



Toxic Chemicals Move to Center Stage

Chemistry: a science that deals with the composition, structure, and properties of substances and with the transformations that they undergo.

—Webster's Ninth New Collegiate Dictionary

Any substance can be toxic when administered in sufficient amount. Even essential nutrients like vitamins are poisons when taken in too large a quantity. But this does not mean that the amounts of substances to which an organism normally may be exposed pose a significant hazard or, indeed, any hazard at all.

—American Chemical Society

The Congress finds that (1) human beings and the environment are being exposed each year to a large number of chemical substances and mixtures; (2) among the many chemical substances and mixtures . . . are some whose manufacture, processing, distribution in commerce, use, or disposal may present an unreasonable risk of injury to health or the environment. . . .

—Toxic Substances Control Act of 1976

The Environmental Awakening of a Nation

The conference room in the new Executive Office Building across Pennsylvania Avenue from the White House was jammed. I managed to find standing room at a considerable distance from the White House staffers who were beaming with a sense of personal accomplishment at the far end of the table. They had called together representatives of about 20 government agencies to inform them of the procedures for implementing the newly enacted National Environmental Policy Act of

1969 which the presidential staff had shepherded through the Congress.

The White House aides emphasized the importance of Environmental Impact Statements. The law required that such statements be prepared by government agencies prior to any federal action that could have significant environmental side effects. They announced that the White House was assembling a new staff for reviewing these statements and the related plans to prevent harmful effects before the agencies could carry out their proposed projects.

At the meeting I was representing the Agency for International Development (AID), the foreign assistance arm of the United States government. I had clear instructions from the Agency: keep these instant environmentalists out of the foreign aid business. The whole purpose of foreign assistance, we would argue, was to improve human environments in distant lands. Environmental Impact Statements and other innovations from this new crowd would be redundant. We did not need another bureaucracy in Washington to make our task more difficult. However, during the next two decades all of us interested in foreign aid slowly recognized that this early environmental arrogance of the AID masked fundamental flaws in promoting near-term economic betterment with little regard to the long-term sustainability of development efforts.

At the time, the AID leadership readily acknowledged that international development programs had serious problems. Several dams financed by the AID in Africa had changed river patterns, creating huge pools of stagnant water that had become expanded breeding grounds for waterborne diseases. But the Agency rationalized this unfortunate side effect as a small price to pay for electricity and irrigation. The AID was assisting Brazil penetrate the Amazon jungle. Plant varieties were being destroyed, and new diseases were being introduced to isolated populations which had not developed natural immunities to many of the diseases that plagued modern societies. But the alternative was for the population of northeast Brazil to continue to live in abject poverty, an alternative that the Agency rejected. The AID had discovered pollution havens in the developing world where dirty industrial plants of multinational companies, alongside even dirtier plants of local industry, did not have to abide with regulations limiting the discharge of contaminants nor with guidelines for disposal of wastes which they would face in the United States. Nonetheless, these countries had few alternatives for satisfying market demands and for creating jobs in the near term, and

the foreign companies were contributing relatively little additional pollution to the already high contamination levels, concluded the AID experts.

In short, we at the AID were overly confident that our specialists who had toiled in developing countries for more than two decades adequately appreciated the importance of environmental protection and clearly knew far more about the side effects of international development than did any of this new breed of environmentalists. The Agency could easily refine its documents and expand its programs for training specialists from the poor countries, so we thought, to show compliance with both the letter and the spirit of the new law which clearly seemed targeted at domestic agencies. In fact, we wondered how these other agencies had not thought seriously in the past about the environmental impacts of their programs in the United States.

I did not have to argue our case that the new environmental offices of the government should forget about the AID. The young political enthusiasts at the end of the table were kept busy confronting a large audience of cynical bureaucrats from the old-line departments of government. The newcomers had their hands full with an agenda designed in the first instance to reign in the river development projects of the Bureau of Reclamation, the coastal engineering activities of the Corps of Engineers, and controversial pork barrel construction programs around the United States. Also, the senior diplomat from the Department of State made an impassioned plea that international activities were too complicated to be encumbered by Environmental Impact Statements. He urged that foreign policy efforts concentrate on encouraging the nations of western Europe to be as forward-looking as the United States. All agreed. Thus, for the next few years the new environmental movement in the United States had little influence on foreign assistance programs.

During these early days of the modern environmental era, my colleagues and I at the AID heard constant rumblings from the White House Office of Science and Technology (now named the Office of Science and Technology Policy) over trace levels of toxic chemicals being found in the environment. However, these poisonous materials were considered to be by-products of American industry, and industrial facilities were few and far between in the countries where the AID had programs. Meanwhile, agricultural specialists of the AID had become very defensive over criticism of their programs to ship large quantities

of pesticides to developing countries. They received a number of complaints from officials in the developing countries concerning the emphasis the AID was placing on the use of pesticides. In response, the AID specialists blamed the poor training of pesticide applicators in those specific countries while dismissing the possibility that the real problem was inherent in the heavy reliance on pesticides to raise agricultural production levels.

Within a few years, private environmental groups in the United States and abroad began to understand the weaknesses in the orientation of almost all foreign assistance programs toward near-term economic payoffs from specific projects, with longer-term environmental impacts only a secondary concern. In the United States, they laid at the AID's doorstep every environmental insult they could uncover in the Third World. They had found many, including the buildup of pesticides in the deltas of Central America, loss of soil productivity through excessive use of fertilizers in Pakistan, increasing air pollution in cities throughout Asia, and uncontrolled acid runoff from mining operations into the streams of Africa. As a result, during the 1970s the U.S. Congress began wrapping its appropriations for the AID in environmental blankets. Before using appropriated funds, the AID must now ensure that environmental side effects would not outweigh the benefits of the programs. With its budget at stake, the AID quickly responded with many environmental pronouncements and programs.

