EPA's traditional activities. At the same time, we must acknowledge that the fundamental nature of our base programs must evolve to create a more hospitable environment for the transition from "end of pipe" treatment to pollution prevention.

- That will mean more innovative use of traditional tools like regulations at the same time that we invest in voluntary programs that recognize industries for going beyond compliance.
- It will require us to work across program boundaries to coordinate different rules that affect the same industry, providing the regulated community with greater certainty and incentives to develop multi-media compliance strategies.
- It will require greater flexibility in grants to states, and improved working relationships with other federal agencies that have a profound influence on the environment through their own behavior or policies.
- It will mean strengthening public data programs that both measure and motivate progress in reducing waste at the source, while reducing burdensome

paperwork requirements that serve no clear purpose.

- It will require strengthening our investment in technical assistance programs that help small businesses find more cost effective ways to comply with the law through pollution prevention.

Taken together, these changes in direction will lead to a "user friendly" EPA, without sacrificing our commitment to the highest standards of environmental performance. As a user friendly agency, we will establish clear and consistent expectations for states, the public, and the private sector, provide incentives for investments in pollution prevention in our regulatory and compliance programs, target information and technical assistance where it will do the most good, and eliminate redundant transaction costs.

None of this would be possible without the enthusiastic support that EPA employees have already shown for change. On June 15, I signed an Agency-wide policy statement establishing basic expectations for the transition to pollution prevention. It builds on the first steps that EPA staff have already taken through initiatives like the Source Reduction Review Project, new grant flexibility for states, Design for Environment, and the Green programs. It also announces a broader effort to build pollution prevention into the "corporate culture" at EPA.

Our transition to this new environmental ethic will succeed only if we are willing to question established practices, cooperate across program and agency boundaries, and not hesitate to acknowledge shortcomings as well as success stories. I know that EPA employees share my excitement at the expanded possibilities for pollution prevention in the Clinton-Gore Administration, as we work together to chart a new course for environmental protection. □

An Ounce of Pollution Prevention?

It is Benjamin Franklin who is usually credited with the maxim *an ounce of prevention is worth a pound of cure*, although Franklin, himself, conceded that the sayings in *Poor Richard's Almanack* were derived from the wisdom of many ages and nations. Poor Richard also said: *"Tis easier to prevent bad habits than to break them."* Was he troubled by the vision thing and trying to tell us something? *Forewarn'd, forearm'd*? The trouble with pollution prevention is that it wears many faces and is not always easily recognized. (What's more—bite thy tongue—it's not always feasible. How, for example, should we apply it to the problem of radon?) Designing an automobile engine to burn gasoline more completely, and thereby emit less carbon monoxide, is pollution prevention; hanging a catalytic converter on the tailpipe is not. Similarly, EPA's "green" programs, which conserve electricity, prevent pollution (electricity generation accounts for 35 percent of all U.S. emissions of carbon dioxide); planting trees does not.

The Pollution Prevention Act of 1990 sets up a hierarchy of preferred approaches to protecting the environment. First and foremost, pollution should be prevented at the source whenever feasible. Pollution that cannot be prevented should be, in order of preference, recycled, treated, or as a last resort, disposed of in an environmentally safe manner. Operationally speaking then, pollution prevention is source reduction, which is further defined in the Act as any practice that reduces the amount of any pollutant entering any waste stream. This applies to all activities in our society, including those carried out in the energy, agriculture, consumer, and industrial sectors. Restricting development to protect sensitive ecosystems like wetlands is pollution prevention, as is cultivating crops that have a natural resistance to pests. Wrapping a blanket around your water heater is pollution prevention, and so is using energy-efficient lightbulbs.

Library of Congress photo.

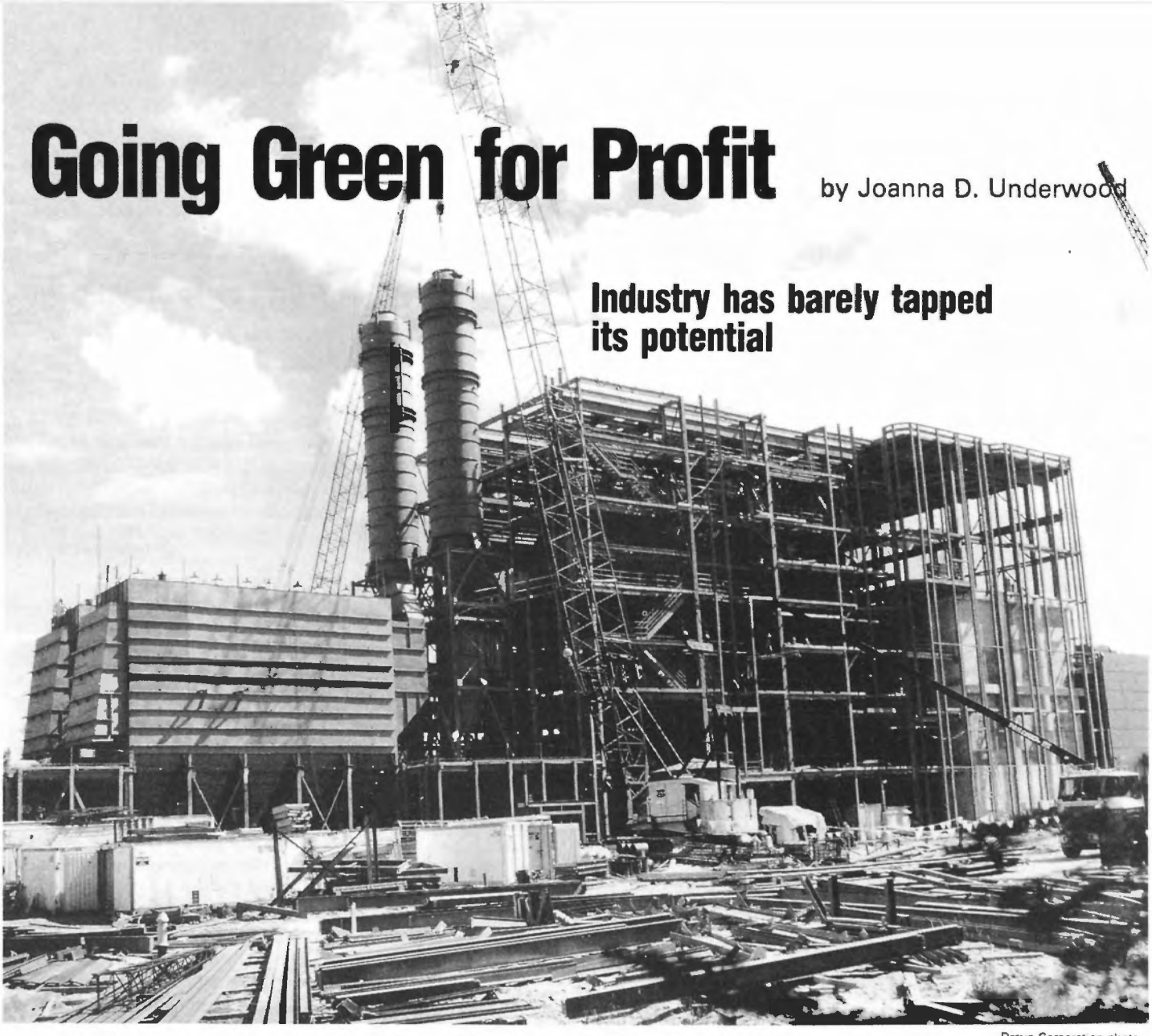
Sounds easy. Pollution prevention is not one of the many tools that can be applied to manage environmental problems (see the May/June 1992 issue of *EPA Journal*); rather, it is the ideal result that all management programs should try to achieve. The trouble is we've had so little experience pursuing pollution prevention that when we get down to making real choices it sometimes eludes us. We may have to compare products over their entire life cycles—mining, manufacturing, use, re-use, disposal. Now that they are both recyclable, which should we use, paper or plastic grocery bags? Paper biodegrades, but not in most landfills, and it is both bulkier and heavier to handle. Plastic manufacture has an image as a pollution intensive industry, but paper making is too. In fact, when pollution prevention has been the result, it has sometimes been inadvertent: It is the rising costs of landfilling, for example, that has persuaded many companies to reduce the solid waste they generate. As Poor Richard advised: *Would you persuade, speak of Interest, not of Reason.* In this issue of the *Journal*, individual companies describe their reasons for adopting pollution prevention as corporate policy and how they went about putting it into practice.

—Eds.

Going Green for Profit

by Joanna D. Underwood

Industry has barely tapped its potential



Dravo Corporation photo

Part of the vocabulary of environmental cleanup that gained currency in the early 1970s, "scrubbers" are end-of-pipe devices for air pollution control. These 100-foot scrubber towers belong to the Portland, Maine, waste-to-energy plant, shown under construction in 1987.

Largely overlooked in this year's Earth Day reportage was the Clinton Administration's promise of a "broad-based culture change" that would make preventing pollution the watchword of federal environmental protection. This is a significant strategic change, a shift in emphasis from pollution control and cleanup to pollution *avoidance*. As such, it holds great promise for measurable results.

Also noteworthy are the new reporting requirements for federal facilities (including defense establishments) that now must file publicly accessible reports on the waste they generate and their emissions of toxic substances. In addition, the President ordered the stepping up of federal purchases of cleaner, alternative fuel (non-gasoline) vehicles. Overall, this new emphasis on prevention marks a potential watershed in our government's approach to environmental problems. EPA Administrator Carol Browner put the matter succinctly: "Twenty years of end-of-pipe regulation have taught us an important lesson: The best way to clean up the environment is to prevent environmental deterioration in the first place."

That lesson was hard learned. Environmental protection is by no means the simple matter that celebrants of the first Earth Day thought it would be back in 1970. In the early seventies, under the first U.S. environmental laws, the script was simple and the prognosis optimistically clear: The new EPA would identify all dangerous pollutants, then set and enforce standards for safe levels of exposure; businesses, with their technical know-how, would respond accordingly.

As part of the new-found awareness, terms like "baghouses" and "scrubbers" and "electrostatic precipitators" soon came into use, even in the public media. While the clean-up effort might cost a lot, we were sure it would work. U.S. environmental problems would be solved, and we

(Underwood is founder and President of INFORM, Inc., a New York-based, nonprofit environmental research organization whose most recent publication is Preventing Industrial Toxic Hazards: A Guide for Communities.)

The great majority of companies in our sample have not established programs that would make aggressive pollution prevention possible.

expected the solution to be quick! We would have air safe for every citizen to breathe by 1975 and zero discharge of pollutants into waterways by 1977 . . . or so we thought.

Twenty years ago, we hadn't counted on dealing with environmental contaminants whose levels of safety we could not assess, making standard setting difficult. The technical fixes we *had* counted on haven't provided a magic cure. Efforts to cope with toxic waste often resulted in the all too familiar "toxics shell game," just moving hazardous materials from one environmental medium to another without effectively getting rid of them. Moreover, the costs involved have skyrocketed.

The immensity of our pollution problems underscores the need for strong federal leadership to promote source reduction—to motivate makers and users of toxic chemicals to find their own preventive solutions. Consider the following:

- In 1990 some 4.8 billion pounds of about 320 specific toxic chemicals or chemical groups were released into the air, water, or land or transferred to treatment and disposal facilities by the nation's 23,638 largest industrial users of these chemicals. These represent but a fraction of the 70,000 chemicals in commercial use. Of course, large industrial chemical producers are but one source of toxic waste.

- More than 200,000 plants, ranging from mom-and-pop operations to companies employing thousands of risk-exposed workers, make or use chemicals in the United States. Tens of thousands of nonmanufacturing facilities such as waste treatment plants, farms, public utilities, and small businesses such as dry-cleaning operations also use toxic chemicals and discharge chemical waste.

- The current yearly cost of complying with federally mandated pollution-control and clean-up programs is estimated at $115 billion. This compares to roughly $26 billion in 1972.

Perhaps the most important progress over these two decades has been our growing recognition of the complexity of ecological realities and how little we have understood the damage that human activities have inflicted on our natural resources.

In the industrialized world, since the turn of this century, a massive, unprecedented use of fossil fuels for energy, transportation, and industrial activities has been at the heart of our modern lifestyles. Fossil fuels have given us a variety of goods that are the envy of much of the world: plastics, cosmetics, adhesives, solvents, clothing, pharmaceuticals. But these benefits have come at a heavy price—resource consumption and environmental contamination patterns that are simply not sustainable. At current rates of use, the world's fossil fuels might last another century. But the pollution levels related to fossil fuel use—ranging from ozone depleting and greenhouse gases in the stratosphere, to smog and acid rain at ground level, to toxics in our air, soil, and water supplies—will be tolerable for a few more decades at best. Our fossil fuel addiction is neither sustainable in the industrialized world nor a model for the 3 billion people in developing countries.

Add to this picture the pressure of a burgeoning world population. Until this century, the world's population took some 600,000 years—from the Stone Age to 1900—to reach 1.6 billion. Since the turn of the century, it has tripled to 5.4 billion human beings. It may reach 10 billion in the foreseeable future.

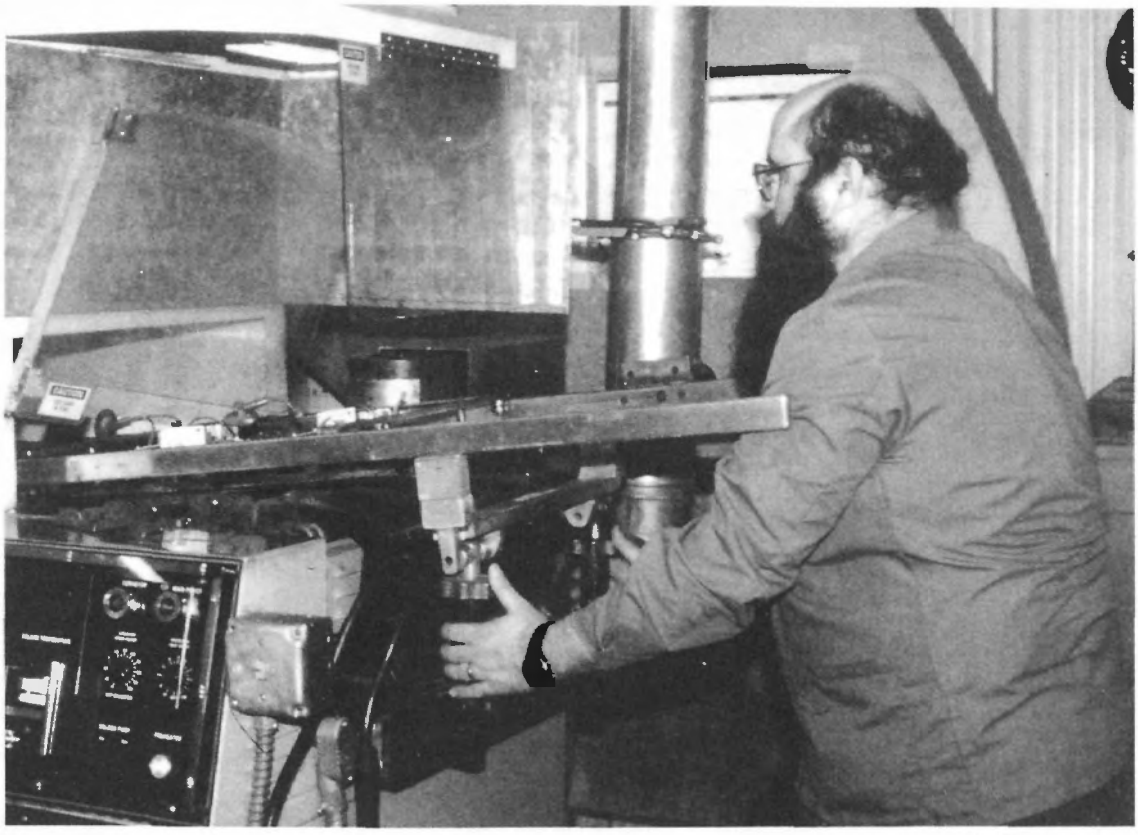
Clearly, while we are groping for *ways* to change, there can be no question that we *must* change. Saving our precious air, land, and water resources—our environmental capital—will require vast and rapid changes in the way we conduct our personal and societal lives. Pollution prevention is one excellent place to focus our efforts.

For almost a decade, INFORM's research has played a central role in showing the exciting opportunities that exist for hundreds of thousands of manufacturers and users of chemicals to slash their waste generation dramatically, to do so quickly, and to become much more efficient and competitive in the bargain.

Our findings were developed through study of 29 U.S. organic chemical plants, selected to reflect the great diversity of the chemical industry. We included plants in three of the country's top waste-generating states: New Jersey, Ohio, and California. We picked small, medium, and large facilities ranging from Colloids of California with a handful of employees to the DuPont plant in Deepwater, New Jersey, employing more than 3,500. We included plants using a wide variety of processes, making many different kinds of products.

Our research focused only on measures aimed at eliminating creation of waste streams *at the source*. In other words, we focused on preventive action only—not on any measures taken after a waste was created, such as recycling, treatment, or disposal (however important these measures might be).

The result was our 1986 report, *Cutting Chemical Wastes*, in which we first publicly identified five types of preventive initiatives: efficiency changes such as process refinements, equipment modifications, and just plain better on-site housekeeping as well as more basic actions, such as product changes or chemical substitutions. We found 44 such initiatives, all of which proved to be



By using a "No-Clean" flux in its soldering operations, Zytec—a Redwood Falls, Minnesota, company that produces customized computer supplies—was able to phase out a freon-based method of parts cleaning. A double benefit resulted: The company saved money and hours of hand labor while eliminating use of an ozone-depleting chemical.

Jim Miller photo, Zytec

triple winners compared to traditional end-of-the-pipe controls:

- First, they accomplished substantial waste-stream reduction (50 to 80 percent, or more).
- Second, they protected workers as well as communities and the environment.
- Third, instead of imposing heavy costs on companies, they produced impressive savings by cutting raw material losses, lowering pollution control costs, and reducing future liability.

For our 1992 study, *Environmental Dividends*, we revisited the 27 plants that were still in operation and found an even brighter picture. Through a total of 181 source reduction initiatives (44 for the 1986 study, plus 137 more), more wastes were being reduced faster while greater savings were being achieved than we had ever thought possible. Here are some examples:

- Exxon Chemical Company, at its large plant in Bayway, New Jersey, added simple "floating roofs" to 16 of its 200 chemical storage tanks that contained the most volatile chemicals, reducing evaporative emissions by 90 percent and saving $200,000 per year.
- A medium-sized Borden resin and adhesives facility in California, through a series of operational plant changes (including going from one- to two-stage rinsing of its chemical vats), slashed by 93 percent its major phenol-laden waste stream, which for years had been discharged first to the local sewer and then to an on-site pond. By so doing, Borden saved more than $150,000 a year in waste disposal and potential legal costs. (See story on page 18.)
- Fisher Scientific Company's reagent chemicals plant in New Jersey had told INFORM in 1986 that tracking materials inputs and outputs wasn't possible in batch processes. By 1992, however, under new management, Fisher had computerized its materials tracking system, identified 21 source-reduction initiatives (the most of any plant in our study), and cut more than 600,000 pounds of waste with annual savings exceeding half a million dollars.

For those plants reporting specific results, we found in *Environmental Dividends* that:

- Half the source reduction initiatives reduced targeted waste streams by 90 percent or more. Eighty slashed more than 128 million pounds of waste annually. Dow, Monsanto, Exxon, and DuPont each reported reductions of more than 10 million pounds a year.
- Two-thirds of the initiatives were quick and easy to implement: They took six months or less, and 80 percent involved simple technological changes.
- One fourth required no capital investment. Two-thirds resulted in payback of the investments in six months or less.
- The savings (tallied for 62 of the projects) came to $21 million annually. Seven plants (Aristech, Ciba-Geigy, Dow, DuPont, Exxon, Merck, and Monsanto) had net savings of $1 million or more. Average saving per project: an impressive $351,000.