Today, the AID professes to be an environmental agency. Forestry preservation, land reclamation, reduced use of pesticides, and pollution control technologies have become highly visible components of the AID lexicon. However, as discussed in a later chapter, neither the AID nor the policy agencies of the U.S. government have adequately recognized the central issue that is relentlessly degrading environmental quality in developing countries and is also becoming a dominant concern on the global environmental scene. This issue is the spiraling growth of the world's population.

The Environmental Movement Restores the American Spirit

In addition to the enactment of the National Environmental Policy Act, three other events highlighted the entry of the United States into

the environmental age at the beginning of the 1970s. In April 1970, the first Earth Day was celebrated in Washington and in many other communities throughout the United States by “the little old ladies in tennis shoes” and by hundreds of thousands of others in “the biggest street festival since the Japanese surrender in 1945.” The EPA was established later that year. Finally, in 1972 the United Nations organized a major environmental conference in Stockholm. No longer would there be unconstrained economic development at home or abroad.

Many historians attribute the environmental awakening in the United States to a series of alarming environmental events that were easily understood by the man on the street and by the politicians in Washington. They point to Rachel Carson’s book *Silent Spring*, which was first published in 1962, describing the impact of pesticides on wildlife and on humans.¹ For more than a decade, and indeed even to today, this book has attracted a wide readership which has uniformly reacted with alarm to the revelations over the side effects of pesticides. Also, historians usually recount the serious air pollution problems that resulted in a shutting down of industry in Birmingham, Alabama, and temporarily paralyzed the city, while across the country Los Angeles was continuously reeling from smog alerts. Meanwhile, stress the history books, state officials indicted mercury as destroying the fishing industry in the western part of Lake Erie. In Cleveland, the pollution entering the Lake became so thick that the Cuyahoga River caught fire. Finally, they note, the oil slick from a breakaway oil well off the coast of Santa Barbara blemished one of the nation’s most beautiful coastal areas and disrupted migratory routes for whales and other marine mammals.

With regard to establishment of the EPA, a former White House aide has described the internal debates within the Nixon Administration as follows:

At cabinet meetings, HEW Secretary Bob Finch, responsible for air pollution controls, and Transportation Secretary John Volpe argued over which department should take the lead in developing a research program for unconventional low-polluting automobiles. On pesticides, Walter Hickel at Interior and Finch argued for tighter pesticide controls while Agriculture Secretary Clifford Harden emphasized the increased crop productivity resulting from application of pesticides. And Secretary of State Bill Rogers weighed in expressing concern on whether a ban on DDT in this country might restrict the supply of DDT to the developing countries. Hickel, who at the time handled

water pollution control over at Interior, wanted more money for sewage treatment control; Bob Mayo, director of the Bureau of the Budget, would have none of it. Maurice Stans at Commerce was wary of tighter pollution controls and what effect this might have on corporate profits. Paul McCracken, Chairman of the President's Council of Economic Advisers, worried that we would be uncompetitive in international markets if our product prices reflected the costs of pollution abatement standards that were more stringent than those of other countries. There was hardly a cabinet officer who did not have a stake in the environment issue. Even the Postmaster General joined the debate, offering to use postal cars to test an experimental fleet of low-pollution cars.

The cabinet meeting left President Nixon dissatisfied. There was no overall strategy, too many unanswered questions. Should enforcement be done by regulation, or by user fees, or by a combination of both? What were the overall costs to industry and the consumer in terms of the increased price of products resulting from various pollution abatement schedules under varying standards and regulations? Finally, what would the various cleanup scenarios do to the federal budget? Nixon clearly needed a pollution czar and one agency to look for the answers.²

The EPA was born shortly thereafter.

The environmental shocks of the 1960s were certainly traumatic, and the bureaucratic confusion in Washington was deplorable. However, there were other important dimensions to the emerging enthusiasm and commitment for a higher quality of life and new environmental priorities at both the national and local levels. First, the American economy was on a roll despite the drain of the Vietnam war. Fueled by spectacular technological achievements throughout the industrial complex, business was prospering at home and abroad. The United States could afford the costs of environmental regulations. Probably of even greater significance, the country was ready for programs that were new and exciting, but most importantly for a cause which was respectable and good.

Several personal experiences brought home to me the depths to which our country had fallen in the 1960s and early 1970s and the importance of the environmental movement in helping to pull society out of a swamp of despair. In 1965 I landed at the Los Angeles airport near the flames of the Watts race riots, and at major intersections national guardsmen sitting in jeeps—behind machine guns mounted on

tripods—directed me to my home in the center of the city. Three years later in 1968 after leaving my office in the center of Washington with Fourteenth Street ablaze from another wave of race riots, I drove by army troops crouched behind the same type of machine guns on the White House lawn. Then, in 1971 I traveled to Saigon and to the highlands of Vietnam to develop programs of technical aid and cooperation only to find myself constantly surrounded by bodyguards in jeeps with these all-too-familiar machine guns.

Throughout this period I watched from vantage points both inside and outside the White House as our national leaders agonized over how to calm racial tensions and how to extract the nation from the mire of Vietnam. All the time, they searched for ways to unify the country in other areas where a national consensus could help offset the divisiveness of racism and war. By the end of the 1960s the United States, as a nation and as a people, was ready for new alternatives, alternatives rooted in goodness and designed to benefit all people. Environmental protection was one alternative.

From Eyesores and Odors to Toxics and Cancer

The increasing revelations of public health hazards resulting from the improper handling of toxic chemicals, and particularly pesticides, clearly contributed to the new emphasis in Washington on environmental protection during the late 1960s and early 1970s. However, with the EPA established and many agencies hard at work preparing Environmental Impact Statements, the attention of the government and the public quickly turned to other more visible environmental problems. Everyone wanted prompt action to clean up the algae clogging lakes and ponds, to reduce smog and ozone hanging over cities, to move municipal sewage causing environmental eyesores and foul odors, to restrict uninhibited land development laying waste to bountiful marshlands, and to redirect garbage to more suitable dump sites.³

Toxic chemicals were not totally neglected. They simply were not at the top of the priority lists of regulators in Washington or in the state capitals. Hundreds of chemicals being used by industry were of potential concern, warned scientists; but the harmful chemical effects, when they were present, were hidden from view. Also, the agricultural lobby,

working through the Congress and the Department of Agriculture, ensured that pesticidal chemicals would remain one of the backbones of American agriculture and would not become a victim of overzealous regulators within the EPA.

The laws for water pollution and air pollution were among the earliest legislative authorities to call specifically for the regulation of toxic chemicals. However, the EPA was uncertain how to assess the hazards from nearly imperceptible levels of mercury, cadmium, lead, and other heavy metals, let alone even more minute amounts of the complicated organic chemicals which were appearing in food and drinking water with increasing regularity. Developing approaches that would limit the discharge of traces of these chemicals into the environment to “acceptable” levels without being excessively demanding of industry was a new type of challenge which the EPA was not eager to tackle.

The Agency engineers argued, with justification, that as a first step the EPA was already requiring the removal of particulates, oil, grease, and other common pollutants from waste streams of industrial facilities throughout the country, and the same pollution control devices that were used to remove these common pollutants would also filter out heavy metals and organic matter. However, while helpful, these devices were not designed to remove all trace amounts of metals and organic chemicals which were of concern in scientific circles.

Meanwhile, several environmental officials housed in a new advisory body in the outer offices of the White House complex—the Council on Environmental Quality which had been established by congressional action—concentrated their efforts on developing an approach which would require the EPA to regulate many “toxic substances.” They used this term to encompass all man-made chemicals regardless of the dangers they posed except pesticides, drugs, cosmetics, food additives, and radioactive materials since these categories of chemicals were already regulated under special laws which had been in place for many years. Included among the many unregulated chemicals which attracted their interest were highly reactive chemicals used as intermediate materials in industrial processes: petroleum products; solvents used in dry cleaning establishments as well as more powerful solvents used in metal working facilities, in paints and dyes, and in

plastics and artificial rubbers; and a variety of household products such as lyes, varnishes, and cleaning powders.

In 1971 the White House aides began drafting new legislation. They pointed out that the water and air pollution control laws could not adequately regulate all toxic substances that were causing problems: in some cases the need was not simply stopping the discharges of waste chemicals from industrial plants but rather banning chemical products in order to protect workers or consumers. Also, information on the possible health and ecological impacts of many chemical substances was very limited. Therefore, the advocates of new legislation proposed that industrial companies be required to conduct laboratory tests on many chemicals which they sold or planned to sell in order to demonstrate whether or not they posed environmental hazards.⁴

The environmental problems attributed to polychlorinated biphenyls (PCBs) that burst onto the scene in the early 1970s greatly strengthened the case for toxic substances legislation which would "fill the gaps between existing laws." This chemical—which is really a mixture of chemicals with closely related molecular structures—was widely used in the electrical industry. The fire resistant properties of PCBs made them ideal as a coolant for transformers. Transformers are located not only outdoors where we commonly see them next to electrical generation and transmission facilities, but they are also hidden from view in subways, electrical trains, office buildings, and other indoor facilities. In addition, PCBs were important materials for capacitors and other electrical devices used in every city and town.

However, once PCBs escape into the environment, they are nothing but trouble. Unfortunately, they were escaping on a nationwide scale. Leakages and spills had become common during the filling and repair of transformers and capacitors. Also, such equipment often ended up in landfills and junkyards where PCBs drained into the surrounding land and water.

PCBs are highly persistent in the environment: they simply do not break down into other chemicals and go away. They spread through the water, through the air, and through the soil as they withstand the chemical batterings of nature. Originally they were known to poison wildlife and to cause chloracne on people's skin. Then they were shown to cause liver function abnormalities. Now they have been linked by

some scientists to cancer and to reproductive disorders although other scientists dispute these contentions.

In the early 1970s PCBs were showing up everywhere—in fish from the Great Lakes, in streams and estuaries, and in soil samples from around the country. The White House sounded the alarm: the Monsanto Company which manufactured almost all PCBs produced in the United States must “voluntarily” close its plant, and Congress must pass new legislation to safeguard the country from other dangerous chemicals in the future.

Monsanto responded and shut down its PCB production facility in East St. Louis. At the same time, PCBs became the “toxic classic” which was repeatedly cited during the next few years in the clamor for new regulatory authority to control toxic chemicals. “What if Monsanto had stonewalled the appeals of the government and not stopped production?” hypothesized the environmentalists. Clearly, tough new regulations were needed, they concluded.

Despite the scare over PCBs, Congress was not very enthusiastic in its initial response to still another major piece of environmental legislation. No one on Capitol Hill understood the magnitude of the proposal to subject all chemicals to regulatory scrutiny. The chemical industry warned that the costs of such legislation would be enormous, potentially affecting annual sales in the tens of billions of dollars. Thus, congressional staffers, together with a few officials of the executive branch, began an educational process that lasted for five years until the new legislation became a reality.