Such positive results—for both the environment and the bottom line—should be grounds for unbounded encouragement. But our 1992 study had a downside: We believe industry has only scratched the surface of its potential. The great majority of companies in our sample have not established programs that would make aggressive pollution prevention possible. This includes even the best-known companies in our sample.

Our 1986 research gave the first clear

view of the significant benefits of preventive action. But the initiatives identified then could be documented to have affected barely 1 percent of total plant wastes. We found our companies and the government officials who regulated them both concentrating almost exclusively on end-of-the-pipe controls. Our question, given the economic pluses of pollution prevention, was "why?"

Further exploration revealed the obstacles to pollution prevention were not regulatory, technological, or even economic, but predominantly institutional. (See article on page 20.) Most of our companies *assumed* their processes were efficient. Making a product was their main job, and they measured their waste at the end of the pipe. Without knowing where—in process terms—the waste came from, they were not in a position to spot preventive opportunities. Further, the staffs of their pollution control departments were neither responsible for, nor knowledgeable about, the plant processes that produced the waste they had to handle. Efforts at source reduction came mainly when no legal or economic way of managing a waste stream could be found.

To help companies overcome these institutional barriers, INFORM recommended five steps:

- Create top management leadership, including production and environmental skills, to implement the policy.
- Motivate plant officials to find prevention opportunities.
- Conduct audits to identify all waste sources within the plants in process and non-process areas.

3M photo

As part of 3M's pioneering Pollution Prevention Pays (3P) program, the company's Northridge, California, plant adopted a water-based method of coating medicine tablets. The result: 24 tons of solvent emissions eliminated yearly.

- Establish full-cost accounting systems to account for the costs of waste management and material losses to the parts of the plants generating waste. (See page 23 for an article on total cost assessment.)
- Establish corporate policies making source reduction the top environmental priority.

In the years between our first and second studies, some encouraging signs of progress appeared. The prospect of cleaner, more efficient plants spawned the Pollution Prevention Act of 1990, the first law focusing on *prevention* rather than on *treatment* of waste. More than two dozen state-level programs were put in place. And many environmental campaigns for preventive action were initiated.

Within the chemical industry, the "Responsible Care" programs launched in Canada, the United States, and other countries placed an important spotlight on pollution prevention. And in the United States more than 1,100 companies have committed to cutting in half their generation of 17 key toxic chemicals by the end of 1995 under the voluntary EPA "33/50 Program." Overall statistics on U.S. industry discharges, reported to the Toxics Release Inventory, have shown a downward turn.

Yet our 1992 research found the pace of change far from equal to the needs of the times. In looking at the programs our companies had established, we found that the companies which had made the greatest gains included these three features: strong corporate leadership, including production and environmental managers; employee involvement programs; and full-cost accounting systems.

However, only four companies had incorporated all of these steps in their programs: Aristech, Ciba-Geigy, American Cyanamid, and Fisher Scientific. Only four out of twenty-seven had pollution prevention efforts involving environmental and production leadership. Only three had strong employee incentive programs, including training, rewards, and regular solicitation of employee ideas. Only six had established full cost accounting systems. (Thirteen still did not have a corporate policy making source reduction the number one environmental priority.)

More aggressive action to reduce toxic waste around the world is vital and feasible. Such action must be aimed at continuous progress through efficiency improvement and then more basic technology changes toward a goal of zero emissions. But pollution prevention is by no means all that will

Imagine what a nationwide source-reduction movement might achieve, with the spotlight suddenly focused inside thousands of plants and the materials that flow through them.

be needed. Chemical waste is only one part of a broader issue: the trillions of pounds of chemicals in commerce, ranging from solvents used in production to pesticides used on farms to paints, cleaners, and nail polish used in homes.

Feeding this public concern is not just what is known about chemical risks but what is not known. Even as chemical operations expand globally, as a thousand new chemicals enter production each year, the public is growing more aware of how little the impacts of chemicals on the environment and public health are understood. The National Research Council has labeled as "well characterized" barely 10 percent of the 70,000-plus chemicals in commercial use. Hence, pressures are growing for products posing fewer toxic risks.

Many new questions are surfacing regarding chemical-based products, including these:

- How can they be made so as to minimize the use of non-renewable resources? What role can other biomass resources play?
- How can products be made for maximum use of the resources that go into them—so that they are more durable, are repairable, have components that can be taken apart and reused, and so that recycling is simpler?
- How can products be made so that—in the whole course of their manufacture, use, recycling, and disposal—problems from the use of toxic chemicals are minimized or, even better, eliminated?
- Are all the products now being made ones that their manufacturers would decide today to make? Do they help meet important human needs—for *health, shelter, clothing, food,* transportation? Or are they only feeding heavily advertised "wants" and encouraging levels of consumption that we can no longer afford? The chemical industry's creativity and the government's leadership are crucial in addressing these questions.

If that handful of plants surveyed by INFORM can report such dramatic results—results to warm the heart of the shareholder as well as the environmentalist—imagine what a nationwide source-reduction movement might achieve, with the spotlight suddenly focused inside thousands of plants and on the materials that flow through them.

The federal prevention initiative takes the movement to a whole new level. With aggressive action, this initiative might well position the United States, one of the wealthiest and most industrialized nations, as a role model to other parts of the world. This includes countries that are rapidly industrializing, such as in Asia and Latin America, and those whose industries are in urgent need of an environmental overhaul, such as in Eastern Europe and the nations of the former Soviet Union.

Let's hope the EPA task force responsible for leading the Agency's transition to pollution prevention will do its work thoroughly and with a deep sense of the crucial nature of its mission. The Clinton Administration has paved the way to making pollution prevention part of the national lexicon. □

Three Case Studies: An Introduction

Watch closely and you'll see signs of a shift in corporate thinking

by Ellen Shapiro

Pollution prevention sounds good in theory, but does it make practical sense for the business community? Earlier articles in this issue of the *Journal* look at some of the organizational and financial obstacles that companies face when they decide to adopt pollution prevention as a strategy. This article considers the consequences of following through on that decision. To show some of the possible outcomes, we present the stories of three companies that have found a way to use pollution prevention to their advantage: Xerox Corp., a worldwide supplier of office equipment, with facilities located in Webster, New York; the Borden Chemical Co. plant in Fremont, California, which manufactures industrial adhesives and resins; and the Hyde Manufacturing Co., a small, family-owned tools manufacturer located in Massachusetts.

The steps being taken by these and a growing number of other firms represent what could be the beginning of a widespread shift in corporate thinking. Rather than merely complying with end-of-the-pipe environmental regulations, these firms take steps to reduce pollution at its source, thereby preventing future problems as well as cutting costs. Some are even finding ways to use their environmental investments to directly enhance the generation of profits.

(Shapiro is a policy analyst in the Economics, Exposure, and Technology Division of EPA's Office of Pollution Prevention, Pesticides, and Toxic Substances.)

These forward-looking companies appear to share certain characteristics that differentiate them from firms that are solely compliance oriented. For example, environmental staff are much more involved with other company functions and vice versa. The environmental staff at compliance-oriented firms, by contrast, focus narrowly on managing waste streams and in providing liaison with regulators.

Firms committed to pollution prevention seem to have better vertical integration, too. Senior managers have a direct interest in the design and progress of environmental projects since they affect the company's product line. At least a few companies are being pleasantly surprised to discover that, as environmental performance becomes everyone's business, overall morale improves.

Morever, companies with a pollution prevention orientation frequently adopt a broad program in which they become involved with their local communities, their suppliers, and their customers on environmental issues. Attention is paid to both upstream and downstream activities, including purchasing policies and end-customer concerns to provide safer supplies and products. Product stewardship—whereby the manufacturer actively helps the consumer use and dispose of its products in an environmentally sound manner—becomes a service offered by the company.

Environmental performance, in effect, becomes one of the company's products, and environmental success is likely to be found in increased sales and customer satisfaction. □

Asset Recycling at Xerox

by Jack Azar

Since Xerox Corporation does business worldwide, it makes sense for company managers to be alert to developments that may affect the international marketplace. One such recent development is the demonstrated concern in many countries about the proliferation of solid waste in the face of diminishing landfill space.

In some countries, legislation is in the works that could significantly affect marketplace demands. In Germany, legislation has been proposed that would require manufacturers and distributors to take back and recycle or dispose of used electronic equipment. The European Community is considering similar legislation. In Canada, too, interest in such legislation has been expressed. And in Japan, a 1991 regulation issued by the Ministry of International Trade and Industry promotes not only the use of recycled materials in certain durable items but also the recyclability of those items themselves.

At Xerox, we saw these signs of concern as indications of a future when the worldwide movement toward recycling would expand to include all kinds of products, including business equipment. We decided to act accordingly. Thus, in 1990, we began developing a corporate environmental strategy that encompasses equipment and parts recycling. The cornerstone of

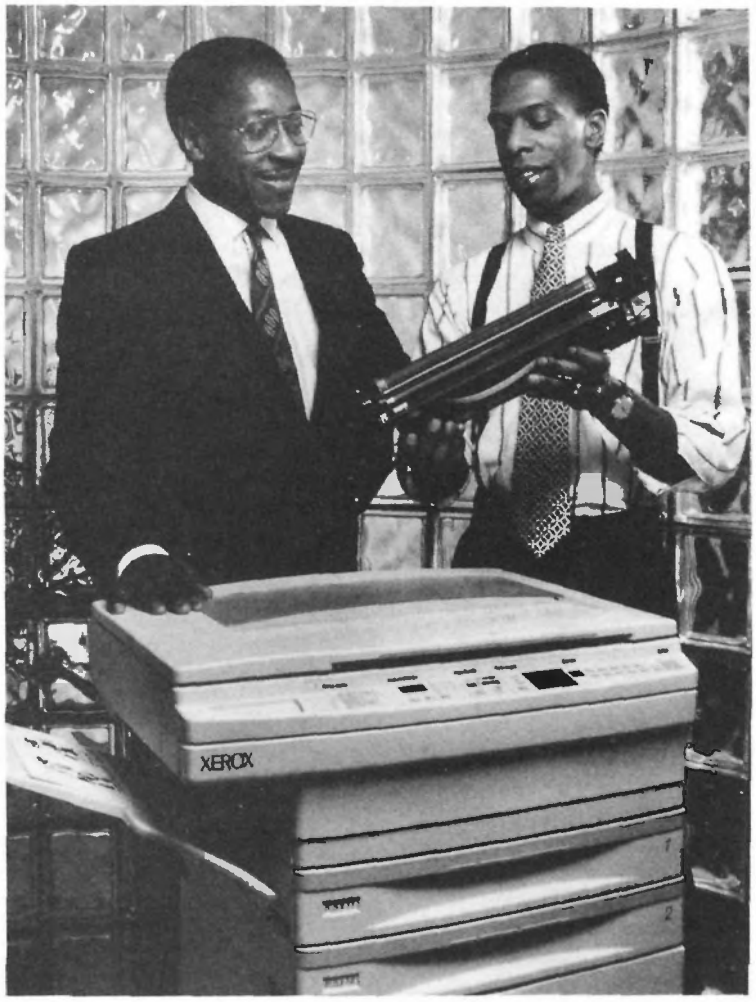
(Azar is Manager for Environmental Design and Resource Conservation at Xerox Corporation. James C. MacKenzie, Corporate Director of Environmental Health and Safety, and Richard S. Morabito, Vice President of Asset Recycle Management, both of Xerox, also contributed to this article.)

this strategy is our *Asset Recycle Management* program. As the name implies, it entails treating all products and components owned by the company—whether out on rental or on our premises—as physical "assets." This initiative marked a new departure for the company's Environment, Health, and Safety organization, which had previously focused almost entirely on proper handling of hazardous materials.

Historically, we had been taking our machines back from rental and remanufacturing them for re-use since the late 1960s. So how is the Asset Recycle Management program different from past practice? The key difference lies in our design-for-environment approach, which begins at the product concept stage. This is a radical departure from the past, when our machines were not *designed* from concept with the remanufacturing process and the recapture of parts and materials in mind. As a result, before Xerox adopted a design-for-environment approach, many used machines were returned in such condition that they were not salvageable for remanufacturing purposes; many ultimately found their way into landfills, contributing to the solid waste problem and depriving us of considerable salvage value.

The company's Asset Recycle Management program is based on a practical hierarchy of objectives:

- Distributing returned equipment for reuse by new customers, so long as it is in optimal working order
- Restoring equipment, through remanufacturing, to its original state
- Converting the equipment or major assemblies from the equipment into another product—for example, using in a printer the electromechanical elements of a copier
- Dismantling equipment to salvage parts for use either on the new product assembly line or as spare parts for field repairs
- If parts are not salvageable, recycling their source materials either at Xerox or externally through suppliers or recyclers. The latter may combine recycled source materials with virgin material into a blend that is used in Xerox parts.



Executives at Xerox Corporation discuss the company's latest returnable copy cartridge, used in the Xerox 5314 Convenience Copier. Spent cartridges are returned to Xerox and remanufactured, avoiding solid waste and saving production costs.

Xerox photo

As a prerequisite for success, implementing a design-for-environment strategy meant getting our design and manufacturing engineers to bring an entirely new perspective to their work. It is difficult to overstate the significance of such a change. To accomplish this, we sought and obtained the support of senior Xerox management in making environmental considerations a formal product requirement.

With the support of senior management, an Environmental Leadership Steering Committee, drawn from the major organizations in the company, monitored activities and provided direction to the individuals involved in the design-for-environment program.

A separate task force addressed critical matters related to asset recovery and recycling. Over five months, the task force identified significant opportunities to optimize the use of equipment and parts, even for existing products. Thanks to the success of the task force, the company formed an Asset Recycle Management organization, thereby institutionalizing the process.

Early on, we recognized that company engineers needed design guidelines to enhance remanufacturing and materials recycling. The Asset Recycle Management organization developed these guidelines, and they are continually upgraded. They include guidance on materials selection and engineering techniques to facilitate disassembly for remanufacturing purposes.

Specifically, the guidelines reflect the following design criteria: extended product and component life—i.e., use of more robust materials and design to make asset recovery practical; selection of materials that are relatively easy to recycle at the end of product life;

simplification of materials to facilitate recycling; easy disassembly as well as easy assembly; remanufacturing convertibility, meaning that a basic product configuration is convertible to a different use—e.g., a copier to an electronic printer; and use of common parts to enable future re-use in different models and configurations.

Traditionally, product concepts incorporate the targeted customers' performance, configuration, feature, and price requirements. To this list we added environmental requirements. As when gathering conventional market data, we solicit customer feedback on environmental requirements through surveys, a customer hotline, and market research that includes focus groups and customer advisory councils.

All these data are factored into an initial design concept that embraces materials and manufacturing approaches. Again, by taking environmental considerations into account at this initial point, we avoid a great many problems and roadblocks that we would encounter if we waited for a later design phase to introduce them.

The Asset Recycle Program at Xerox is not concerned solely with equipment and parts; it also focuses on the business process associated with product delivery worldwide.

Unlike our previous business process, the new product-delivery process incorporates design for recycling right from the early concept phase, on a parallel track with new product design and manufacture. The remanufacturing process for returned equipment is planned in detail at the same time. Our goal is to have the remanufacturing process available when new products are launched, so that recycling of field-test equipment and manufacturing prototypes can begin within the next several months.

In the past, machine remanufacturing took place in separate refurbishing centers. Now it is integrated into new product assembly lines: This helps assure high quality and performance comparable to new products.

Our first environmental design to reach the market was a customer-replaceable copy cartridge, which has many of the characteristics of a complete xerographic copier. Designed for use in our smaller convenience copiers, the copy cartridge contains the main xerographic elements critical to the copying process—photoreceptor, electrical charging devices, and a cleaning mechanism.

Copy cartridges designed for older convenience copiers posed a special challenge. They had not been designed for recycling. In fact, their plastic housings were assembled by ultrasonic welding. We had to break them open to get at the components within, thereby destroying the plastic housings. While we were usually able to reclaim the photoreceptor-transport assemblies, all we could do with the housings was grind them down for reuse as injection-molding raw material.

When Xerox began developing a new 5300 series of convenience copiers, we worked with the product-delivery team to design a new cartridge that is assembled with a few fasteners. It is totally remanufacturable, a process that costs far less than building one with all new parts, and more than 90 percent of the material is recoverable. Like all our remanufactured or recycled-content products, it also meets all product quality specifications and carries the same warranty as newly manufactured cartridges.

To date, the Asset Recycling Program at Xerox has been a big success from the standpoint of both environmental and business considerations. On the business side, we saved a total of $50 million the first year in logistics, inventory, and the cost of raw materials. We expect these savings to increase greatly as design-for-environment Xerox products enter the market.

In addition, only a minimal amount of material has been scrapped compared with previous years. However, we have a considerable way to go to reach our goal of zero materials to landfill.

There are still external barriers to overcome. Some commercial customers still reject recycled-content products as "used," and so do several government jurisdictions in the United States and abroad. We hope that the environmental imperative will lead them to accept recycled or recycled-content equipment that meets their performance requirements. □

Plastics: A Special Problem

At Xerox, we want to develop new products that, at the end of product life, will contribute virtually nothing to landfills. Ideally, we want to recycle all materials that aren't reusable as components.

Plastics are a problem in this regard not only because not all plastics are easily recyclable, but also because they are frequently difficult to identify in the form of finished products. Moreover, there are very few recyclers of engineering thermoplastics.

Xerox plans to participate in both the supply and demand phases of plastics recycling. Our goal is to use 100 percent recyclable thermoplastic resins in our products. By 1995 we hope to use 25 percent of post-consumer recycled materials in our machine and supply products, and we aim to reach 50 percent by 2000.

Xerox is working with plastics manufacturers to test and qualify recycled-content materials and to develop specifications for recycled materials that meet the needs of business equipment. We have instituted an international marking system for plastic identification to simplify the processes of material separation and recycling at the end of product life.

In the process of this collaboration, we are reducing the number of thermoplastic resins that we will use in our machines from well over 500 to fewer than 50. We estimate that a very small number, fewer than 10, may satisfy 80 percent of applications.