Searching for Legislative Rationality: The Toxic Substances Control Act

When I arrived at the EPA in early 1973, I learned that my principal task was to lead the effort of the executive branch of the government for enactment of the Toxic Substances Control Act. The Nixon Administration had already introduced proposed legislation into the Senate and the House of Representatives. But progress was stalled on Capitol Hill at that time as the education of the interested congressional staffs had progressed very slowly.

During the next three years this legislative lull turned into a series

of firestorms as toxic problems erupted in every important congressional district and as concerns over cancer resulting from exposure to chemicals in the environment became inextricably linked with the call for a new toxic substances law. Confusion, confrontation, and in the end cooperation reverberated through the halls of Congress, the offices of the EPA, and the confines of the Office of Management and Budget. Many government departments, state agencies, industrial firms, environmental groups, labor unions, and scientific societies discovered a new legislative initiative that would permanently transform their ways of doing business. I quickly joined the chorus of the original architects of toxic substances legislation in proclaiming that the new legislation was to be different from the earlier environmental laws. It was to be “rational,” we boasted.

The basic concern was clear. Life depends on aggregations of chemicals in different forms, and as our standard of living rises, so does our dependence on chemicals. While a few man-made chemicals may at times cause problems, mankind has survived living with synthetic chemicals from the earliest days of alchemy. Since no population is prepared to turn back the clock and return to natural settings, control of chemicals on a massive scale surely must be approached with some care.

Thus, an overriding provision in the toxic substances legislation was a requirement that any regulatory action under the law must be justified by the EPA as providing environmental benefits that outweigh the economic costs of the action.⁵ This approach differed from the provisions in the earlier air and water pollution laws for regulating toxic chemicals. According to these earlier laws, determinations of the health and environmental hazards of chemical discharges were the sole consideration as to the appropriateness of regulation. Economic impact had not been a relevant concern.⁶

A second important principle was that the tens of thousands of chemicals already on the market were presumed to be safe unless proven harmful by the EPA. However, many EPA officials were not comfortable with the Agency accepting this burden of proof. They worried that the EPA would not be able to segregate the hazardous chemicals from those that were environmentally benign and then make sufficiently persuasive arguments about the chemical hazards. Also, they feared that imprecise scientific evidence used to justify regulatory action would not stand up when challenged in the courts. Others argued

that if the government with all of its resources could not make strong cases, the hazards could not be very serious to begin with.

In contrast, under the law regulating pesticides at the time, the EPA had begun to assert on the basis of limited information that a variety of pesticides already in use throughout the country were hazards. The Agency planned to suspend continued use of these pesticides unless the manufacturers could demonstrate that they were safe. This challenge by the EPA of the safety of pesticides which had been in use for many years was called “rebuttable presumption” of hazard: industry had the responsibility to rebut the presumption of the EPA that the targeted pesticides posed unacceptable risks to human health or to ecological resources.

It was successfully contended by myself and others that such an approach, which shifted the burden of proof from the government to the manufacturer, who was then required to demonstrate that a chemical already in commerce was safe, was not to be followed under the new toxic substances law. The government, and not industry, should have the burden to prove the case of acceptability or unacceptability for chemicals which were already in use. The overwhelming majority of chemicals in use were not causing problems, and therefore chemicals that were already on the market should be considered innocent until shown to be harmful, we repeatedly argued.

However, the most contentious aspects of the proposed new law were the provisions for controlling the introduction into the marketplace of the 1000 to 2000 newly developed chemicals each year. To the environmental lobby, at least initially, the obvious approach was a requirement for approval by the EPA of each new chemical before it could be manufactured. Such a requirement would parallel the EPA’s approval process for each new pesticide.

But most parties, including the important environmental groups themselves, soon rejected this approach for several reasons. The pesticides program of the EPA had developed a poor reputation for lengthy delays in reviewing and approving applications for new pesticides, and that program considered only a few dozen new chemicals annually. Imposing comparable delays on more than 1000 new chemicals each year under toxic substances legislation would wreak havoc on the marketing activities of many chemical companies. Uncertainties in marketing provoked by such delays would in turn place a

serious chill on research and development activities at a time when the international competitive edge of the U.S. chemical industry rested on a high level of innovation in going from the laboratory to the marketplace.

Also, pesticides are designed to be toxic so they can kill bugs and weeds, and they are deliberately released into the environment. In contrast, toxicity is not a design criterion for industrial and consumer chemicals. Very few of these chemicals are deliberately spread into the environment. The exceptions include highway deicing chemicals, fertilizers, and colorants for golf courses. In short, I, and many others, vigorously argued that the regulatory approaches to new pesticides which are toxic by design and the approaches to other new chemicals which were not designed to be toxic should be different.

Thus, the concept of "premanufacturing notification" evolved. This approach called for companies to report to the EPA all new chemicals which they planned to produce prior to beginning production. The EPA would have a limit of 90 days to uncover health or environmental hazards. The Agency would have the opportunity to review new chemicals, but industry would not be penalized by delays in the review process.

Another fundamental principle embraced by Congress related to the responsibility for testing chemicals suspected of posing environmental hazards. While the burden of proof to demonstrate conclusively that a chemical was an environmental hazard and therefore should be restricted fell to the EPA, Congress decreed that the manufacturers of suspected chemicals should provide the EPA with sufficient information about the chemicals to permit the government to adequately assess the associated risks. Thus, the burden of testing chemicals fell to industry.

Manufacturers had long provided information to the EPA under the air and water pollution laws about many of the chemicals which they produced and about their by-products, but the information requirements of the new law were far more explicit and wide-ranging. In particular, the EPA could require manufacturers to carry out toxicology studies costing more than one million dollars per chemical to develop data concerning the safety of chemicals specified by the Agency. Also, the EPA could order the manufacturers to submit detailed information of the quantities of the chemicals being produced, the by-products of

individual production processes, and the present and potential uses of the chemicals.

The new law was to address other knotty issues. Congress decided to exempt small businesses from some regulatory requirements. But we who were to be responsible for implementing the law wondered, "Are chemicals manufactured by small businesses less dangerous than chemicals produced by big companies?" The EPA would protect trade secrets while also honoring requests from the public for information about the chemicals under the Freedom of Information Act. "But won't some groups want the secret data?" we asked. Overlaps with other laws were to be sorted out on a case-by-case basis with an emphasis on using the most cost-effective laws to address specific problems. "But how can any regulatory program admit that its approach is not cost-effective?" Finally, the new law was to encourage efforts of the states to develop complementary regulatory programs. "But does this mean that there will be layers of laws?" Thus, the proposed law seemed to raise more issues than it resolved.

A continuing series of highly publicized toxic problems around the country from 1973 to 1976 focused congressional attention on the proposed toxic substances legislation. Asbestos, vinyl chloride used in plastics, the fumigant ethylene dibromide, and other chemicals were repeatedly showing up in the environment as health or ecological hazards. A common reaction to such incidents was a call by politicians and by the press for new legislation, specifically the Toxic Substances Control Act, even though laws that were already in place may have been quite adequate to address some of the problems.

The incident which imparted the final impetus for the passage of toxic substances legislation involved the chemical Kepone. In 1975 a very small company operating in a converted gasoline station in southern Virginia was producing this highly toxic chemical. The company flushed Kepone residues from the process directly into the James River with devastating impacts on the local fishing industry since the fish became contaminated at levels that were considered unsafe for human consumption.

As a pesticide ingredient, Kepone was explicitly excluded from regulation under the proposed new law. Few congressional leaders understood the differences in the reaches of the pesticides and water pollution laws, which were the basis for cleaning up the Kepone mess,

and of the pending toxic substances legislation. They simply wanted some type of action to prevent another Kepone incident. Passage of the Toxic Substances Control Act was a convenient outlet for their frustrations over the government being saddled with a large bill from dredging Kepone off the bottom of an important tributary of the Chesapeake Bay.

Meanwhile, during the mid-1970s cancerphobia reigned in Washington. Every week the press featured scientific findings which suggested that still another chemical was a carcinogen—a chemical that could cause cancer. The government prepared a collection of maps of every state showing the incidence of cancer in each city and county, described as a cancer atlas. The maps suggested correlations between the occurrence of cancer and concentrations of industry, again prompting the Congress to call for new legislation.

A few scientists who had become strong advocates of greater governmental regulation of chemicals made irresponsible statements that ninety percent of cancer deaths could be attributed to environmental chemicals. These statements were echoed by the press. What they apparently meant to say was that 90% of cancers could be traced in part to “environmental factors” including smoking, infections, diets, alcohol consumption, and other sources that had little to do with man-made chemicals escaping into the environment.⁷ As the obsession with chemicals and cancer intensified, we in the EPA also lost some of our perspective. We decided to “go with the flow” and ride the wave of cancer warnings. We picked up the chant and began to press for toxic substances legislation by urging that “chemicals be tested for cancer in the laboratory and not tested on people.”

Already by the end of 1974, enactment of the new legislation had seemed a certainty. The chemical industry had accepted the inevitability of such legislation. Many industrial leaders believed that prompt enactment of the proposed legislation was better than the uncertainty of future legislation. Most environmental leaders were excited by the prospect of a new law which would provide another tool for forcing industry to become more responsible.

But near the end of 1974 opposition arose from a most unlikely source, the Sierra Club. While the environmental groups had been among the strongest supporters of the legislation from the outset, Sierra Club lobbyists decided that more Democrats were likely to be elected to Congress for 1975–1976 than were in office during 1973–74, and

therefore legislation which placed more severe strictures on industry could be expected if enactment were delayed. With the weight of such an influential group against immediate passage of the legislation, congressional support sputtered, and the law was not passed in 1974. The version that emerged two years later was almost identical to the draft opposed by the Sierra Club, which had made a serious miscalculation about the impact of political partisanship on this legislation.

As the debates continued in the congressional committees during 1975 and 1976, concerns over the economic impact of the law arose time and again. Industry, the EPA, and the General Accounting Office, which is an arm of the Congress, carried out hasty economic analyses. The estimated annual impact of the law on industry ranged from \$200 million to \$2 billion.⁸ However, the difficulty in predicting industrial responses to such far-reaching legislation and the uncertainty in estimating lost marketing opportunities became quickly apparent. In particular, the costs in lost sales of products which were not developed due to the chilling effect that the law might have on research activities were impossible to estimate accurately.

In any event, while the economic dimensions of the proposed law were important, they were clearly overshadowed by congressional concerns over PCBs, Kepone, and other problem chemicals, concerns which carried the day and led to enactment of the new law in October 1976.⁹

Then and now, Congress and the American public have perceived toxic chemicals as a threat to public health which must be harnessed, whatever the cost. However, as we will see, once the cost implications in terms of jobs, modified life-styles, and increased taxes from rigid control of large numbers of chemicals become clear, the attitudes of many self-proclaimed environmental zealots rapidly adjust to the realities of the modern industrial age.