Yankee Thrift as Pollution Prevention at Hyde Manufacturing

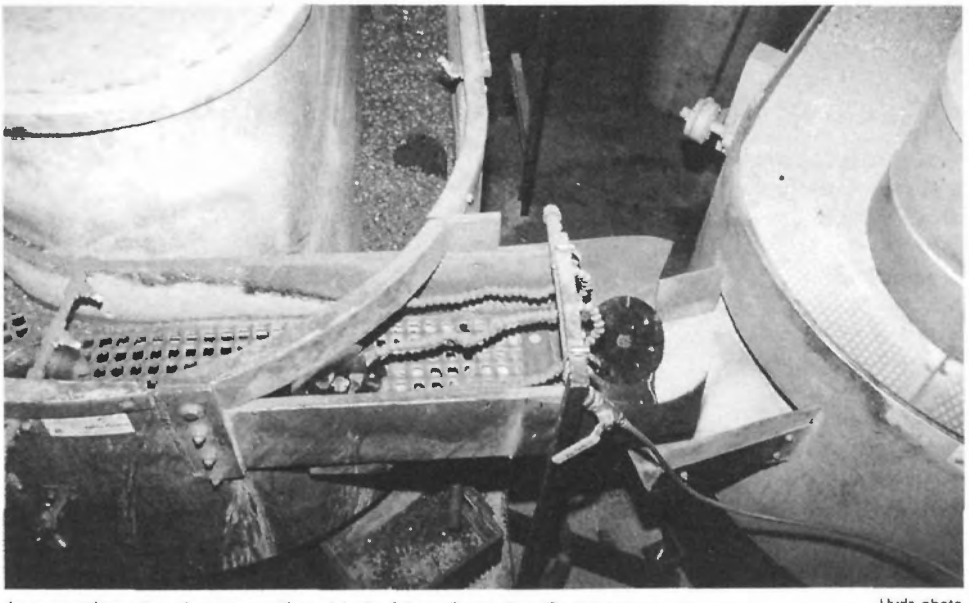
by Douglas DeVries

The greatest pollution prevention device in the world is an active human mind. Active minds working together have made this firm what it is today, a 118-year-old learning organization. Mr. I.P. Hyde started making knives for the shoe industry about a mile from where our plant is located in Southbridge, Massachusetts. He made knives for three days a week and peddled them two days a week. Mr. Hyde, a good Yankee business man, believed in using up, using over, and making do. His one-man shop could not afford to waste any resources.

Hyde Manufacturing Company now has sales in excess of $30 million a year. Our 305-member team carries out as many as 30 different processes in producing the finest putty knives, surface preparation tools, and machine blades in the world. Every day we face issues that Mr. Hyde couldn't have dreamed of. We develop more new products each month than he did in a lifetime. We constantly have to plan for future federal, state, and emerging international environmental requirements to make sure that we don't invest in processes or products that changing laws will render obsolete.

At the same time, we have stakeholders, including the community where many of our employees live, who are affected by the way we operate our business. One of the factors, for example, that led us to adopt our ambitious goals for reducing waste was the need to reduce the load on the local publicly owned wastewater treatment plant.

How a company responds to the complex challenges of today's marketplace depends on the vision of its top management. At Hyde, we have returned to the fundamentals of using up, using over, making do, and not expecting or accepting waste from any of our manufacturing processes.



Hyde photo

In a routine cleaning operation, Hyde Manufacturing Company uses biodegradable ground corn cob grits to absorb aqueous cleaners and oil from tool parts such as this newly produced machine blade.

Hyde's environmental goal is zero discharge of hazardous material to all media—air, land, water—and production of the smallest amount of waste possible for this type of operation. We will not introduce any new chemical hazard into our plants. These were goals we established four years ago after attending a meeting sponsored by the Massachusetts Department of Environmental Management's Office of Technical Assistance. During this meeting, we met employees of the Robbins Company in Attleboro, Massachusetts. They told their story of zero discharge and what it had done for their company. Our decision to embark on a source reduction strategy was based on two factors: end-of-pipe control was too risky and costly and the fact that Robbins had achieved the same goal through source reduction. We became a member of the Blackstone Project (see box on page 33) and began our journey of applying the principles of Total Quality Management to our environmental efforts.

Since we started our program in 1989, we've used a variety of pollution prevention techniques to help us reach our goal. By eliminating a cleaning operation, we reduced the use of 1,1,1-trichloroethane from 15,000 pounds per year to zero. We eliminated kerosene from another cleaning operation by substituting a water-based cleaner that uses mechanical assistance. Through in-process recycling of a substitute coolant, we were able to reduce waste coolant discharge by 80 percent. Through conservation measures, we reduced overall water use by 80 percent. In addition to these process-focused measures for pollution prevention, we are expanding our environmental management program to incorporate recyclability into the design of our products.

Here are some typical statistics that

(DeVries is Environmental Manager for Hyde Manufacturing Company in Southbridge, Massachusetts.)

highlight the achievements of this program so far:

- The use of ozone-depleting chemicals, long a mainstay of the metal working industry for cleaning, ended in late 1991. All related equipment and chemicals were removed in early 1992, well ahead of government-required deadlines.
- Water purchases have been reduced from 27 million to 5 million gallons per year, with a savings of $29,000 and a reduction in sewer charges of $43,000.
- New filtration and fluid handling methods have reduced discharge of grinding coolants from 40,000 gallons per year to zero gallons during the last four years.
- Waste paper recycling has reduced the material sent to the town landfill by about 135 tons per year.
- The use of clay absorbents was stopped; they were replaced by corn cob grits, a biodegradable renewable resource with a high btu value which, when disposed of, can go to a resource recovery facility.
- We installed air-cooled air compressors to reduce water consumption and supply supplemental plant heat in the winter.
- Dunnage for outgoing shipments has been changed from new newspaper to paper peanuts. These peanuts are 100 percent post-consumer recycled paper. Pallets for outbound shipments are molded waste wood.

Hyde is taking care of the environment and taking care of business. It is good business to be environmentally sound; it is the only way to be in business. The foundations laid down by Mr. Hyde allowed us to succeed for the last 118 years, and now we are rebuilding those foundations to ensure the next 118 years of company growth. What is our pollution-prevention bottom line? Environmental program expenses for the last three years have exceeded $100,000; savings or cost avoidance from environmental programs has exceeded $200,000. □

Cutting Waste at Borden

by Frank Tejera

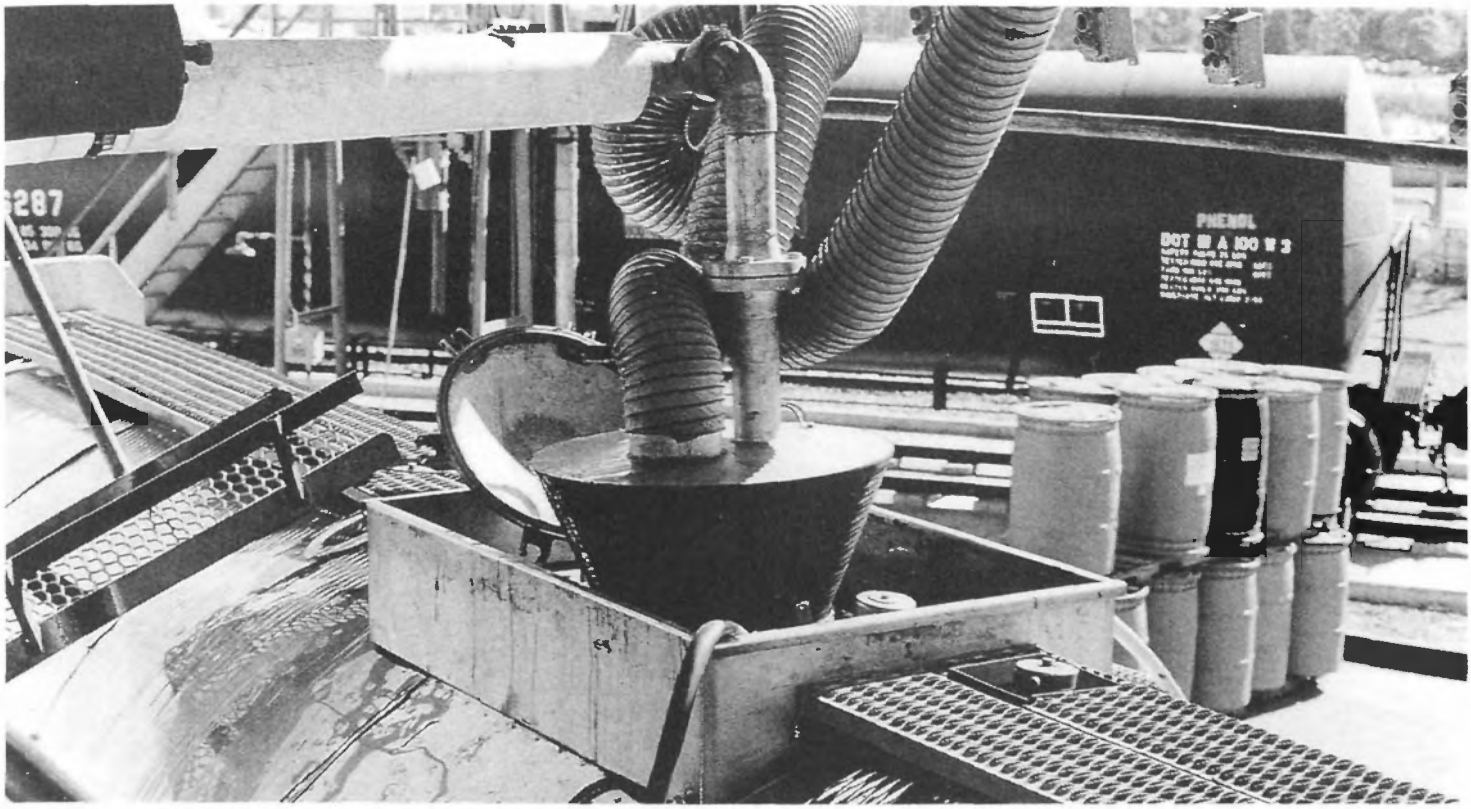
Twelve years ago, the Borden Packaging and Industrial Products plant at Fremont, California, embarked on a waste reduction program that has been successful beyond expectation. The Fremont plant currently manufactures aqueous formaldehyde solutions in various grades. We also produce formaldehyde-based phenol (PF) resins, marketed primarily for use in fiberglass insulation, as well as urea (UF) resins and wax emulsions, which are used primarily by the particleboard industry.

Formaldehyde is produced from methanol in a continuous process that operates 24 hours per day, seven days per week. UF and PF resins are manufactured in batch reactors with batch sizes ranging from 50 to 160,000 pounds, depending on type and sales volume. In 1992, combined, total production at the Fremont facility was 200 millions pounds.

We launched our pollution prevention program in 1981 after an unacceptable level of waste—more than 200,000 gallons of resinous sludge—had accumulated in a wastewater evaporation pond over a three-year period. As a result of ongoing efforts, the plant now recycles all of its PF resin washwater. Moreover, it generates only a minimal amount of sludge, reducing solid PF resin waste by over 90 percent and virtually eliminating solid UF resin waste.

Our formaldehyde unit has been recycling all of its wastewater,

(Tejera is Plant Manager of Borden Packaging and Industrial Products in Fremont, California.)



A tapered, rubber-lined plug links Borden's vapor recovery system to loading trucks as formaldehyde is loaded. Vapors drawn from the truck are piped to a scrubber; the spent scrubber water is then recycled back into the formaldehyde manufacturing process, eliminating waste.

Frank Tejera photo, Borden

including stormwater, since 1987. With a capacity of nearly 300,000 gallons, the plant's stormwater collection system captures runoff from all of the processing areas of the site for even the heaviest rain. This particular feature helped the plant win a water conservation award at the 1992 California Water Conference.

We achieved our reductions in waste by:

- Segregating UF and PF resin wastes and wastewaters. Our previous practice of mixing these incompatible resins in the waste stream increased sludge formation and made recycling harder.
- Modifying the way filter housings are cleaned. Using compressed air in the cleaning process helped us recover product that otherwise would have become waste.
- Modifying filter rinsing procedures. By introducing a new two-step rinsing process and recycling the concentrated first rinse, we were able to reduce the amount of wastewater as well as the amount of resin lost to the wastewater stream.
- Retraining plant personnel to make them more conscious of waste reduction opportunities and including waste-reduction goals in employee incentive programs.
- Tracking waste generation and the resin concentration in washwater.
- Changing formulations that tend to form excess particulates.

This last step was particularly important because the resin business is dynamic and competitive, requiring continued performance improvements. The formulation modifications were initially prompted by a customer complaint about excessive particles in a resin shipment. In addition, we were unpleasantly surprised to find excessive amounts of waste on opening resin tanks for cleaning.

Last year, Borden formed a team to look at the UF resin manufacturing process from beginning to end. The team was charged with reducing the amount of particulate in existing resins and also developing ways to anticipate problems early on, the objective being to decrease particulate formation in the first place.

As a result, a number of changes were made in manufacturing, storage, and handling procedures that enabled early detection of particulate formation. Tank cleaning now yields only two to three gallons of waste as compared to the two to three drums that were common in the past. The changes also eliminated those surprise instances when a tank yielded as much as 10 to 15 drums of sludge.

With solid waste from UF resin manufacturing virtually eliminated, the plant is now seeking to reduce the number of cartridges needed to filter new products being manufactured. Also, we have set a goal of zero wastewater discharge. We have not yet been able to find a way to recycle 2,000 gallons of wastewater sent each day for treatment from reactor rinsing and returnable tote bin cleaning associated with UF resin manufacture, but we are vigorously pursuing a suitable recycling solution. At Borden's Fremont plant, pollution prevention is a task that is never quite finished. □

Corporate Obstacles to Pollution Prevention

The sociology of the workplace is just as important as technical solutions

by Peter Cebon

If pollution prevention is such a great thing, why doesn't it just happen? Plenty of case studies show it is a "win-win-win" alternative, benefitting the corporation, the community, and the countryside. Yet it took 10 years for government to take such an obvious idea seriously, and another five to create a semblance of regulatory interest. On the corporate side, very little happened before publication of the first Toxic Release Inventory in 1989 put public pressure on companies. Not all companies have found pollution prevention cheap or easy.

Pollution prevention is a complex subject ranging from small changes in operating technique to massive, research-driven endeavors to create new products and processes. To keep things manageable, let's focus here on one type of pollution prevention: incremental changes in existing technology. In this context, incremental change means the substitution of one or two steps in a production process; it may also mean changes in the relationships between production steps. Examples might include changes in a washing step, or redesigning the process to eliminate the need for washing altogether. Eliminating chlorofluorocarbons and saving energy by replacing a refrigeration process with a heat exchanger that can exploit waste cooling from another part of the process would likewise be incremental change.

For these incremental changes, three decision-making stages are critical: identifying a pollution prevention opportunity, finding a solution appropriate to that opportunity, and implementing that solution. It will be useful to examine how three important aspects of an organization—its culture, its ability to process information, and its politics—can affect these three stages. The discussion should demonstrate the importance of thinking of pollution prevention as a social, rather than simply a technical, activity.

What makes pollution prevention difficult in practice? The question can best be answered by first considering a second question, How is pollution prevention different from end-of-pipe emissions control? A key difference between the two is that pollution prevention opportunities are embedded deep within the plant and are tied to very specific physical locations. To determine whether a particular solution is feasible, people need a really intimate understanding of the way the plant works. This kind of understanding doesn't come from design drawings but from the uses and working idiosyncracies of the individual pieces of equipment.

Emissions control devices, on the other hand, are physically quite separate from the rest of the production process. All that's necessary to understand them is the composition of the material coming out the pipe. Because that tends to be the same from one plant to another, the solutions can be relatively independent of the process. One example: Despite different makes and ages of conventional boilers, different control systems, different histories, and different operating strategies, a scrubber is always a viable emissions control strategy for high-sulfur, coal-fired power stations.

A brief digression: In Monty Python's *Flying Circus*, an accountant tells us why his job is not boring. He recounts, in excruciating detail, the

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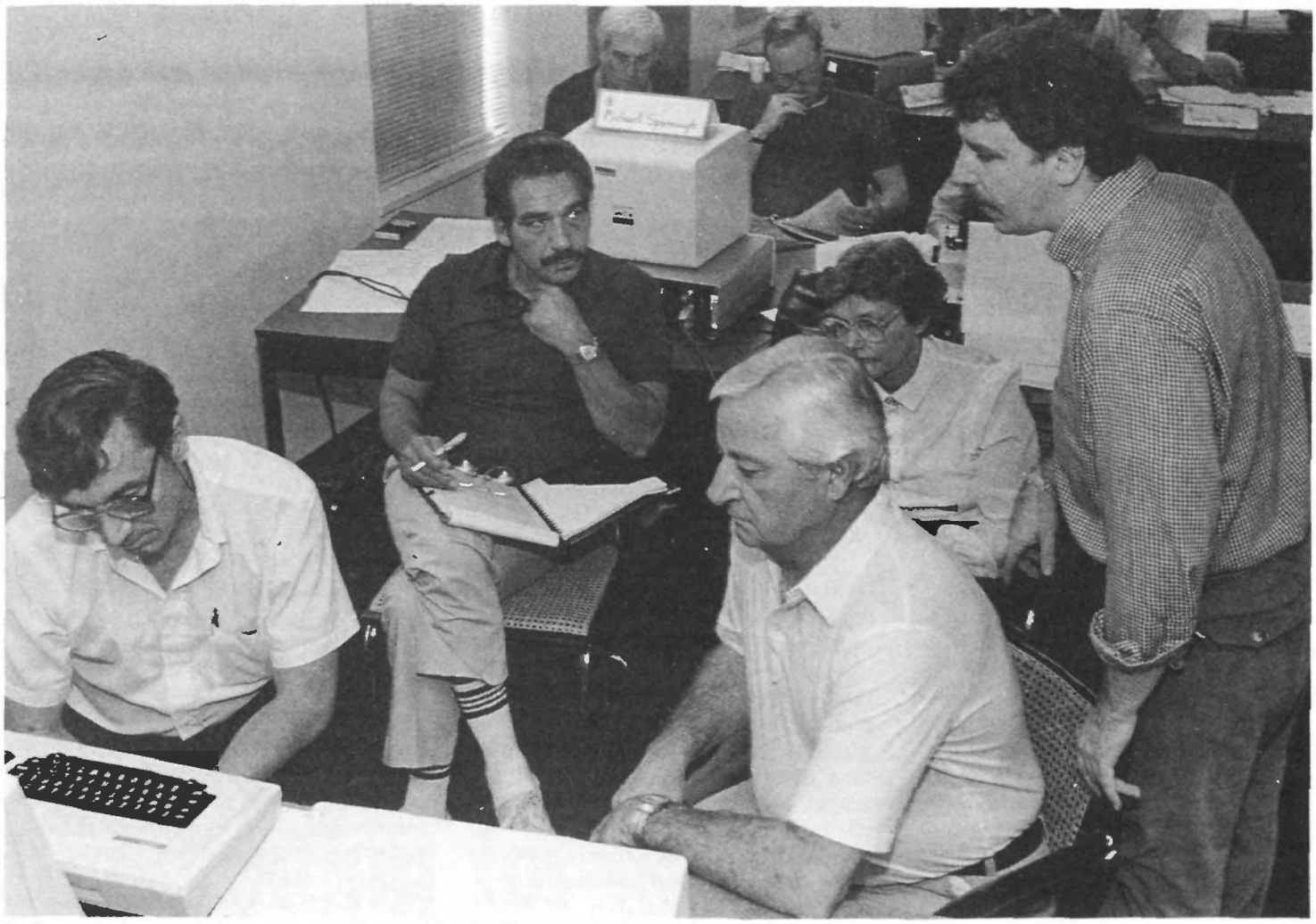


In the workplace, pollution prevention is a social as well as a technical activity. AFL-CIO photo.

many "not at all boring" things that happen in his day. But why is this funny? Because it plays on a common stereotype that accountants are very boring people who find exciting exactly those routine details of daily life the rest of us dismiss as ordinary. For the stereotype to resemble reality, one of two things must be happening: Either people who choose to be accountants bore us, or the profession socializes new members to think and act in a way the rest of us find boring.

Organizational culture is the same. Organizations tend to recruit people who think in a way compatible with the organization's view of the world, or else socialize them to think that way. They train, reward, and punish employees to reinforce the organization's beliefs, and they allocate resources in accordance with those beliefs.

Now, suppose an organization makes a cultural assumption that technical expertise is the only really valid form of knowledge and, therefore, that knowledge built from hands-on experience has very little value outside of day-to-day operations. From what we said above, people in such a company are likely to make at least two kinds of errors. First, engineers who are reasonably—but not intimately—familiar with the process may conclude that there are no preventive opportunities because they can't see them. Second, the company may send in a "SWAT" team of technical experts to ferret out opportunities comparable to those described in many case studies. Not surprisingly, the team doesn't find many and concludes the opportunities don't exist.