A Passive President Accepts the New Toxics Legislation

When the Toxic Substances Control Act finally overcame all the hurdles in the Congress and arrived at the White House for signature, President Ford delayed his response to the very limit of the time allowed until a pocket veto would take effect. Only a few hours remained

when he finally signed the legislation into law in the privacy of his office in October 1976.

But why did he delay? Why didn't he celebrate the passage of this complicated legislation with a signing ceremony in the rose garden, a beautiful environmental setting just outside his office? Environmental and industrial leaders, congressional and cabinet officials, and labor and foreign trade executives who had repeatedly clashed during the incubation of the legislation could have joined hands in an unusual display of national consensus. President Ford's campaign for reelection desperately needed demonstrations of support from all sides. Yet the White House limited its public relations effort to a routine press release of the type used to record less-than-noteworthy presidential actions.

Perhaps the president's staff correctly judged that the new legislation was politically insignificant in comparison with education, welfare reform, crime, and other social and economic issues confronting the nation. Perhaps the impassioned congressional debates, the intensity of the lobbying efforts, and the media accounts of the cancer crisis had exaggerated the threat of toxic chemicals. But isn't legislation that could affect the daily workings of tens of thousands of industrial firms throughout the country of considerable importance?

The White House inner circles wanted the chemical problems which regularly punctuated the *Washington Post* and the *New York Times* to go away. After struggling until the last minute to understand the complicated provisions which Congress had crafted, they undoubtedly concluded that the new legislation would help, even though it could hardly be considered monumental in their eyes.

Meanwhile, the Manufacturing Chemists Association (now renamed the Chemical Manufacturers Association) and the Chamber of Commerce had advised the White House of their desires to have the legislation signed and thereby end the regulatory uncertainty that had hung over the chemical industry for five years. The Sierra Club, the Natural Resources Defense Council, and other environmental groups assured presidential aides that their concerns had been addressed. The AFL-CIO argued that safety was even more important than jobs and that the law should be enacted. The Office of Management and Budget, the EPA, and other government agencies endorsed the legislation. Even some of the states had become vocal advocates for the law which would shift to the federal government many of the politically charged prob-

blems of public health threats that they were encountering every day. Since no one seemed to object, any need for the president to be concerned with the fine print must have appeared very unimportant in comparison with the larger issues of the reelection campaign. In any event, the president clearly missed a useful opportunity to enhance his image as a responsible advocate of environmental protection.

The Education of the Revolving-Door Regulators

In 1976 only a handful of people, perhaps ten, concentrated in Washington had a good understanding of the scope of the new law and its implications for environmental protection, for commerce, and for the nation's administrative and legal systems. And their understanding was elementary at best. During the years that followed, a very large cadre of specialists in toxic substances control has developed. However, the political leadership of the program has changed frequently, bringing many newcomers into the picture.

Despite sizable research and regulatory programs, the collective understanding within and outside the government of how this legislation can best protect society from toxic insults has advanced very slowly. During the 1970s the key policy issues related to the methodologies needed for assessing risks to health and ecological resources posed by seemingly small amounts of man-made chemicals and for determining when risks were significant. Then, how could such risks be balanced against the costs of regulatory actions, and how could the likely reductions of the risks from such actions be estimated? These same issues constitute the bulk of today's regulatory and judicial agendas, and they are at the heart of the continuing educational process for regulators in Washington and in the state capitals.

The new Toxic Substances Control Act was to be the centerpiece of the government's efforts to regulate toxic chemicals. It would require industry to provide information on the production of chemicals and on the toxicity and behavior of the chemicals in the environment. This information was needed by the EPA to determine whether to impose more stringent controls under a variety of laws on toxic pollutants being discharged into the air and into waterways. And it would allow the EPA to halt or limit manufacturing and marketing activities when necessary.

Thus, the new statute would place a cap on industrial activities that contributed to chemical hazards in the environment. It would reduce the frequency of incidents of harmful chemicals entering our food and water supplies. The law would lead to safer working conditions within factories and safer living conditions in the neighborhoods around large manufacturing complexes.

Finally, the law would provide a new type of administrative framework for reaching environmental decisions. Such decisions would take into account not only environmental hazards but a broad range of economic and even social considerations as well.

When the president signed the law, enthusiasm was high within the EPA, other interested federal agencies, industrial organizations, and environmental groups. The specialists who had devoted five years to working out the intricacies of the law were prepared to translate concepts into action—to end an era of regulatory uncertainty and to begin “balanced” regulation. At the top of the list of immediate actions were three urgent issues.

First, great strides had been made during 1974, 1975, and 1976 to encourage the phasing out of PCBs and to begin cleaning up areas where PCBs had been stored or discarded. Some of the actions had been required by state laws or were carried out in response to federal water pollution regulations. Industry had undertaken other actions on a voluntary basis. Now it was necessary to codify restrictions on PCBs in all-encompassing federal regulations to ensure the permanent shackling of this ubiquitous nemesis.

Second, American scientists had argued persuasively that discharges into the atmosphere of Freon and similar refrigerants called chlorofluorocarbons were degrading the belt of ozone which serves as a radiation shield for the Earth. The new law broadened the legal basis for requiring a reduction in the manufacture and use of these chemicals, and appropriate regulations to limit the production of these chemicals had been prepared. Thus, the first steps could be taken to address the problem of depletion of stratospheric ozone.

Finally, the law called for the EPA to review the properties of all newly developed chemicals before industry began selling the chemicals and to place limitations on the production and use of any new chemicals which posed environmental or health threats. In order to determine whether a chemical was “new,” the Agency needed to prepare and

publish a master list of all “old” or “existing” chemicals—the chemicals already in production. Any chemical not on the list would then be considered a new chemical. EPA experts had prepared draft regulations to promptly collect from industry information concerning the existing chemicals so the list could be prepared and the review of new chemicals could begin.

However, plans for early action in these and other areas soon fell apart. The Carter Administration arrived in Washington. Not unexpectedly, that Administration brought its own team to the EPA to administer this law as well as the other environmental laws. Unfortunately, some appointees mistakenly thought that only Democrats were the real advocates of the environmental movement and that the Republicans who preceded them had been dragging their feet on environmental issues. Based on my experience, however, environmental partisanship traceable to political allegiances had few policy footholds within the EPA under the Republican administrations of the 1970s. In any event, the Democratic appointees slowed down activities which had been started by their Republican predecessors at the EPA, intent on placing their own fingerprints on future regulations. Many regulations which were in various stages of development were placed in limbo.

As to my personal involvement, the new Administrator of the EPA removed me from my career civil service position as the Director of the EPA’s Office of Toxic Substances. Apologizing all the while, his assistant told me the reason behind my transfer to another position: I knew too much about the intricacies of the new law, and it would be difficult for less knowledgeable political appointees to take control of the program if I remained in my position. I now appreciate the depth of mistrust that frequently divides political appointees from career technocrats in Washington. Particularly in the environmental field with all the complexities of scientific uncertainty, incumbent career officials frequently are perceived as having too many opportunities to drive policy in directions which are consistent with personal convictions but which may not correspond to the views of political leaders.

The new team started over. Many had impressive credentials, and they recruited a large number of well-qualified specialists from within and outside the EPA to manage the toxic substances program. However, these new leaders did not appreciate the complexities of address-

ing tens of thousands of chemicals of different characteristics, with different chemicals touching different interest groups.

Fortunately, the three sets of regulations mentioned above—phasing out PCBs, limitations on chlorofluorocarbons, and preparation of the master list of existing chemicals—had reached advanced stages, particularly in the eyes of the Congress and public interest groups. Thus, the new team had to truncate its self-education to a few months, and original regulatory timetables slipped by only six months to two years in these three areas as the new Administration tried to understand the new law. In many other areas, however, the Agency's implementation of the law during the years of the Carter presidency can only be described as minimal, with original timetables slipping many years.

As one example of misdirected efforts, on several occasions the EPA spent hundreds of thousands of dollars over many months and even years developing and defending regulations which would require industry to conduct laboratory tests on single chemicals that were suspected of having toxic properties. The Agency became so deeply enmeshed in the details of the regulatory process that it forgot the purpose of the law—namely, to have many chemicals tested as quickly as possible. The Agency could have simply carried out the tests itself at lower costs and saved two to three years in the process. Preferably the Agency could have developed regulations to require testing by industry of groups of chemicals rather than repeating the regulatory process for each chemical. Agency specialists had advocated that approach since 1973. The value of grouping chemicals for regulatory purposes was finally recognized toward the end of the 1970s, and the EPA eventually adopted this approach.

By the time the Carter Administration had gained a firm grasp of the new legislation, the Reagan Administration arrived in Washington. Again, a new set of administrators entered the EPA and other agencies with related interests. Suspicious of regulation in general, and particularly regulation aimed at manufacturing activities, this new team applied the brakes to regulatory actions which they judged might have adverse economic consequences. They argued that the scientific basis for many of the regulations which were in the process of development within the EPA was faulty, but at the same time they reduced the research budget of the EPA by 30%—the very budget intended to

improve the scientific basis of regulations. By the time the Administration had begun to appreciate the benefits which might be derived from the toxic substances law, the Congress had enacted a new mechanism for addressing many of the central concerns over toxic chemicals—the Superfund legislation to clean up abandoned chemical wastes. Much of the attention concerning the assessment of problems associated with toxic chemicals rapidly shifted to programs required for implementing this new legislation.

The most successful aspect of the Toxic Substances Control Act has been the EPA's process of reviewing premanufacturing notifications by industry which signal commercial intentions to market new chemicals. After a slow start, the EPA has done a fine job in establishing procedures which quickly separate notifications for chemicals that are environmentally benign from notifications that raise genuine health and environmental concerns. A surprisingly few of the 2000 notifications received each year fall into the latter category, reflecting a heightened awareness within the industry that new chemicals simply must be environmentally acceptable or the EPA will restrict them.

With regard to curbing existing chemicals which present environmental problems, however, the EPA's record under the Toxic Substances Control Act has been quite controversial. In 14 years the Agency has taken actions to limit only a handful of chemicals and to require testing of only a small percentage of chemicals identified by experts as potentially toxic.¹⁰ Environmental groups contend that many chemicals identified in the early 1970s as being environmental hazards should have been limited long ago—some dyes, plastics, solvents, and heavy metals, for example. Others argue that on close examination the alleged hazards of the 1970s were overstated and that there has been no need to take more aggressive action to restrict large numbers of chemicals which have been safely handled for decades. While the debate will continue as to whether some of the common chemicals which have been used for many years pose a health or environmental threat, the EPA sorely needs to give higher priority to its efforts to screen the potential hazards associated with many existing chemicals. The Agency has been preoccupied with refining and re-refining regulations to control PCBs, supervising the removal of asbestos from schoolrooms and public buildings, and restricting chlorofluorocarbons. The Congress has ordered all of these actions, and of course they are important.