Other important cultural beliefs also affect companies' prevention behavior regarding pollution prevention. Consider the way people conceptualize the production process. Do they think of it in terms of technology or people? How do they see their jobs and the jobs of others? Do they look for opportunities to improve things or wait for things to go wrong? Finally, do they see unusual events as problems to be solved or opportunities to get even deeper insights into the way things work?

Pollution prevention presents a difficult information processing problem because it requires people to understand more than the intimate details of the production process; they must also understand the technical possibilities. Such specialized information is generally carried into the organization by technical specialists or vendors. Such information is, for the most part, accessible only to people with the skills and communications links to get and understand it.

Pollution prevention solutions, then, require a nexus between two very dissimilar types of information: contextual and technical. The organizational problem lies in bringing the two together. This is notoriously difficult because they tend to be held by different actors in the organizational cast. We saw above that process

All these managers have top management's endorsement, but that generally amounts to permission to compete, not to succeed.

engineers and "SWAT" teams are unlikely to find opportunities and solutions. Let's look at one last player, the environmental manager. Environmental managers, an obvious choice, are generally responsible for helping a firm comply with the law. While their work may expose them to many pollution prevention solutions, they often have trouble getting access to production areas. People in production often perceive them as "the compliance police." Also, most of their work—applying for permits, running treatment plants, reporting spills, and filling out waste manifests—doesn't require intimate process knowledge.

Instead of looking to individuals, we might think about combinations. The production operators—the people who turn the knobs and run the process—and production engineers—the people who help solve technical problems and design and implement changes in the production technology—could work together to find solutions. While the operators know exactly where the possibilities are, they rarely have the skills to realize them or knowledge of the smorgasbord of available solutions. Together with the production engineers, however, they have all the information. And, sometimes, the production engineers have both good enough relationships with the operators to find the problems *and* the skills and contacts to get the technical information to determine the solutions.

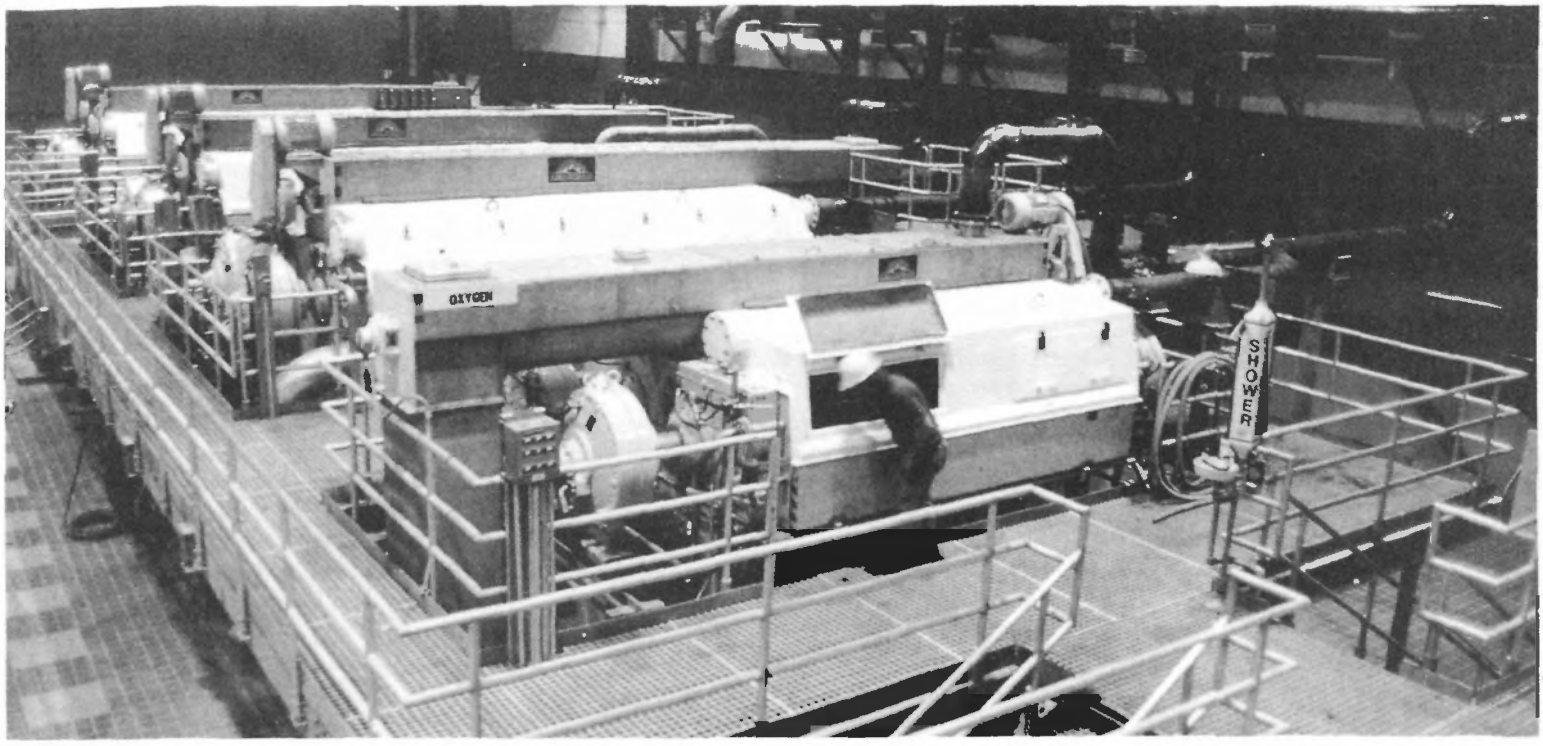
Suppose, then, that a pollution prevention manager wants to get engineers and operators working together. This can be intensely political because of competition from numerous other managers. Production engineers and operators generally report to production supervision, and most of their time is taken up with immediate production issues. The engineers must understand and remedy the day-to-day crises, ensure the product is up to standard, deal with the latest spill, make sure people work safely, and do myriad other jobs. Operators spend most of their time actually running the plant. The pollution prevention manager competes for their remaining time along with the safety, diversity, energy, quality, and training managers. All these managers have top management's endorsement, but that generally amounts to permission to compete, not to succeed.

That is not the end of the politics. The pollution prevention manager's solution requires the engineers and operators to work together. For that to happen, both groups must be amenable. In some chemical plants I've studied, the engineers have been young, they have lacked the interpersonal skills to solicit and obtain good help from the operators, and they have not fully appreciated the operators' skills. The operators, on the other hand, have been older and not necessarily forthcoming with the latest know-it-all engineer breezing through the plant on a three-year rotation looking for career enhancing ideas.

Even when pollution prevention solutions are identified, resources such as capital and people are allocated by intensely political processes. Largely because pollution prevention projects are so often deeply embedded in the technology of a plant, assessing the return on a pollution prevention investment may be difficult. (See next article by Allen L. White.) This is important because in many companies discretionary capital is scarce and money for new projects is hard to come by. Unless the true costs and potential profitability of preventive options can be properly assessed, they are at a disadvantage in competition with other projects for discretionary company resources.

In sum, rather than being simple, as many case studies might have us believe, pollution prevention is often quite difficult to put into practice. As discussed, pollution prevention can be hampered by at least three realities of organizational life: The cultures of organizations can effectively limit their perspectives; in many organizations, it is very difficult to get the right information to the right people at the right time; and many aspects of organizational life are highly political. These realities, among others, inhibit organizations' abilities to carry out the three basic stages of decision making—identifying preventive opportunities, identifying specific solutions, and implementing those solutions.

But these barriers are not insurmountable. There are many encouraging case studies. A number of companies have managed to overcome existing barriers and find cost-effective preventive solutions to their environmental problems. □



Union Camp photo

At Union Camp's Franklin, Virginia, paper mill, the primary bleaching agents are ozone and oxygen, instead of the chlorine conventionally used, and the mill recycles most of its wastewater. Initial capital costs are somewhat higher than for a conventional plant, but operating costs are lower.

Accounting for Pollution Prevention

Total cost assessment enables companies to see the true costs and benefits

by Allen L. White

(White is Director of the Risk Analysis Group at the Tellus Institute for Resources and Environmental Strategies in Boston. *The author thanks Deborah Savage and Monica Becker for contributions to this article.)*

Accounting is the cornerstone for managing any business enterprise. It also is fundamental to supporting wise pollution prevention decisions.

Accounting activities are commonly classified into two types. *Financial accounting* gathers information for users *outside* the organization, such as stockholders, creditors, and the tax collector. The profit-and-loss statement and filings with the Security and Exchange Commission are products of financial accounting. *Managerial accounting* gathers information aimed at managers *inside* the organization—those responsible for planning, controlling, and directing operations.

Financial accounting focuses primarily on the near-term, is governed by uniform practices and principles, and uses dollars as its standard unit of measurement. Managerial accounting, on the other hand, focuses on the longer term, follows firm-specific practices and principles, and uses a variety of measurement units to communicate information to managers. As such, managerial accounting is key in making pollution-prevention investment decisions.

From a pollution prevention perspective, effective managerial accounting requires two types of information. The first is physical—quantities of water, energy, chemicals, wastes generated and disposed of; the second is cost—how much the use, processing, and disposal of these materials cost the firm in terms of labor, equipment, buildings, depreciation, bank interest, liability, permitting, and so forth. Consistent, timely physical and cost information is necessary for characterizing how much, what types, where, and at what cost pollutants are generated in the operations of the firm. This alone, however, is not enough. To identify and exploit pollution prevention opportunities, managers need to translate this information into the

If accounting practices misrepresent the true profitability of prevention options, both business and the environment lose out.

language of business using yardsticks designed to measure performance and profitability.

Total Cost Assessment

Few dispute the critical role of managerial accounting in effective pollution prevention. But studies during the last three years point to a number of biases in current accounting practices which can systematically undermine its adoption. The consequences can be formidable. Each year, U.S. industry spends an estimated $115 billion on pollution control activities, $41 billion of which is capital investments. If accounting practices misrepresent the true profitability of prevention options, both business and the environment lose out. Correcting such bias requires an approach we call "Total Cost Assessment" (TCA). As discussed below, TCA encompasses four elements: cost inventory, cost allocation, time horizon, and financial indicators.

Cost inventory. In evaluating the profitability of prevention investments, firms often exclude costs which rightfully belong in the analysis. This is a cost inventory problem. It may occur due to shortcomings in either physical or cost data collection, or a combination of the two. For example, new utility costs or future savings could have been forgotten, or hard-to-measure, but nonetheless real savings could have been ignored. The latter might include avoided future liability, reduced occupational injury or illness, or increased revenues due to the introduction of "green products."

Accurate costing for prevention has obvious benefits for sound business management, but in practice it is often more complicated than may first appear. To illustrate, consider the case of a firm committed to reducing its use of a solvent, Chemical X. Chemical X is used as both an input in manufacturing a product and as an agent to clean pipes leading to a mixing tank. If one queries the operations personnel who use batch sheets (chemical recipes) for manufacturing the product, the answer to "how much" solvent is used will be based on units of product multiplied by the quantity of Chemical X in each unit.

If, on the other hand, one asks the environmental engineer the same question, the answer also may be based on batch sheets, but *with the addition* of quantities of Chemical X that are recycled in-process. One reason: Under some state regulations, use is use no matter what the source of chemical input, virgin or recycled.

Finally, if one asks the purchasing department the very same question, the answer may be based on still a different measurement approach—the difference in quantity of Chemical X remaining in storage tanks at the end of each month compared to the quantity at the beginning of the month.

What is the correct answer? All three may be correct, though their answers may vary by as much as 20 percent, depending on the exact question being asked, the accuracy of measurement methods, and the degree of quality control in last storing and analyzing the data. Of course, these figures ultimately must be reconciled if the task of targeting and costing pollution prevention opportunities is to proceed rationally. Overseeing their reconciliation is the job of the management accountant.

Cost allocation. Closely coupled with "how much" is the question, "by what." In other words, which processes or products are responsible for hazardous materials used and wastes generated. To answer this, the firm must assign figures to specific processes or products. Doing so requires a precise picture of how materials flow into, through, and out of the manufacturing process. This tracking is often referred to as a "mass balance."

In concept, all operating and capital costs should be allocable to some process or product: e.g., synthesizing a chemical, packaging a product, labeling a package, or disposing of a solid waste from a cutting or trimming operation. To develop accurate data, the management accountant must work in concert with production, purchasing, materials management, environmental, and R&D staff.

But, once again, gathering data is more complicated than might first appear. Even seemingly straightforward data such as solid-waste management costs may be confounded, for example, by disposing of wastes from various product lines into single receptacles. The benefits of greater precision are at some point outweighed by the costs of implementing the requisite tracking systems. For most firms, however, there appears to be much room for cost-effective improvement in cost allocation.

Time horizon. When a business looks at a potential prevention investment, it must ask the question: How long will it take to show profitability? For small, cash-strapped companies, the answer might have to be less than a year. For larger, better capitalized firms, an acceptable answer might be five or ten years, or even longer.

Prevention investments often take time to show profits, particularly when profitability is based on such items as future liability avoidance, recurrent savings due to waste avoidance, and revenue growth owing to market development of environmentally sound products. A TCA approach takes these future benefits into account by considering at least a five-year time horizon, whenever feasible.

Financial indicators. Financial indicators for pollution prevention projects should capture all the elements discussed above. Some, but not all, indicators used by business meet these standards. Among those that do are Net Present Value (NPV)

and Internal Rate of Return (IRR). One that does not, though it still may be used as a project screening tool, is simple payback.

Sharpening the Accounting Lens

As described in the accompanying box, we applied TCA to actual pollution prevention projects recently considered by two pulp and paper mills. As a major source of industrial pollution, pulp and paper provide a useful context for examining TCA. Historically, environmental regulation of the industry has focused on end-of-pipe control of discharges to the air and water. More recent restrictions, however, such as limits on toxic constituents in mill sludge and standards for foam, odor, and color, are moving the industry to examine materials and process changes.

For each project, we developed a "company analysis" comprising costs and allocation practices typically used by the firms. We compared these to "TCA analyses" of the same project, in which a fuller accounting and careful allocation of costs and savings were made over an extended time horizon.

Analysis of this limited sample suggests many opportunities for improving both physical and cost accounts. We also found that more comprehensive treatment of project costs and savings does not necessarily yield greater profitability for prevention investments. TCA is equally likely to turn up additional *costs* as it is additional *savings*, potentially diminishing the appeal of prevention investments. Moreover, the effort expended in preparing the TCA analysis, though typical of startup costs of any new management practice, may be substantial enough to make even large firms wary of adopting such an approach. In our view, however, the substantial benefits from improved accounting outweigh these initial costs and provide the foundation for better informed management practices. □

Two Cases in the Pulp and Paper Sector

To assess how TCA might work in the real world of business management, we worked in close collaboration with the staff of two paper mills to analyze the economics of two pollution prevention projects. Project 1, at a fine paper mill, would permit fiber, filler, and water reuse on two paper machines at all times, thereby conserving raw materials and reducing water use, wastewater volumes, and energy use for fresh and wastewater pumping and freshwater heating. Project 2, at a paper coating mill, would convert solvent/heavy metal coating to aqueous coating. This investment would substantially reduce use of solvents and heavy metals, emissions of volatile organic compounds, and hazardous waste generation. However, it would substantially increase water, steam, and electricity usage as well as wastewater streams to the local public treatment works.

The results of an analysis are revealing. In Project 1, the white water/fiber reuse project, the company analysis omitted very substantial energy savings from reduced fresh and wastewater pumping and treatment and freshwater heating. This omission, alone, dramatically underestimated the true profitability of the investment.

In the case of Project 2, the paper coating firm omitted all non-disposal waste management costs, utilities (energy, water, and sewerage), solvent recovery, and regulatory compliance costs from its analysis of the aqueous conversion project. Also omitted, and to some extent corrected in the TCA analysis: estimates of liability avoidance resulting from reduced solvent wastes disposed of off-site, savings due to reduced worker exposure to fugitive solvent emissions, and reduction of fire and explosivity hazards. Finally, potential (though difficult to quantify) improvements in "green" market competitiveness were excluded.

But the real surprise in Project 2 was the omitted costs of installing a heating system to prevent aqueous coatings from freezing, the energy for operating the heating system, and the additional energy needed to dry aqueous versus solvent-based coatings. These costs more than outweighed the savings, and the TCA evaluation revealed Project 2 to be profitable, but actually less profitable than the company analysis indicated.

Financial indicators for each project tell the story. For Project 1, the white water and fiber reuse investment, the net present value (NPV)—over 15 years—for this $1.5 million capital expenditure shifted from $0.36 million in the company analysis to $2.85 million under the TCA approach; the internal rate of return (IRR) increased from 21 percent to 48 percent; and the simple payback of 4.2 years decreased to 1.6 years, well within the mill's two-year payback guideline. By excluding the savings associated with freshwater pumping, treatment, and heating, and wastewater pumping, the company analysis made the project appear substantially less profitable than it actually would be.

Contrasting results were produced for Project 2, the aqueous conversion investment. The NPV for this $0.9 million capital expenditure shifted from -$0.2 million to -$0.4 million in the company versus TCA analyses; IRR decreased from 11 percent to 6 percent, and simple payback rose from 7.6 to 11.7 years. The inclusion of previously omitted savings for waste management, regulatory compliance, and future liability in the TCA were outweighed by the previously omitted utility costs. As a result, the TCA analysis revealed that the proposed project was actually less profitable than originally thought.

EPA's Flagship Programs

Existing programs promote pollution prevention in innovative ways

by David J. Kling and
Eric Schaeffer

As indicated earlier in this issue by Administrator Browner, pollution prevention has become the guiding principle—the central ethic—of EPA's efforts to protect human health and the environment. As this policy is put into practice, pollution prevention will be integrated into every EPA program and activity.

There is much work to be done. Yet prevention has already come a long way at EPA, and existing activities will provide a strong foundation for what's to come.

Several themes characterize our current pollution prevention activities. They and the programs that express them are described briefly below.

Integrating Pollution Prevention into EPA's Mainstream Activities

As industry leaders will testify, pollution prevention strategies reduce pollution and its management costs and conserve precious resources. They thereby provide the critical link between environmental protection and economic productivity. The challenge we face is integrating pollution prevention into the way we do business. Following are some examples of how we are beginning to incorporate prevention into our daily activities:

(Kling is director of EPA's Pollution Prevention Division; Schaeffer is director of EPA's Pollution Prevention Policy Staff.)

- *Source Reduction Review Project* (SRRP). As a short-term goal, the Source Reduction Review Project ensures that source reduction measures and multi-media issues are considered as air, water, and hazardous waste standards affecting 17 industrial categories are developed. For the long term, the project tests different approaches to provide a model for the regulatory development process throughout EPA. For example, EPA is developing a regulation affecting the pulp and paper industry that will promote process changes to reduce the quantity of pollutants released to air, water, and land.

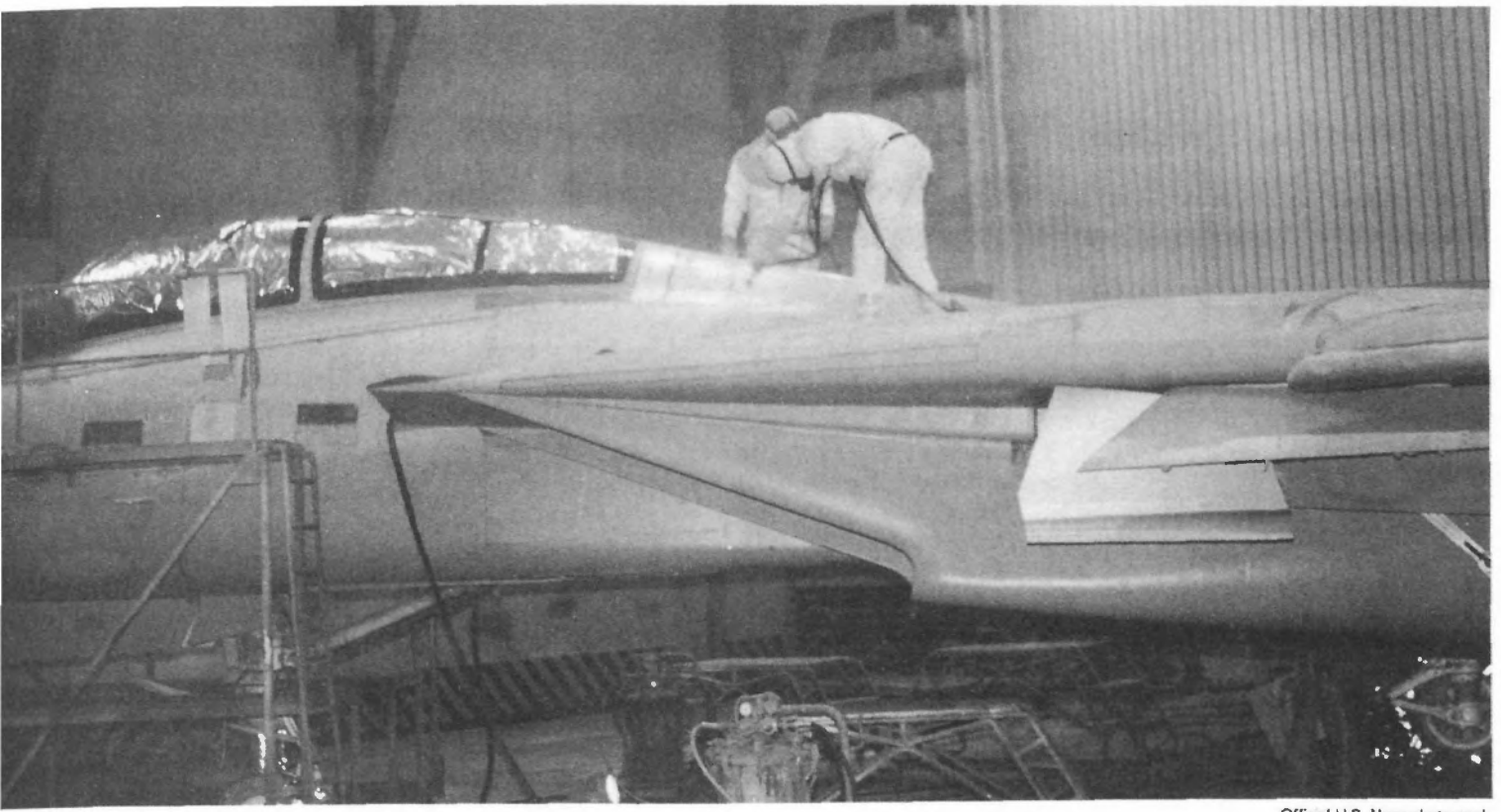
- *Pollution Prevention in Enforcement Settlement Policy.* EPA negotiators are strongly encouraged to incorporate pollution prevention conditions into settlements—both criminal and civil—involving private entities, federal facilities, and municipalities. The conditions can either correct an existing violation ("injunctive relief") or constitute a "supplemental environmental project" that the party performs. For example, in fiscal year 1991, EPA agreed to reduce the penalty for a dry-cleaning company that had failed to report (through the Toxics Release Inventory) the use of an industrial chemical. In exchange, the company agreed to change its industrial process. The result was a drastic reduction in the use of tetrachloroethylene, with significant overall savings to the company.

State and Local Partnerships

Increasingly, state and local agencies are becoming the "face of government," which is why EPA is working to develop and assist state and local pollution prevention programs. A number of states already have progressive pollution prevention efforts underway. (For example, see article by New Jersey Governor Florio on page 31.) EPA initiatives to strengthen the national network of state and local programs include:

- *Pollution Prevention Incentives for States.* Under the state prevention grant program, EPA has awarded more than $25 million through fiscal year 1993. These grants help the states to enhance innovative and results-oriented programs, implementing multimedia prevention approaches and targeting high-risk, high-priority areas. For example, Tennessee was awarded $300,000 for its Waste Reduction Assistance Program (WRAP). The program has trained more than 12,000 employees from a variety of industries in the fundamentals of pollution prevention, thereby enabling them to conduct snapshot assessments of their company solid-waste streams. Companies find that reducing waste leads to savings in disposal, raw materials, labor, and utility costs. In addition, companies boost revenues by selling recyclable goods.

- *Multimedia Grants.* Each year, EPA awards about $500 million in state grants for permitting, inspections, enforcement actions, and carrying out other federal mandates under laws such as the Resource Conservation and Recovery Act, the Clean Air Act, and the Clean Water Act. The Agency's new grant guidance, effective in fiscal year 1994, gives states the flexibility to incorporate pollution prevention into these activities to the extent permitted by law. This grant flexibility will provide an important source of support for innovative state projects such as the Massachusetts Waste Prevention First program, which promotes source reduction as the principal means of



Official U.S. Navy photograph.

Painting Navy and Air Force planes with a self-priming topcoat called UNICOAT can reduce associated VOC emissions and hazardous waste by up to 67 percent and save millions of dollars as well. Developed at the Naval Air Warfare Center at Warminster, Pennsylvania, UNICOAT replaces the traditional two-coat primer and topcoat procedures with one coating.

correcting violations detected through multi-media permitting.

Private Partnerships to Develop Innovative Cross-Media Approaches

An important focus of pollution prevention policy is cultivating new ways of doing business. As industries begin to understand the economic as well as the environmental benefits of pollution prevention, they will champion prevention on their own. The following programs are designed to provide information on the costs of pollution and on the availability of more environmentally benign technologies and materials. These programs also reward companies that are taking the lead in adopting pollution prevention approaches.

- *33/50 Program*. This is a voluntary initiative to reduce toxic-waste generation from industrial sources. EPA targeted 17 chemicals for reductions of 33 percent by the end of 1992 and 50 percent by the end of 1995. To date, more than 1,150 companies have signed up to participate, committing to more than 354 million pounds of reductions in toxic chemical emissions.

- *Green Lights Program*. The first of EPA's market-driven, nonregulatory "green" programs, Green Lights encourages voluntary reductions in energy use through more efficient lighting technologies. More than 700 participants have agreed to survey their facilities and, where possible, upgrade lighting efficiency in 90 percent of their square footage, within five years. Green Lights participants are saving more than 35,000 kilowatts annually, or $6.9 million, in electricity costs.

- *Energy Star Computers*. Energy Star is a voluntary partnership between EPA and the manufacturers that sell 60 percent of all desktop computers and 80 to 90 percent of all laser printers in the United States. These companies are now introducing products that automatically "power down" to save energy when not in use. Consumers will easily recognize the more efficient systems, because they will be labeled with the EPA *Energy Star* logo.

- *Design for the Environment* (DfE). DfE is a cooperative effort between EPA and industry to promote consideration of environmental impacts at the earliest stages of product design. Initial projects include evaluating alternative dry-cleaning processes and more environmentally preferable substitutes for toxic chemicals used in printing processes. Other projects include designing a more environmentally conscious computer workstation and funding research into alternative synthesis of important industrial chemical pathways. A new focus of the DfE program is a joint effort with the accounting and insurance professions to integrate environmental considerations into capital budgeting and cost accounting systems.

As industries begin to understand the economic as well as the environmental benefits of pollution prevention, they will champion prevention on their own.

• *EPA-GSA Cleaners Project.* Through this joint effort, EPA and the General Services Administration (GSA) are developing cleaning product procurement criteria based on considerations of efficacy, human health and environmental safety. The ultimate objective is to advance the pollution prevention ethic throughout the federal supply system, and then among other public and private sector purchasers. The two agencies intend to announce the project jointly late this fall.

• *Water Alliances for Voluntary Efficiency (WAVE).* WAVE encourages hotels and motels to install water-saving techniques and equipment. Hotel chains such as Marriott, Sheraton, and Hilton have signed partnership agreements with EPA to retrofit their facilities with water-efficient technology in bathroom fixtures, dishwashing equipment, cooling towers, landscape design, and irrigation. WAVE intends to expand the program to other commercial buildings and institutions, including office buildings and schools.

Cooperative Efforts with Other Federal Agencies

President Clinton's Earth Day message articulated his support for pollution prevention and the role the entire federal government should play. The model for cooperation across the federal government is embodied in the Pollution Prevention Executive Orders. (See box.) Other collaborative efforts between EPA and other federal agencies include:

• *Agriculture in Concert with the Environment (ACE).* ACE grants, which are funded and administered jointly by EPA and the U.S. Department of Agriculture, help farmers reduce the risk of pollution from pesticides and soluble fertilizers and safeguard environmentally sensitive areas, including critical habitat and wetlands. The more than $2 million in ACE grants awarded in fiscal year 1992 went to a wide range of projects, including development of apple cultivars that are pest resistant and that thereby require fewer pesticide applications.

"I've always felt that my role as a beaver transcends any political changes at E.P.A."

Drawing by D. Reilly; copyright 1993 *The New Yorker Magazine.*

• *National Industrial Competitiveness through Efficiency: Energy, Environment, Economics* (NICE^3). Administered jointly by EPA and the U.S. Department of Energy with matching state and industrial funds, the NICE^3 grant program was provided $4.4 million through fiscal year 1993 to support new processes and equipment that reduce high-volume wastes in industry, conserve energy and energy-intensive feedstocks, and improve industrial cost-competitiveness.

Identify, Generate, and Transfer Information

Collecting and sharing information encourages and empowers the private and public sectors to adopt preventive approaches. Information is also needed to document trends in emissions and waste generation and to measure progress in pollution prevention.

• *The Toxics Release Inventory (TRI).* TRI is EPA's compilation and public dissemination of the type and quantities of toxic chemicals companies are releasing to the environment, data that the companies must report annually. Since passage of the Emergency Planning and Community Right-to-Know Act, TRI has become a cornerstone of efforts to identify, target, measure, and reduce toxic chemicals. In August, President Clinton signed an executive order that requires federal facilities to reduce emissions and report annually under TRI. This winter, EPA plans to propose an expansion of the TRI list to include at least 200 additional chemicals. A second phase of the expansion would include an addition of facilities that must report under TRI. Beginning with the data from the 1991 reporting year, companies also reported quantities of waste generated and the progress they had made in pollution prevention. The public nature of the TRI makes it a powerful tool for prevention. It helps empower people to improve the environmental quality in their communities and holds industry

accountable for the pollution it generates.

• *Pollution-Prevention Information Clearinghouse (PPIC).* This makes information resources available to the public and to industry to facilitate the adoption of methods, processes, and technologies for pollution prevention. The clearinghouse also maintains a collection of documents, including journals, course curricula, conference proceedings, and federal and state government publications on source reduction and recycling which is available nationwide through interlibrary loan. The Pollution Prevention Information Exchange System is a computerized public forum for a wide range of pollution prevention information and expertise. EPA is working with the states, which often deliver prevention assistance to the public, to redesign the system. Increased state involvement in managing the functions of the clearinghouse will provide more thorough, updated information.

Partnerships in Technological Innovation

A truly effective pollution prevention program requires EPA to work cooperatively with other agencies and outside organizations in promoting innovative prevention technologies and practices. Following are some examples of our efforts so far:

• *Clean Technologies program.* "Clean Tech" is a broad-based, applied research program focused on improving U.S. and world-wide environmental quality, efficiency, and economic competitiveness through the development and application of innovative pollution prevention methods and clean technologies. Under this program, EPA's Office of Research and Development creates and disseminates a wide variety of technical documents on pollution prevention; works in partnership with other agencies, universities, and industry groups to develop and evaluate cleaner technologies and processes; and provides technical assistance to various

Resources

For more information about the EPA pollution prevention programs listed below, contact the **Pollution Prevention Information Clearinghouse**, 401 M Street, SW (PM 211-A), Washington, DC, 20460. Phone: 202/260-1023; fax: 202/260-0178; or contact EPA's Office of Prevention, Pesticides, and Toxic Substances, 401 M Street SW, Washington, DC, 20460. The EPA Public Information Center, 202/260-7751, also is available to help with requests about pollution prevention and other environmental issues.

Agriculture in Concert with the Environment: Call Harry Wells, Agriculture Coordinator, Pollution Prevention Division, Office of Pollution Prevention and Toxics, 202/260-4472.

American Institute for Pollution Prevention: Contact Thomas R. Hauser, Executive Director, Department of Environmental Engineering, University of Cincinnati, Cincinnati, Ohio, 45221-0071. Phone: 513/556-3693 or 513/556-3648.

Building Materials Research: Copies of the American Institute of Architects' *Environmental Resource Guide* are available for reference at the EPA Public Information Center.

Clean Technologies Program: Call Gregory Ondich, Manager, Program Development staff, Office of Environmental Engineering and Technology Development, Office of Research and Development, 202/260-5753.

Design for the Environment: Call Libby Parker, Chief, Design for the Environment staff, Office of Pollution Prevention and Toxics, 202/260-0667.

Energy Star Computers: Call Brian Johnson, Office of Air and Radiation, 202/233-9114.

Green Lights Hotline: Phone 202/775-6650, or fax your request to 202/775-6680.

National Industrial Competitiveness through Efficiency: Energy, Environment, Economics: Call the Technical Inquiry Service at the Department of Energy's National Renewable Energy Laboratory, 303/231-7303.

Pollution Prevention Information Exchange System: For information on this electronic conduit to information and databases, call 703/821-4800.

The 33/50 Program: Call the TSCA Hotline at 202/554-1404, or fax your request to the TSCA Assistance Service at 202/554-5603.

Toxics Release Inventory: Call the Emergency Planning and Community Response Act Hotline at 1-800-535-0202.

Water Alliances for Voluntary Efficiency: Call John Flowers, Office of Wastewater Enforcement and Compliance, 202/260-7288.

The public nature of TRI makes it a powerful tool for prevention in that it empowers communities to improve environmental quality and provides a yardstick for measuring industry's progress

industries, particularly those composed mostly of small businesses.

Examples of activities under Clean Tech include conducting and evaluating nearly 75 pollution-prevention opportunity assessments at industry sites; evaluating 70 specific manufacturing technologies; developing a pollution prevention guide that has been used by thousands of facilities to develop and implement pollution prevention programs, and publishing 19 guides to pollution prevention for various categories of industry.

- *Building Materials Research.* EPA's research on the environmental effects of building materials forms the basis of the American Institute of Architects' *Environmental Resource Guide,* which helps architects consider the environment as they plan buildings and choose building materials.

In addition, the President's 1994 budget proposal for EPA includes $36 million for a new inter-agency Environmental Technology Initiative; a substantial portion of these 1994 funds will be used to promote prevention, particularly among small businesses. EPA offices, led by the Office of Research and Development, are in the process of developing project scenarios for this purpose. Lastly, EPA will be looking at environmental statutes for opportunities to encourage investment in source reduction.

Legislative Opportunities

Important pollution prevention goals can be achieved under existing federal laws. However, where there are substantial legal barriers to pollution prevention, or opportunities to encourage investment in source reduction, then statutory changes may be appropriate.

Congress is presently considering legislation to amend the Federal Water Pollution Control Act—often referred to as the Clean Water Act. The concepts of pollution prevention and source reduction are incorporated into provisions of the proposal concerning effluent guidelines and pretreatment standards. Certain industrial dischargers would also be required to develop plans to reduce the release o some pollutants.

When Congress undertakes change to Superfund, the Solid Waste Dispos Act and other laws, there will be additional opportunities to incorporat pollution prevention objectives into th Agency's basic statutory mandates. One legislative proposal has been put forth to require certain industries to develop voluntary pollution preventic plans for reducing the use and discharge of toxic materials. (See artic on page 34.)

These seven themes and the activities highlighted point to a continuing dynamic endeavor—one that seeks sustained institutional change and innovative new program approaches, expands and empowers pollution prevention partnerships, harnesses information, improves our ability to measure success, and helps build state and local pollution prevention infrastructure. □

Focus on the Federal Government

"It is time that the United States government begins to live under the laws it makes for other people," President Clinton said during his 1993 Earth Day Address. With that directive, the President announced that he would sign executive orders strongly committing the federal government to take specific actions to prevent pollution in agency purchasing and facility management.

The executive orders will require that all federal facilities that manufacture, process, or use toxic chemicals report their releases under The Emergency Planning and Community Right-to-Know Act. Because that act, passed in 1986, does not explicitly include federal facilities, the federal government has been exempt from any legal obligation to comply with the Toxic Release Inventory and other EPCRA requirements.

In addition, the orders also will ask federal agencies to reduce releases and off-site transfers (for treatment and disposal) of toxic chemicals at least 50 percent by 1999. Each agency will establish voluntary goals for reducing the use of toxic chemicals at facilities and in products purchased or manufactured by federal agencies. Finally, the order requires the Department of Defense and the General Services Administration to complete their review of federal standards and specifications to cut the unnecessary use of hazardous materials in goods and services purchased by the federal government.

The New Jersey Program

by Governor Jim Florio

Efficient businesses are seen as key

Merck photo.

At the Merck manufacturing plant in Rahway, New Jersey, engineer Carmelita Macrohon records emissions readings at a solvent recovery unit. Merck and other New Jersey companies are required not only to report their emissions but also to prepare detailed pollution prevention plans.

The promise of pollution prevention, and the linchpin to its success, is that environmental goals can be achieved while simultaneously promoting economic vitality. In New Jersey, we see efforts to increase the efficiency and competitiveness of our industrial community as key to economic development in the state as well as advancing environmental and worker protection.

Consistent with the federal government's definition of "source reduction," the term "pollution prevention" in New Jersey means changes at the industrial source that result in reductions in the use and generation of hazardous substances per unit of product. The five general categories of pollution prevention in New Jersey are product reformulation, raw material substitution, improved operating techniques, process modifications, and in-process recycling. Out-of-process recycling, additional treatment, control and incineration are *not* considered pollution prevention in New Jersey.

Hindsight enables us to conclude that the current system of environmental regulation, while having led to significant improvements in environmental quality and public health protection, may not stimulate efforts to move beyond compliance to develop innovative, non-technology-based solutions to today's environmental problems. The premise that underlies New Jersey's landmark 1991 Pollution Prevention Act, as well as many other states' pollution prevention laws, is that if industry is required at least to *consider* pollution prevention options, the financial benefits of pollution prevention will be a sufficient incentive to prompt industry to *implement* pollution prevention options. New

(Florio is Governor of New Jersey.)

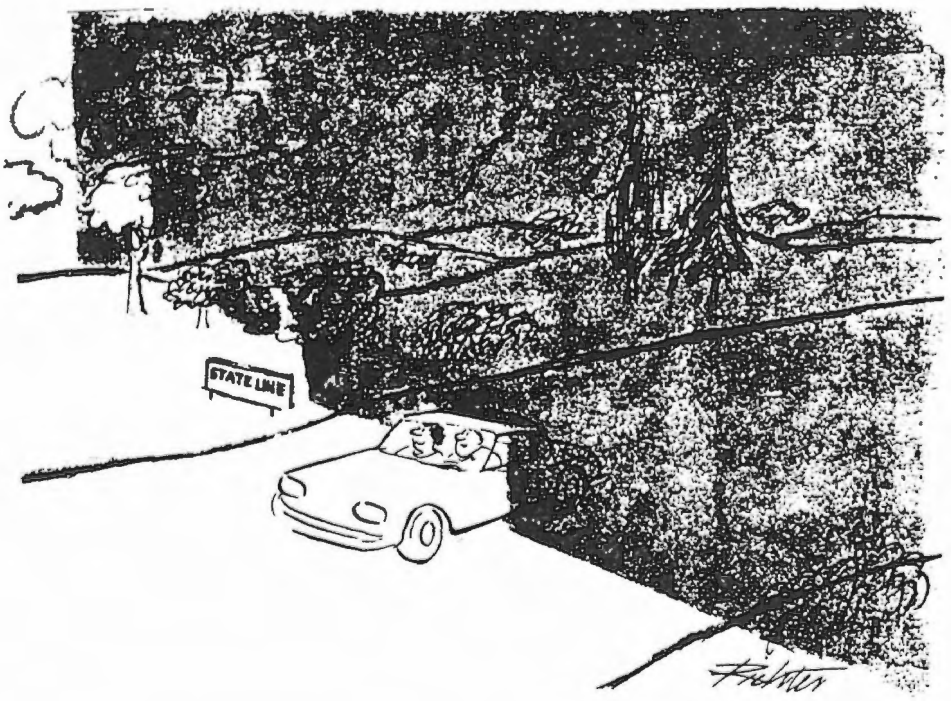
The promise of pollution prevention, and the linchpin to its success, is that environmental goals can be achieved while simultaneously promoting economic vitality.

Jersey's pollution prevention program has three components: facility planning, regulatory integration, and a promising new approach to facility-wide permitting.

Our facility-planning program is closely dovetailed with state and federal community Right-to-Know reporting requirements. The federal Toxics Release Inventory is modeled on New Jersey's 1983 worker and community Right-to-Know Act that, like the federal program, collects release and inventory data. However, New Jersey also requires the collection of critical "throughput data" that we believe are essential in measuring pollution prevention progress. Throughput data record the amounts of chemicals brought on-site, produced, consumed on-site, and shipped off-site as product, as well as the net amount in inventory.

The state's 1991 Pollution Prevention Act requires TRI reporters to develop detailed process-level Pollution Prevention Plans, which remain on-site, and to submit summaries of the plans and annual progress reports to the state. The goal is to prompt companies to view their pollution prevention plan as a personalized tool to drive corporate decision making rather than as another paper exercise to satisfy regulatory compliance.

In addition, the reporting parts of the program are designed in a way that will enable both government and the public to track industrial progress in pollution prevention. The New Jersey Department of Environmental Protection and Energy is about to issue a comprehensive guidance document that walks industrial facilities through the pollution prevention planning process, focusing on applying the process in a way that makes sense to the operations and to the culture of individual companies.



"They have very strict anti-pollution laws in this state."

Cartoon by Richter, USA. Cartoonists & Writers Syndicate.

In approving the Pollution Prevention Act, the New Jersey legislature found that "the inherent limitations of the traditional system of pollution control should be addressed by a new emphasis on pollution prevention," and that it is in the best interests of the state to "transform the current system of pollution control to a system of pollution prevention." This mandate of integrating pollution prevention into the environmental regulatory framework is one that cannot be implemented overnight. Overall, we have found that while the current regulatory structure does not *prohibit* pollution prevention, it does not necessarily *promote* it either. In New Jersey, we are looking at how current regulations, policies, procedures, and the regulatory culture can be reformed to stress prevention approaches.

Finally, the facility-wide permit part of New Jersey's pollution prevention program is an exciting venture that integrates all components of the environmental management hierarchy. Statutorily defined, a facility-wide permit combines air, water, and hazardous waste permit requirements along with a company's pollution prevention plan into a single permit. The New Jersey Act essentially sets up the facility-wide permit project as an experiment with 15 companies, with a requirement to report back to the legislature in 1996 on the project's outcome and the potential for broader application. Besides streamlining administrative paperwork, facility-wide permitting prompts both the facility and the agency to take a holistic view of the facility's operations with an eye towards pollution prevention rather than pollution control.

New Jersey has learned some early lessons in implementing our pollution

prevention program. First, the command and control model of pollution control regulation simply does not lend itself to pollution prevention. Pollution control assumes that waste is generated in industrial processes, that environmental protection and healthy industries are incompatible, and that pollution control is most reliably done after-the-fact through the application of expensive technologies. Pollution prevention, on the other hand, does not assume that waste is generated from industrial processes and sees efficient businesses that use and generate the least amount of hazardous substances as strong and environmentally protective businesses.

A second key issue that regulators face is that the obstacles to pollution prevention can be *institutional*, and not *technical*. Pollution prevention involves thinking differently about how we run industrial operations. It involves building a consideration of environmental consequences into product and process design and not just slapping on environmental controls as an afterthought. For those of us in government, it means recognizing that promoting industrial efficiency is a benefit not just to the environment, but to businesses themselves. That recognition alone is the driving force for a whole new era in environmental regulation. □

What About Other States?

More than 30 states have recently enacted or are debating a pollution prevention law. Depending on the state, such legislation may include provisions ranging from pollution planning requirements to technical assistance for companies.

Many of these laws require that companies assess the quantities and the types of hazardous waste generated at their facilities and that they evaluate the opportunities for reduction. Many call for estimates of the costs of managing wastes at the facility, including liability and compliance costs. Some state laws dictate implementation schedules for the plans; few, however, set numerical goals—Maine is one exception.

State pollution prevention programs are not by any means limited to preparing plans. In 1990, for example, eight states—Connecticut, Iowa, Maine, New Hampshire, New York, Rhode Island, Vermont, Wisconsin—passed laws to eliminate heavy metals (mercury, lead, cadmium, hexavalent chromium) from packaging materials. Oregon gives tax credits for the construction of facilities that prevent, control, or reduce air, water, solid waste, or hazardous waste pollution. And in Illinois, facilities that volunteer "toxic pollution prevention innovation" plans enjoy expedited processing of their permit applications and support for variance requests, adjustments to standards, or site-specific standards. In addition, most state programs provide much-needed technical assistance to small- and medium-sized companies.

Since 1986, the Massachusetts Department of Environmental Protection (DEP) has been developing a program that treats each regulated company as a whole, rather than separate bundles of smokestacks and drainpipes or drums of waste. As with most environmental agencies, DEP's air, water, and waste divisions were relatively independent, and they were often unaware of each other's actions. The results could be unfortunate: A company required by the water division to install a wastewater treatment system might learn only later from the waste division of its responsibilities for the hazardous sludges produced.

DEP decided pollution was a problem no matter what the medium, and that the best approach was to prevent it. Their first step was to initiate the Blackstone Project, under which inspectors looked at a whole plant for violations of any and all media permits; if they found them, they recommended that the company seek assistance from the state in applying source reduction technologies rather than, on their own, applying media-specific solutions.

Apparently the approach worked: Over 80 percent of the companies in the project said they preferred Blackstone inspections to standard single-medium ones, even though the Blackstone inspections resulted in enforcement actions for most of them. Massachusetts is expanding on the Blackstone approach, and EPA is encouraging flexibility in the use of state grants so as to support pollution prevention initiatives like Blackstone.

—Eds.

Why Not Require Pollution Prevention Planning?

by Senator Joseph I. Lieberman

Required analyses would help companies

Despite Congress' extensive efforts to legislate against pollution over the past 20 years, EPA's own Toxic Release Inventory (TRI) shows that more than 7 billion tons of chemicals were either released into the environment or transferred off-site from manufacturing facilities in 1991 alone. Seven billion tons is a figure that errs on the low side, since industrial chemical releases reportable to TRI are not all-inclusive.

Millions of tons of dangerous chemicals continue to be discharged into our nation's waterways. Twenty-one years after the Clean Water Act became law, there's no excuse for not doing a better job.

Sixteen years after passing the Resource Conservation and Recovery Act, we still have not made a real dent in the amount of hazardous waste we produce. By one estimate, hazardous waste generation in the United States is likely to increase 75 percent between 1988 and 2000.

In light of these and other disturbing figures, it is clear that we need to focus our environmental laws and regulations on better ways to prevent pollution before it occurs, so that we can spend less effort and money on cleaning it up after it's in the environment. That way, not only do we safeguard human health and the environment, but we also bolster American industry's ability to use its resources to compete globally.

To that end, I have introduced in the 103rd Congress two complementary initiatives designed to encourage America's businesses to use more foresight in environmental protection: One encourages businesses to map out pollution prevention strategies; the other helps disseminate such strategies—and the technologies to implement them—to small and medium-sized businesses.

(Senator Lieberman (D-Connecticut) serves on the Senate Committee on Environment and Public Works.)

The Hazardous Pollution Prevention Planning Act (S. 980) does not include command and control measures to require pollution prevention directly. Instead, it would require companies to review pollution prevention opportunities and set their own goals; in other words, it would require pollution prevention planning.

Once businesses see the advantages of pollution prevention through the planning process, they don't need to be forced into it. First, pollution prevention has obvious advantages for the protection of human health and the environment. Second, pollution prevention can significantly reduce costs to American companies associated with the purchase of raw materials, waste treatment, disposal, liability, and accidents. In other words, it could make a big dent in the $115 billion that industry spends a year on compliance.

The third advantage is that pollution prevention can help improve American competitiveness. As one computer executive explained to me, waste byproducts are actually a cost in his highly competitive industry—and a sign of inefficiency. As more and more business leaders are discovering, environmentally sound manufacturing shows up on the bottom line. Competing in the global market means curtailing the inefficiency that pollution from pipes and stacks often signals. The importance of pollution prevention is now becoming urgently clear: American companies produce five times more waste than German and Japanese competitors per dollar of goods manufactured, forcing U.S. firms to spend more of their capital on waste disposal instead of R&D.

While some ground-breaking companies are implementing innovative pollution prevention programs, many companies are not taking advantage of significant prevention options. A major reason for this, according to Warren Muir of the nonprofit group INFORM, is that many companies are unaware of all the sources of pollution in their own plants. A study by INFORM showed that virtually every facility that carefully looks at its operations finds significant opportunities for prevention; at the same time, all indications are that industry has barely scratched the surface of its potential for pollution prevention (See article by Joanna Underwood of INFORM on page 9). To quote Muir, "Anything government can do to stimulate companies to take a look when they otherwise wouldn't should promote significant source reduction."

A recent Government Accounting Office study echoed this finding, reporting that representatives of states and industry and environmental organizations have endorsed planning as an effective approach to identifying opportunities for pollution prevention.

The pollution prevention planning provisions in the bill I recently introduced are relatively simple and reflect extensive discussions with representatives of industry, state governments, and public interest groups. Owners or operators of those facilities currently required to report to the TRI would be required to develop pollution prevention plans. EPA would be given authority to enlarge coverage to additional facilities after researching the extent of pollution prevention to be achieved from such an expansion. The plans would consider options and establish five-year goals for pollution prevention.

Some industry representatives expressed concern that certain types of pollution prevention might not be workable for their particular operation or might even be counterproductive in terms of environmental benefits. Therefore, the proposal recognizes that it might be appropriate for an owner or operator to determine—after analysis—that no improvement can be

find ways to cut waste

made in a particular type of pollution prevention.

The idea behind this legislation is this: It is extremely important for companies to perform a pollution prevention analysis. It is also important that management supports the plans that are generated. Thus, under my bill, a prevention plan must include a statement by the highest ranking official at the facility endorsing the plan.

Is there a role for regulatory agencies in pollution prevention planning? Industry has serious misgivings about the government's mandating pollution prevention standards as part of the planning process. Indeed, Michael Porter of the Harvard Business School has written that government must not constrain the technology used to achieve pollution prevention. Because I share this concern, the bill I introduced specifically states that EPA is not given authority to mandate either that pollution prevention performance standards be achieved or that particular pollution prevention measures be implemented. EPA and delegated states have the authority to review plans, but only to determine if they are complete, not to evaluate their substance.

Finally, experts have repeatedly emphasized the importance of government technical assistance for small and medium-sized companies. Based on suggestions from small business representatives, S. 980 includes a special compliance program for small businesses. Under this program, modeled after a successful program in California law, EPA would be required to prepare pollution prevention manuals and checklists for certain categories of smaller businesses. EPA could also, upon request, provide technical assistance to companies to carry out these strategies.

Because such environmental assistance programs for smaller and medium-sized businesses are so important, I introduced an amendment, passed by the Senate as part of the EPA Cabinet bill, that builds on the modest technical assistance program established in the 1990 Clean Air Act Amendments by enlisting help from the Commerce Department's Manufacturing Technology Centers. Already, the six regional facilities now in operation have been very effective in transferring know-how and hardware to companies that couldn't otherwise gain access to these resources.

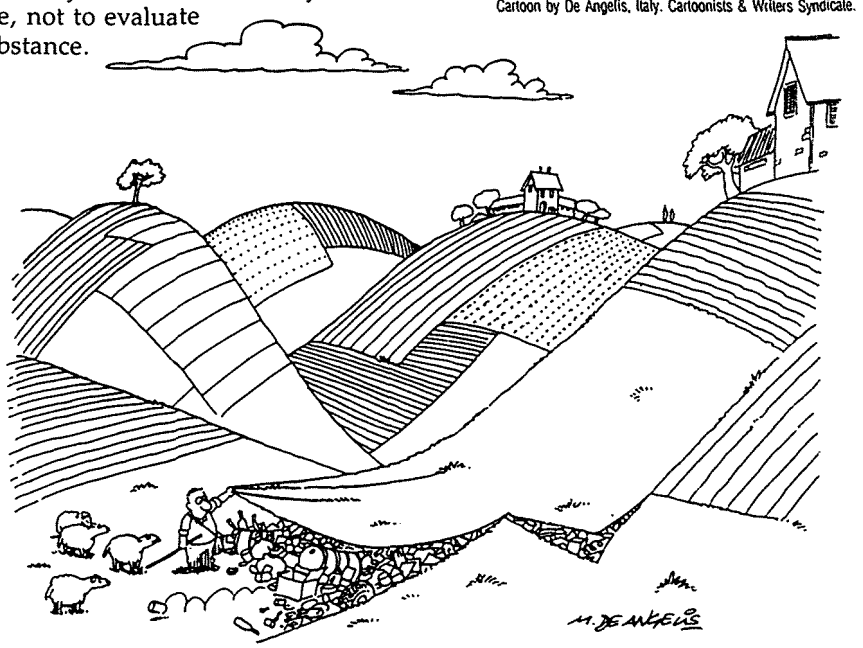
Under my amendment, EPA and the Commerce Department work together through the Manufacturing Technology Centers to deliver environmental services to some of these same smaller businesses, an effort that will work well with President Clinton's plans to establish 94 more centers by 1997.

The amendment also expands on technical assistance to small businesses by elevating the small business ombudsman office at EPA so that it will have direct access to the office of the new EPA Secretary and giving it a legislative mandate. This office will be responsible for helping smaller businesses identify the most cost-effective approaches to meeting the requirements of our environmental laws and finding ways to help businesses save money through preventing pollution in the first place.

Similar technical assistance programs on a smaller scale have already produced numerous success stories. Consider, for example, the North Carolina program that netted six participating plants $410,000 in savings in one year. Or consider the Ventura County, California, program that saved industry a minimum of $50 for every $1 the county invested in sending government specialists into local facilities to help businesses with pollution prevention.

In sum, my legislative initiatives build on the advice of Warren Muir and others at INFORM that government efforts to stimulate companies to take a look at their sources of pollution will produce significant pollution prevention results. The bills seek to open industry's eyes to the advantages of thinking ahead of the pollution curve, and then to supply companies with the support, technical and otherwise, to turn good thoughts into deeds. □

Cartoon by De Angelis, Italy. Cartoonists & Writers Syndicate.



Environmental Technology and the Economy

A national strategy is needed

by Senator Max Baucus

Our environment and economy are inseparable. In order to prosper, we need a healthy economy; in order to survive, we must have a healthy environment. In his first Earth Day address, President Clinton affirmed that fundamental logic: "Only a prosperous society can have the confidence and the means to protect its environment," he said, underscoring his determination not to set the economy and the environment at odds.

One of the most promising areas to link these twin goals is environmental technology. Supporting the innovation and use of environmental technology at home and abroad can help put us on the path towards sustainable development as well as help create American jobs and boost our economy.

Most people think of environmental technology as just equipment to clean up the messes we already have. It is much more than that. Already, pollution preventing is one of the fastest growing and most significant segments of the environmental technology industry. For example, green design—taking the environment into account when a product is still on the drawing board—is being developed quickly. We must marshall our resources to encourage these new technologies and find other ways to make economic development environmentally sustainable.

In May, I joined Sen. Barbara Mikulski, (D-Maryland) and Sen. Joe Lieberman (D-Connecticut) in introducing legislation to help organize, develop, and promote environmental technology in the United States. Our bill calls for developing a national strategy to ensure that our nation keeps pace with others that already have coordinated government programs, a strategy that will help American industries develop and adopt new, cutting-edge environmental technology.

(Senator Baucus (D-Montana) is chairman of the Committee on Environment and Public Works.)

The driving force behind market demand for environmental technologies is tough environmental regulations. For example:

- Many of the recent advances in developing and marketing clean cars are a direct result of California's zero-emission vehicle program.
- Germany is a world leader in controlling emissions from power plants because of its tough acid rain laws.
- The development of hydrochloro-fluorocarbons (HCFCs) and other substitutes for ozone-depleting chlorofluorcarbons (CFCs) is a result of the Montreal Protocol and the Clean Air Act.

However, it is not enough just to pass strict environmental laws. Other nations with similar laws are outrunning us in developing and marketing environmental technologies, primarily because they have coordinated strategies to support the development and implementation of environmental technology. Our government tends to ignore U.S. industries—and then asks why our competitors beat us in the market.

Skeptics argue that there is nothing wrong with this policy; that if environmental technology is indeed good for the economy, that sector will develop independently. They are right to a point—but few environmental technologies have reached that point. Blocking progress are several factors unique to the environmental technology market:

- There is a lack of information on environmental problems. Pollution is a wasteful byproduct, and most businesses would rather not publicize their environmental problems. The scarcity of information about environmental problems means that solutions are slow to develop. Often, companies will develop internal methods of dealing with environmental problems. Instead of having technology incubators within companies, we have technology traps.
- Environmental technologies often lack a national market. Local authorities tend to set permitting conditions that are site-specific. So, regardless of where else a technology may be in use, it often must be re-marketed for each new location. The strategy we propose will help foster a national market by giving regulators and businesses a way to verify the costs and performance characteristics of innovative technologies.
- Although strict regulations can drive demand for environmental technology, they also can stifle innovation. Typically, when performance or equipment standards are written, a reference technology is published as the basis for the standard. Regulated companies *can* use other methods to achieve compliance, but there is little incentive to experiment. The "safe" option is to apply the reference technology because permit writers tend to be suspicious of anything else. A better strategy, one which the bill fosters, is to continue development of and innovation in technology and pollution prevention even after regulations have been written.
- A lack of adequate testing is often another barrier encountered by new technologies. Many companies that could be in the market for new environmental technologies do not want to take a chance on untested technology. The threat of enforcement action is reason enough for most companies to play it safe by using established technology—even when that established technology is not the cleanest or most cost-effective. Like the quandary every teenager faces when he or she first enters the job market, new technology can't find work until it

Electric Power Research Institute photo

California's new zero emissions law—requiring that, by 1998, 10 percent of all new cars sold there must be completely nonpolluting—has given a boost to clean car technology such as electric vehicles.

gets experience—and it won't get experience until it is put to work.

- Lastly, a lack of funding often impairs the development of environmental technology. Many good ideas never get off the ground because venture capitalists see the barriers that new technologies face—and stay away.

The bottom line? Environmental technology deserves our support because its development represents a significant social benefit, a benefit that market forces alone may not accomplish. The laws of the marketplace are good at commercializing products that have a proven demand and the promise of short-term profits. But the market is not very good at planning for long-term needs and creating a demand for socially beneficial products.

In addition to addressing these barriers, the legislation I have introduced will help to organize federal government activities associated with environmental technology. The Congressional Research Service estimates that the federal budget for research and development related to environmental technology is approximately $4 billion per year (spread among several federal agencies). In the past, this budget has been poorly coordinated among these agencies. A coordinated approach across all departments is needed. We do not necessarily need to spend more on federal research and development, but we need to spend more wisely.

New environmental technology is also critically needed for the cleanup of contaminated sites. We are embarking upon one of the biggest clean-up efforts of all time. With a price tag estimated at $100 billion to $1 trillion, the cleanup of federal facilities and Superfund sites dwarfs the amount spent on the interstate highway system or the Apollo space program.

If we spend these huge sums and just end up with clean sites, then we have not spent our money wisely. Some of these funds should be devoted to the development of new technologies that not only help us clean up these sites more efficiently, but also prevent the need for future cleanups. By spending some of these funds on new technologies, we will create jobs and a new line of work that will enhance our competitive strength.

We cannot solve our environmental problems solely by developing new technologies; we must also put these technologies to work. And inertia has built up behind the use of existing technologies and practices. It's easier to go with the status quo than to gamble on something new. This problem is especially severe in our smaller industries, which make up more than 98 percent of all manufacturing firms. Government must reach out to help these smaller companies adopt new and existing environmental technologies.

There are already promising signs of how enormous the potential benefits to our economy and our environment are. The Organization for Economic Cooperation and Development (OECD) has estimated the world market for environmental technology at more than $200 billion per year and growing to $300 billion within a decade. OECD also estimates that the United States currently enjoys a $4 billion trade surplus in this market.

In absolute expenditures, the United States is both the largest producer and the largest consumer of environmental technology. OECD estimates U.S. production at $80 billion, employing some 800,000 people. But, like many other industries we once dominated, there are signs that our lead is slipping. Germany leads in the environmental technology trade, exporting about 40 percent of what it produces, importing only 5 percent of its needs, and thus creating a $10 billion trade surplus. The United States exports only 10 percent of its production, and imports of environmental technologies are soaring.

The link between the economy and the environment will not occur by itself. We must develop new policies to protect our environment, promote economic growth, and foster high-skill, high-wage jobs. Working together, we can set the United States back on the path toward a better environment and a brighter economic future. □

Cutting Pollution Loads in the Netherlands

Affluent nations should lead the way

by Jan Suurland

Environmental policy in the Netherlands is based on the view that highly industrialized and affluent nations should take the lead in working toward sustainable development. Under the broad focus of the National Environmental Policy Plan, the Dutch government is using a variety of voluntary and command-and-control schemes to reduce pollution loads in the Netherlands to between 70 and 90 percent of 1985 levels by 2010. Interim targets for 2000 require emissions reductions of between 50 and 70 percent, relative to 1985 levels.

Central to achieving those goals is the "target group approach," which will be used to achieve emissions reductions and resource efficiency in the subsectors of industry, agriculture, energy conversion, building and construction, traffic and transport, waste management services, and consumerism.

The specific reduction targets for each subsector are not negotiable. However, flexibility is allowed in meeting the targets. To this end, stakeholders within the different sectors are invited to enter into voluntary agreements with the government that will specify detailed goals, timetables, procedures to be followed, and the responsibilities of the contracting parties. For agreements aimed at reducing industrial pollution, individual firms must submit, every four years, a company environmental policy plan to the licensing authority. Presently, agreements have been reached with the metallurgical, chemical, and printing industries; by the end of 1993, agreements should be concluded with the metal-electro and dairy industries.

(Suurland is the Director of Industry, Building, Product, and Consumer Affairs for the Directorate-General for the Environment, the Netherlands Ministry of Housing, Physical Planning, and Environment.)

For sectors dominated by a large number of rather homogeneous and small units of operation, such as the printing and metal-electro industries, the agreements are signed only by the government and the trade organizations representing the industries. In collaboration with industry, the government is preparing standard packages of pollution prevention and control options to help companies make their environmental plans.

For sectors dominated by complex and large-scale processes, such as the metallurgical and chemical industries, the performance of individual companies has a major effect on the sector's performance; therefore, the agreement must be signed not only by the trade organization but by the majority of companies in that sector.

Under the agreements, companies may follow their own priorities in selecting the measures that will produce the reductions, as long as they can demonstrate that they will be able to meet the target goals. This enables companies to make optimal use of pollution prevention and resource-saving techniques, because they are in a position to combine market-based strategic investment decisions with the need to retrofit or replace existing production facilities in order to meet the environmental targets.

By making use of the instrument of company environmental plans, a lot of bureaucratic red tape that is normally involved in permit-review procedures can be avoided. Even more importantly, an approved company environmental plan will provide medium-term financial security to the individual entrepreneur because he can be sure that, as long as he meets the agreed-upon targets, there will be no obstacles raised by the permitting authority regarding new investments. The agreement also provides the permitting authorities with a set of broad guidelines about how to appraise individual company plans.

Whereas the target group approach is aimed at specific quantitative results, another Dutch initiative, the Environmental Care Systems program, focuses on enhancing environmental awareness and managing environmental issues in all sectors of private and public enterprises.

The program began in 1990 and will run until 1995. At that time, about 10,000 industrial plants that impose a considerable risk to the environment should have formal and integral environmental management systems, in accordance with the program's standards. Another part of the program provides environmental management assistance to the nation's 250,000 small and medium-size firms, so that they may assess and improve their own environmental performance.

Each company's integral environmental care system should include, among other elements, an environmental policy statement, a baseline assessment of environmental performance supplemented by an action program to reduce environmental impacts, and the assignment of responsibilities and tasks to ensure a proper integration of environmental considerations in all decision making and operations. Companies that belong to the 10,000 group are expected to issue an annual report on their environmental performance.

A recent interim evaluation of the program shows that considerable progress already has been made. By the end of 1992, about 25 percent of all companies had implemented an integral environmental care system. Another 25 to 30 percent had started preparations for implementation. The buildup of the regional network for environmental management consultancy units to assist small and medium-size firms is almost

An essential feature of this policy is that producers can be forced to take back used products they once marketed as new.

completed, and demand for their services is picking up.

Under the National Environmental Policy Plan, a number of actions have been taken to advance the "greening" of product markets in the Netherlands. Before the end of this year, the government will issue a policy paper that will present its view on a product policy based on the principles of life-cycle management.

A major part of the efforts to reduce waste volume is directed at consumer product waste. An essential feature of this policy is that producers can be forced to take back used products they once marketed as new. This principle of "producer responsibility" is being implemented through voluntary and legally enforceable schemes by which producers are required to meet specific targets of product waste prevention and recycling. Producer responsibility schemes have been or will be established for packaging materials, automobiles, tires, electronic equipment, batteries, refrigerators, and other durable consumer goods.

A system of eco-labeling has been established that is being operated by the "Foundation for Environmental Labeling," a joint venture of government, national trade organizations, and consumer and environmental nongovernmental organizations. Under this scheme, individual producers of designated consumer goods may apply for a certified eco-label, which is granted only to products that meet high standards of environmental performance, well above the average environmental quality of products in the particular market. Standards are based upon the best available opportunities to avoid adverse environmental impacts throughout the life cycle of the product. Eco-labeling has been introduced for writing paper and water-conserving shower heads and, in 1993, another 10 to 12 product groups likely will be designated.

The government also is developing a system of product information which will include, as much as possible, total life cycle environmental impacts. This will enable consumers to compare the environmental performance of products and will provide a basis for retailers and manufacturers to anticipate the environmental preferences of consumers. We hope this system of product information will be formed as much as possible through voluntary agreements with trade organizations, supported by regulatory measures, in order to ensure appropriate standardization. □

Dutch Environment Ministry photo

The primary metals industry was one of the first to enter into a pollution reduction covenant with the Dutch government. This sheet metal is at Hoogovens Steel Company in Ymuiden.

Stoking a Fierce Green Fire

A review of Philip Shabecoff's history of the environmental movement

by Dennis Williams

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In recent years, social justice has become an issue in the environmental movement. These marchers in Jefferson Parish, Louisiana, are protesting pollution in this ethnic community.

Environmental journalist Philip Shabecoff begins his book on the American environmental movement, *A Fierce Green Fire* (Hill and Wang, 1993), by guiding the reader across the American landscape as it might have looked to a 15th-century European. He creates a verdant land populated with unharried wildlife and noble savages, all living in absolute harmony. Sadly, this paradise is spoiled by villainous Europeans who invade the Edenic garden and, within a few hundred years, transform it into Hell's backyard. This sets the stage for Shabecoff's discussion of those who fought to protect the environment by making the environmental decision-making process more democratic and, therefore, less destructive.

In the first third of this 352-page book, Shabecoff recounts the spoliation of the American landscape by greedy developers and attempts to protect it by government officials, such as Gifford Pinchot and Theodore Roosevelt, and moral-minded amateurs, such as John Muir and his fellow Sierra Club members. Historians have often used Pinchot and Muir to illustrate the ideological schism that developed among pro-environment groups at the turn of the century. Muir led a popular movement to preserve scenic landscapes for recreational purposes, while Pinchot developed coalitions among scientists and developers to support the natural resource development doctrine of sustained yield management. Shabecoff notes the schism, but identifies the actions of these groups as two sides of an attempt to democratize public land use, which, he suggests, is the goal of the environmental movement. In Shabecoff's view, the attempt to make decisions about environmental development for the public good progressed haltingly from the turn of the century, when many of the national parks, forests, and wildlife refuges were set aside, until the 1930s, when large government programs, such as the Soil Conservation Service and the Tennessee Valley Authority, attempted to protect large blocks of the

(Williams is Assistant Historian for EPA. The views presented in this review are his and do not necessarily represent those of the Agency.)

American landscape from further degradation wrought by irresponsible private development.

Conservationists such as George Perkins Marsh, John Muir, Gifford Pinchot, Robert Marshall, and Aldo Leopold sounded the tocsin against environmental deterioration for nearly a century. But the American people and their representatives gave low priority to it until late 20th-century environmentalists, such as Paul Ehrlich, Barry Commoner, and David Brower, alerted people to the possibly catastrophic consequences of environmental abuse. Shabecoff credits these figures with creating a national psychological tension unbound by Rachel Carson's *Silent Spring*.

In April 1970, Senator Gaylord Nelson (D-Wisconsin) built the first Earth Day event on the public concern Carson's work raised. Ranging from student activists to blue collar workers to members of Congress, the Earth Day protestors infused the environmental movement with political clout. It prompted the federal government to create EPA in December 1970 and to write and revise environmental legislation. Earth Day and the environmental ferment it represented also inspired environmentalists to form new environmental organizations such as Earth First! and Greenpeace, and it infused new life into old-line conservation organizations such as the Sierra Club and the Audubon Society.

By the early 1980s, the environmental movement's successes united a number of its enemies under the leadership of President Ronald Reagan. Shabecoff interprets Reagan's ascent to the presidency as an anti-environmental counter-revolution. By placing James Watt, a pro-development westerner, in charge of the Department of Interior and Watt's protége Anne Gorsuch Burford, a Sagebrush Rebel from Colorado, as EPA administrator, Reagan hoped to free American business from the burden of environmental regulation. Shabecoff suggests that the strong public reaction against both Watt and Burford, which ultimately led to their political demise, demonstrated the environmental movement's strength.

In the last part of his work, Shabecoff discusses the accomplishments and the future of the environmental movement. He examines the effectiveness of policy changes regarding air, water, toxic substances, solid waste, biotechnology, and energy in the United States between 1970 and the early 1990s. He suggests that, while statutes such as the Clean Air Act, Clean Water Act, the Toxic Substances Control Act, the Resource Conservation and Recovery Act, and the Superfund law contributed to cleaning up the environment, they often failed to meet the expectations of the environmentalists who lobbied for them. In an effort to enhance their political strength, some within the environmental movement attempted to broaden their concerns to include questions of social justice and to take a more cooperative approach on economic/environmental questions. Finally, Shabecoff predicts that the environmental revolution will prevail against the small but powerful interests that now oppose it.

One weakness of the book: Shabecoff bases his interpretations of pre-1970 topics on often outdated, secondary sources. As a result, his view tends to be simplistic. In Chapter One, for instance, he suggests that American Indians possessed intuitive ecological awareness and were benign, passive inhabitants of North America. Europeans, on the other hand, were destructive inhabitants who generally lacked ecological awareness. Throughout the book, he pits noble, altruistic environmentalists against greedy developers who pillage the environment for their own gain. While popular, such notions are wrong-headed. Much recent scholarship by environmental historians suggests that American Indians actively altered the environment to suit their needs—at times even to the point of contributing to the extinction of some species.

While some environmentalists have supported allocating public natural resources more democratically, others have worked to protect scenic landscapes or other natural resources from the masses. Likewise, while some developers have exploited the land exclusively in their own interest, others believed that their manipulation of the environment would benefit large numbers of people. Furthermore, while Shabecoff's many good anecdotes provide insight into the issues that drove the late 20th century environmental movement, he presents them with too little concern for the sequence of events. By jumping between decades, even centuries, and applying modern standards to past actions, he distorts the portrait.

Still, Shabecoff has taken an important step in illustrating the environmental movement's present internal crisis. He paints the movement as many in it would portray themselves—as a democratic David fighting a selfish Goliath. However, this interpretation unravels somewhat in the last chapter, when Shabecoff argues that by the 1990s the environmental movement had become a majoritarian movement opposed by a few powerful interest groups. He doesn't attempt to make sense of this contradictory development. Why? Perhaps because he allows the movement's rhetoric to cloud his view.

For the past century, environmentalists have developed a powerful mythos to define themselves: They are a few good people defending the powerless environment against powerful, destructive forces within American society. Now that the environmental movement appears to have converted the American majority to its position—as public opinion surveys, legislation, bureaucratic organization, and even television advertisements for chemical and lumber companies seem to suggest—the old interpretation no longer rings true. A new one, which must make sense of the movement's whole history, has yet to emerge. Shabecoff's argument that the environmental movement exists on the cutting edge of democracy illuminates but one of many themes contributing to the movement's development. □

A lesson Plan on Pollution Prevention

by Stephen Tchudi

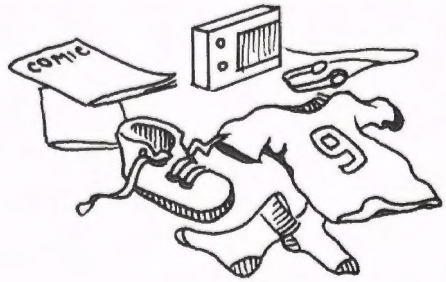
To the Teacher: All educators want their students to apply their learning beyond the classroom walls. Pollution prevention offers rich possibilities in practical, interdisciplinary lessons for students from kindergarten on up, with projects for hands-on learning in virtually every school subject. Pollution prevention can be explored through math problems, science projects, history and social studies, and English/language arts.

What is Pollution Prevention?

How many times has an adult in your life hollered at you, "Look at this messy room! Clean it up now!" That person probably has said more than once, "If you didn't trash your room in the first place, cleaning it up wouldn't be such a chore!"

Keeping our "rooms" clean in the first place is what pollution prevention is all about. Pollution prevention, also called "source reduction," means reducing or eliminating the *creation* of pollution. This can be done by using energy, water, or other resources more efficiently *before* we recycle or dispose of them. Examples of pollution prevention include using energy-conserving lightbulbs and planting crops that are naturally resistant to bugs, so that pesticides aren't needed.

It takes a lot of your time—your "resources"—to clean your messy room. Likewise, it is expensive and complicated to clean up the messes we've created in our environment (and a lot of hollering goes on about who has to do the cleanup). So pollution prevention makes a lot of sense.



(Dr. Tchudi is Professor of English at the University of Nevada, Reno, where he teaches interdisciplinary programs and edits The Phoenix, *the newsletter of the Assembly on Science and Humanities of the National Council of Teachers of English. "Hands On" science experiments were from Sheila Meibergen, Brown Elementary School, Reno.)*

Exploring Pollution Prevention

- *52 Pickup Revisited.* You probably have heard of this "game," where a trickster scatters a deck of cards on the floor and tells the victim to play "52 Pickup!" Explore this game as an example of pollution prevention. With a friend, time how long it takes a deck of cards (or a fistful of paper scraps) to flutter to the floor from shoulder height. You can count the seconds by saying "a thousand and one, a thousand and two . . . ." It won't take very long! Then time how long it takes you to *pick up* those same scraps. Think about this: It's much more difficult and time consuming to clean up the environment than it was to trash it in the first place.

- *In the News.* Start a file of newspaper articles from your local newspaper on the topics of pollution, pollution prevention, and waste disposal. You

may be surprised to see that almost every issue of every daily paper will have pollution-related stories. As your stack of articles grows, sort them into piles or folders: water, air, trash, toxic waste, etc. Which articles are strictly about *preventing* pollution, rather than recycling or disposing of it once it's created? Is pollution prevention receiving much attention in your town?

- *Fast Food and the Wastebasket.* One national fast food chain advertises on its (recycled) paper bags that it now wraps its burgers in paper instead of putting them in a box. As a result, it explains, each year 15,000 tons of trash are eliminated nationwide. That, in turn, cuts down on the amount of gasoline consumed, because fewer garbage trucks are needed.

  The next time you visit a fast-food restaurant, collect all the trash created by your meal—napkins, plastic spoons, styrofoam, cardboard, even the placemat on the tray. Also, make a count of how many customers make purchases during a 15-minute period. Back at home or school, sort the trash into piles—plastic, paper, styrofoam. Estimate how many or how much of each item is used in 15 minutes at *one* restaurant. Then multiply to estimate how much trash is being created by a single restaurant in a single work day. Finally, estimate how many fast-food restaurants there are in your town, your state, and in the United States. Crunch the numbers and create a bulletin-board display with these statistics. See if you can meet with a fast-food store manager in your town and ask him or her to explain what the company is doing to cut down on waste.

- *How could your school cut down on the amount of trash you throw away each day? Make a list of the possibilities (don't include "doing away with homework"!).*

- *"You Can Make A Difference."* EPA publishes a guide to pollution prevention with that title. After studying copies of the EPA guide or any of the books listed in "Good Reading," write your own pollution prevention booklet or leaflet. You could include topics such as cutting down on junk mail, keeping environmentally harmful chemicals out of your home, creating a lawn that doesn't need watering (xeriscaping), decreasing the use of styrofoam, or getting involved with community pollution prevention projects. You might also submit copies of your writing to the school newspaper or even to your local newspaper.

- *Pro and Con.* Using your newspaper clipping file and/or drawing on telephone interviews or guest speakers, stage a debate on the issue: "Resolved: It is better to prevent pollution than to pay the price of cleanup." Or if you want a topic that is more challenging, try this: "Resolved: Pollution prevention is none of my business" or "Resolved: One person really *can't* make a difference in pollution prevention."

- *On Your Own.* Pollution prevention really is a broad topic. Each of the following has something to do with it. What's the connection? Check your school or public library for books, and plan to do a school newspaper article, science project, or a report on one of the following:

smog	toys
cigarette smoking	waste water
oil spills	thermostats
plastic	styrofoam
soft drink containers	rainforests
water supply	xeriscape
landfills	car exhaust
laundry detergent	cities
paint/paint remover	solar energy
grass	diapers
paper	weeds
composting	packaging
greenhouse effect	telephones
the ozone layer	batteries
methane gas	pest control
aerosol spray cans	car pools
acid rain	food chain
water treatment	

- *The Job Hunt.* You might be surprised to learn that you can plan for a career in pollution prevention. The prevention of pollution is of concern to foresters, parks and recreation managers, environmental planners, and water engineers. An especially good book on this topic is *The Complete Guide to Environmental Careers.* (See "Good Reading.") □

Good Reading

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Seemingly Feeble and Stealthy Steps

An excerpt from Thoreau's *Faith in a Seed*

. . . Though I do not believe that a plant will spring up where no seed has been, I have great faith in a seed. Convince me that you have a seed there, and I am prepared to expect wonders. —H.D. Thoreau in *The Succession of Forest Trees* (1860)

In the Environmental Education Act of 1990 Congress included provisions for a series of national awards recognizing outstanding contributions to environmental education, including a Henry David Thoreau Award to be given in recognition of outstanding contributions to literature on the environment. The first Henry David Thoreau award has been given to writer and independent scholar Bradley P. Dean for his edition of Faith in a Seed: The Dispersion of Seeds and other Late Natural History Writings *(Island Press, 1993)—the first release of previously unpublished writings by Thoreau to appear in 125 years.*

In preparing these writings for publication, Dr. Dean not only employed standard textual editing practices but also used non-textual physical evidence, such as tears, sealing-wax residues, and types of ink and paper to study the process of composition and determine the sequence of manuscripts. Dean is secretary of the Thoreau Society and editor of the "Thoreau Society Bulletin" and "The Thoreau Society Research Newsletter."

*To quote from an introduction to the book by Robert D. Richardson, Jr., "*Walden *is a great—perhaps our greatest—celebration of the sweet freedom of a life in nature that is single, unattached, and uncommitted.* The Dispersion of Seeds, *in contrast, celebrates fertility, fecundity, and interconnectedness . . . .* Walden *is the acknowledged masterpiece of Thoreau the poet-naturalist;* The Dispersion of Seeds *. . . is the culminating work of Thoreau the writer-scientist." The following excerpts are from* The Dispersion of Seeds:

. . . A great pine wood may drop many millions of seeds in one year, but if only half a dozen of them are conveyed a quarter of a mile and lodge against some fence, and only one of these comes up and grows there, in the course of fifteen or twenty years there will be fifteen or twenty young trees there, and they will begin to make a show and betray their origin.

In this haphazard manner Nature surely creates you a forest at last, though as if it were the last thing she were thinking of. By seemingly feeble

Drawings by Stacey Stevenson.

and stealthy steps—by a geologic pace—she gets over the greatest distances and accomplishes her greatest results . . . .

It is a boy's statement, and does not imply much wisdom, to discover that "little strokes fall great oaks," for the sound of the axe invites our attention to such a catastrophe. We can easily count each stroke as it is given, and all the neighborhood is informed by a loud crash when the deed is consummated; but they are few who consider what little strokes, of a different kind and often repeated, *raise* great oaks or pines. Scarcely a traveller hears these or turns aside to communicate with that Nature which is steadily dealing them . . . .

Yes, these dense and stretching oak forests, whose withered leaves now redden and rustle on the hills for many a New England mile, were all planted by the labor of animals. For after some weeks of close scrutiny I cannot avoid the conclusion that our modern oak woods sooner or later spring up from an acorn, not where it has fallen from the tree, for that is the exception, but where it has been dropped or placed by an animal.

Consider what a vast work these forest planters are doing! So far as our noblest hardwood forests are concerned, the animals, especially squirrels and jays, are our greatest and almost only benefactors. It is to them that we owe this gift. It is not in vain that a squirrel lives in almost every forest tree or hollow log or wall or heap of stones.

Thus, one would say that our oak forests, vast and indispensable as they are, were produced by a kind of accident, that is, by the failure of animals to reap the fruit of their labors. Yet who shall say that they have not a dim knowledge of the value of their labors?—that the squirrel when it plants an acorn, and the jay when it lets one slip from under its foot, has not sometimes a transient thought for its posterity, which at least consoles it for its loss?

But what is the character of our gratitude to these squirrels—to say nothing of the others—these planters of forests, these exported dukes of Athol of many generations, which have found out how high the oak will grow on many a mountain, how low in many a valley, and how far and wide on all our plains? Are they on our pension list? Have we in any way recognized their services? We regard them as vermin. The farmer knows only that they get his seed corn occasionally in the fields adjacent to his woodlot, and perchance encourages his boys to shoot them every May, furnishing powder and shot for this purpose, while perhaps they are planting the nobler oak-corn (acorn) in its place—while up-country they have squirrel hunts on a large scale every fall and kill many thousands in a few hours, and all the neighborhood rejoices. We should be more civilized as well as humane if we recognized once in a year by some symbolical ceremony the part which the squirrel plays in the economy of Nature.

The noblest trees, and those which it took the longest to produce, and which are the longest lived—as chestnuts, hickories, and oaks—are the first to become extinct under our present system and are the hardest to reproduce, and their place is taken by pines and birches, of feebler growth than the primitive pines and birches, for want of a change of soil. There is many a tract now bearing a poor and decaying crop of birches, or perhaps of oaks, dying when a quarter grown, and covered with fungi and excrescences, where for two hundred years grew oaks and chestnuts of the largest size.

The time will soon come, if it has not already, when we shall have to take special pains to secure and encourage the growth of white oaks, as we already must that of chestnuts, for the most part. These oaks will become so scattered that there will not be seed enough to seed the ground rapidly and completely . . . . □

Securing a Safe Water Supply

EPA helps Cincinnati clean up its drinking water

by Jean Dye

The Ohio is one of America's most scenic rivers. But it is also an industrial waterway, carrying millions of tons of coal, synthetic organic chemicals, and petroleum products annually. According to the U.S. Army Corps of Engineers, about a fifth of the traffic on the river is hazardous cargo that could affect water quality in those cities that use the Ohio River as a source of drinking water. One of those cities is Cincinnati.

Richard Miller, then director of the Cincinnati Water Works, was concerned as early as the mid-1970s about both the day-to-day quality of the city's drinking water and the possibility of an up-river industrial spill. His concerns were shared by EPA's Drinking Water Research Division, part of the Office of Research and Development in Cincinnati.

EPA was aware that nearly 200 synthetic organic chemicals, not removed by standard water treatment, had been identified in trace amounts in the Ohio River. According to Robert Clark, director of the Drinking Water Research Division, synthetic organics such as gasoline or pesticides resist conventional filtration systems because they do not "clump" when normal coagulation treatments are used, and they are not filtered by sand, the standard filtration medium. EPA was concerned about the health risk of ingesting even trace amounts of organics over long periods of time. EPA and the City of Cincinnati came together to research and test a technology called Granular Activated Carbon (GAC) to filter out the cause of some of their greatest water quality concerns—synthetic organic chemicals.

(Dye, a writer-editor, is an enrollee in the Senior Environmental Employment Program assisting EPA under a cooperative agreement with the National Council of Senior Citizens.)

Widely used in Europe, where it was first developed, GAC technology employs deep beds of carbon granules to trap contaminants. When the granules are saturated, they are regenerated by baking at high temperatures and then reused. EPA's drinking water researchers had been conducting laboratory studies on GAC for many years. According to Miller, the challenge of the cooperative research agreement between EPA and Cincinnati, signed in August 1977, was to adapt the technology to a full-scale municipal operation. EPA awarded the Cincinnati Water Works a $3 million research grant, and the city contributed another $1 million to fund the four-year research study.

Cincinnati's municipal water system serves about 800,000 residents in a three-county area and filters about 140 million gallons of water a day. Ranking twentieth in the United States in size, the Cincinnati system was large enough to challenge the GAC research team. According to Miller, no other filtration system had ever adapted the GAC technology on such a large scale. No one knew what a large GAC facility should look like or how the carbon regeneration process would work when millions of pounds of carbon were involved.

What *was* certain was that the GAC technology would be a "downstream," or add-on system. Cincinnati's conventional process of chemical mixing, coagulation, sedimentation, sand filtering, and disinfecting would remain in place to filter particulates and microorganisms (such as bacteria and viruses). The GAC addition would remove a broad range of synthetic organic chemicals, while providing a permanent barrier in the event of a hazardous spill.

The partners set to work building and evaluating a mini-model able to process one million gallons of water a day. Various sizes of GAC filtration beds were tested for their effectiveness in removing organic materials, for operational lifespan, and for their ability to be regenerated and reused. The research team also studied cost effectiveness and the impact of the regeneration process on air quality.

The findings convinced city officials to authorize a new $60 million GAC water treatment facility, plus a $10 million upgrade of the existing plant to be funded from local water revenues. A series of public hearings and some local political resistance lengthened the planning schedule, according to Miller. Work finally began on the new 150,000 square-foot installation in the spring of 1989, and the completed facility—the largest in the world—was opened for operation in October 1992.

The Cincinnati GAC plant is impressive: The building houses 12 carbon filter beds, each one the size of a small house (about 30 ft. by 65 ft. by 26 ft. deep). Each bed is filled to a depth of nearly 12 feet with 600,000 pounds of carbon granules.

After being purified by conventional means in the original plant, drinking water is pumped to the GAC building, where it passes through the carbon beds to remove organic contaminants. It is then pumped to underground tanks to await distribution.

So efficient is the GAC process that the 1986 amendments to the Safe Drinking Water Act specify it as the standard (Best Available Technology) by which all other technologies are evaluated. According to EPA's Robert Clark, Cincinnati's experience played a part in the setting of that standard.

The GAC system, which brings high-quality drinking water to residents at an added cost of about six cents per day, is an excellent example of cooperative programs between municipalities and EPA's Office of Research and Development. Clark says, "This technology goes beyond simply meeting drinking water standards. It is an attempt to provide consumers with the highest quality drinking water possible in a very cost-effective manner." □

Lowrance

Metzenbaum

Minerva

Sylvia Lowrance has been appointed Associate Deputy Administrator with responsibilities including improving communication between the Administrator's office and the program offices and regions. She also will assist the Deputy Administrator in coordinating Agency regulatory development efforts, focusing on cross-media and cluster issues. Lowrance will provide guidance on such issues as reauthorization of the Clean Water Act, extramural resource management, dioxin and mining matters, and the environmental goals project.

Lowrance, with the EPA since 1979, has extensive experience in the Agency's hazardous waste programs. In 1988, she became Director of the Office of Solid Waste and before that directed OSW's Characterization and Assessment Division. She has worked in policy and management positions in EPA's RCRA, Superfund, and Waste Enforcement programs and in the Office of Emergency and Remedial Response and the Office of Water.

Before joining EPA, she was a government relations representative for several national trade associations. Her many awards for excellence in public service include the Presidential Award for Meritorious Service (1992). She holds a bachelor's degree from the University of Michigan (1975) and a law degree from the Catholic University of America (1982).

Shelley Metzenbaum is EPA's new Associate Administrator for Regional Operations and State/Local Relations.

Before coming to EPA, Metzenbaum served as Undersecretary of the Massachusetts Executive Office of Environmental Affairs (EOEA) from 1989 to 1991. There she was responsible for budgetary, administrative, and management affairs for the five state agencies involved in environmental regulation and natural resource management, including the Department of Environmental Protection. Among other accomplishments at EOEA, Metzenbaum initiated several environmental permit processing reforms and developed ENVest, the Massachusetts environmental investment campaign which raises private sector contributions for environmental projects. She was also instrumental in the creation of the Massachusetts Environmental Business Council, which assists environmental businesses with international marketing, employee search and training, and other needs.

From 1987 to 1989, Metzenbaum was Director, Office of Capital Planning and Budgeting, Massachusetts Division of Capital Planning and Operations.

Metzenbaum has also served as a management consultant for clients including the National Governors' Association and the Kennedy School of Government; Director, Office of the Mayor, City of Boston; and Economic Development Specialist, Office of the Governor, State of Arkansas.

Metzenbaum graduated Phi Beta Kappa with a bachelor's degree in humanities and Asian studies from Stanford University, and a master's degree and Ph.D. in public policy from the Kennedy School of Government at Harvard University.

Dana Dunmire Minerva has been appointed Special Counsel to the Deputy Administrator.

Minerva comes to EPA from the Florida Department of Environmental Regulation, where she served as an Assistant Secretary and Special Assistant to the Secretary. There she helped manage the department's rule-development process and the meetings of the Environmental Regulation Commission. She also served as chief of the Office of Intergovernmental Programs, which was the department's liaison with federal, state, and local agencies; the office also implemented the department's conservation land acquisition, land use plan review, power plant sitings, and coastal zone management programs.

From 1989 to 1990, she was Staff Director for the Florida House of Representatives' National Resources Committee. She supervised the drafting of significant bills relating to environmental protection and assisted legislators as they worked to pass this legislation into law. From 1986 to 1989, she was an attorney for the committee.

She has also held positions as Senior Attorney, Office of General Counsel, Florida Department of Community Affairs, 1985 to 1986; Legislative Analyst, Florida Senate, 1984 to 1985; and Attorney for Florida House of Representatives, Select Committee on Growth Management, 1982 to 1984.

Minerva received a bachelor's degree in political science from Stetson University and her law degree and a master's of science degree in urban and regional planning from Florida State University.

Bailey

Brown

Betty L. Bailey has been appointed Director of the Office of Acquisition Management (OAM) within EPA's Office of Administration and Resources Management.

Dr. Bailey has served as OAM's acting Director since June 1993. Previously she was director of contracting for the Air Force Communications Command Headquarters at Scott Air Force Base, Illinois.

She joined the civil service in 1977 at Edwards Air Force Base, where she was promoted to Chief of R&D contracting for the Air Force Astronautics Laboratory. In 1987, she became Director of Policy and Management in the Directorate of Contracting at Air Force Systems Command, Space Division, Los Angeles Air Force Base.

In 1990, Dr. Bailey became the Deputy Director of Contracting, headquarters Air Force Communications Command, Scott Air Force Base.

She earned a bachelor's degree and a master's degree in business administration from Golden Gate University and a doctorate in business philosophy from California Coast University.

EPA's Office of Administration and Resources Management also announces the appointment of **Jeanette L. Brown** as Deputy Director of OAM.

Brown came to EPA from the U.S. Small Business Administration (SBA), where she was Director of the Office of Procurement and Grants Management. Previously, Brown was Director of the Division of Program Development for the Minority Small Business Capital Ownership Development Program.

Prior to her work at the SBA, Brown served as a Branch Chief and Supervisory Contract Specialist for the Navy Automatic Data Processing Selection Office of the Navy's CAD-CAM (CAD II) Program for the Navy's five systems commands. In 1988, she became Branch Head of the Research and Development/Major Acquisition Branch. She subsequently served as the lead contract specialist in the Contracts Division of the All-Up-Round Branch of the Joint Cruise Missile Project.

She began her career in 1978 as a Navy Cooperative Education (CO-OP) Student. In 1980, after graduating from Morgan State University in Baltimore, Maryland, with a bachelor's degree in business administration, she began a Navy Internship at the Naval Regional Contracting Center in Washington, DC. She attended graduate school at the American University. □

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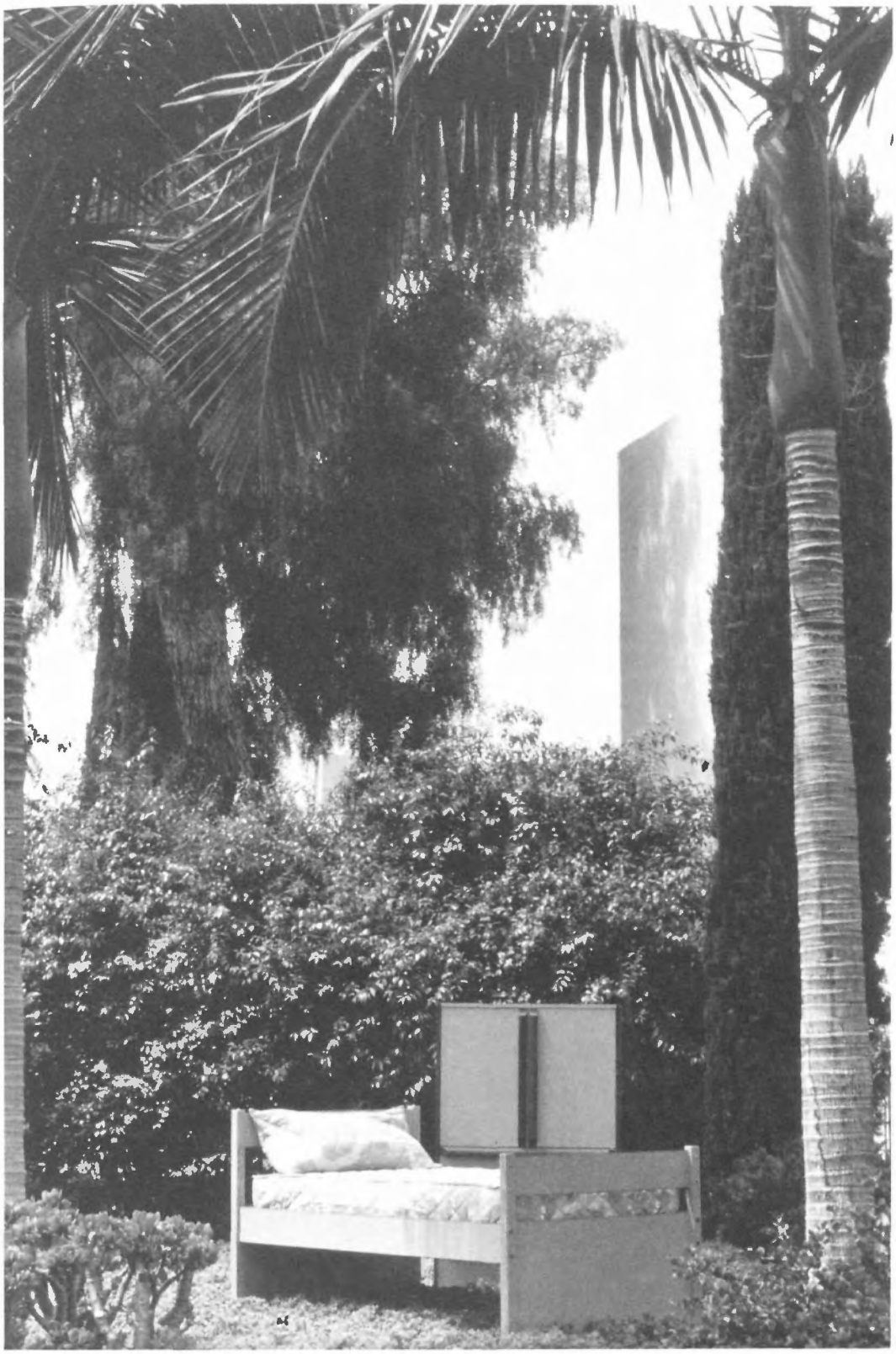

Southern California Edison photo

Camelot Furniture Company of Orange, California, produces furniture with a high-gloss finish without using either volatile organic compounds or solvent-based coatings. The technique involves waterborne coatings applied with high-volume, low-pressure spray application.

Back cover: Our overflowing landfills are a reminder of the need for pollution prevention. Rob Badger photo.