But the EPA needs a broader surveillance effort to prevent harm from the relatively few hazardous substances among many chemicals that are bought and sold every day.

Impatience Leads to Alternative Routes for Controlling Toxics

While most political leaders had focused on the proposed Toxic Substances Control Act during the mid-1970s as the eventual solution to the toxic “threat,” environmental activists in Washington had become restless with the slow pace of the legislative process. Many scientific societies and private environmental organizations were not content in limiting their interests in toxic chemicals to lobbying for legislation. At the same time, the philanthropic foundations which had provided financial support for private environmental groups to serve as counterweights to industrial lobbies were considering whether to reduce their funding in view of the expanding role of the EPA. The environmental organizations needed dramatic evidence of their continuing value in keeping the EPA on course and thereby serving as an environmental conscience of the nation. Thus, several environmental groups were looking for ways to force the EPA to greatly accelerate its timetable for controlling toxic chemicals under legal statutes which were already in place.

In one of the most significant activities of the environmental groups during the 1970s, the Natural Resources Defense Council claimed that industry was irresponsibly discharging toxic chemicals from plants in every state and county with devastating effects on rivers, streams, and estuaries. The council identified over 125 chemical pollutants of primary concern and turned to the courts to require the EPA to take regulatory action to limit these discharges. The judge was sympathetic. Within a few months the EPA and the environmentalists signed a Consent Decree, binding the EPA to begin controlling the 125 chemical pollutants. During the decade that followed, these chemicals became well known as the “priority pollutants.”¹¹

Limiting discharges of chemicals into aquatic resources as required in the Consent Decree was not completely new to federal or state governments. Since its inception, the EPA had issued guidance to the

states on water quality “criteria.” This guidance set forth chemical contamination levels—or criteria—which were environmentally acceptable in streams and rivers that were sources of drinking water or irrigation water or were holiday retreats for boating, swimming, and other recreational purposes. Many state agencies used the EPA guidance in determining appropriate restrictions on pollutants in an effort to keep water pollution below the recommended levels. Initially, the EPA developed criteria levels for metals (e.g., mercury, cadmium, lead, tin) and a few pesticides (e.g., DDT, dieldrin, aldrin). As the pressures from environmental groups increased, the Agency established criteria levels for other chemicals as well.

Also as a part of the national effort to protect the quality of water resources, in the early 1970s the EPA had begun a long and tedious process of requiring industry to install improved technologies for removing pollutants from wastewater streams in all types of industrial facilities. The costs to industry were substantial, and in many cases industry challenged the reasonableness of the new requirements in court actions which resulted in frequent delays of many months or even years in the promulgation of final regulations. During the years that followed, the EPA identified hundreds of appropriate technologies for limiting pollutant discharges, and industry installed many of these technologies in thousands of facilities. These technologies removed both biological and chemical pollutants from waste streams. But as previously noted, they were not designed to eliminate many of the minute traces of toxic chemicals which were so much more potent than small amounts of other pollutants.

The Consent Decree for the priority pollutants required substantial research efforts that stretched the limits of our understanding of how to deal with very small quantities of toxic chemicals. The EPA established new programs to refine the estimates of the health effects and ecological hazards of each of the 125 chemicals on the list. The Agency developed, validated, and then proscribed analytical chemistry methods for measuring low concentrations of the chemicals. Researchers tested new engineering technologies to determine their effectiveness in removing trace chemicals from different types of waste streams. The priority pollutants surely awakened the environmental community to the practicality and to the costs of controlling toxic discharges into the environment.

Providing impetus for the Consent Decree were many newspaper accounts of chemical contaminants entering drinking water supplies—in Cincinnati, in Philadelphia, in Southern California, and elsewhere. As analytical techniques for measuring very small levels of chemicals improved, chemists began discovering traces of all types of pollutants in drinking water. Scientists attributed some of these contaminants to natural runoff from areas where trees and other plants had decayed. Other chemical pollutants were by-products of the process of chlorinating water to destroy biological contaminants. Still other unwanted chemicals seemed unequivocally linked to discharges from industrial facilities and from sewage treatment plants.

In one highly publicized account, scientists from the University of New Orleans identified many organic compounds in the tap water in Louisiana—compounds which had been linked with cancer in experiments with laboratory animals. They then attempted to show that the gastrointestinal cancer rates in Louisiana were abnormally high, thus implying a cause-and-effect relationship. The results of this investigation and similar studies in another half-dozen cities at about the same time fell far short of demonstrating that the drinking water was not safe or that there was a statistical correlation between cancer rates and specific contaminants in the drinking water. But the scientists captured the attention of both congressional and administration leaders who soon became committed to strengthening still another law, the Safe Drinking Water Act aimed at reducing trace levels of toxic impurities as well as other types of contaminants in water supplies.¹²

Meanwhile, EPA scientists began conducting regular nationwide surveys of pollutants in drinking water. The results have sometimes been alarming as more and more trace chemicals appear throughout the nation. Debates punctuate many scientific meetings over whether trace amounts of different chemicals, individually or in combination, pose a health risk. In any event, as Congress tightened the law governing drinking water contamination, the list of chemicals subject to regulation increased substantially from the nine metals and pesticides that had been controlled since the early 1970s. By 1990 the number of chemicals for which acceptable levels had been adopted was about three dozen with limits for 50 more to be established by 1992.

Toxic air pollutants also became increasingly important in the 1970s and 1980s. Of course, emissions from leaded gasoline had been

a national concern for many years as evidence continued to mount about the effect on the learning capabilities of children from lead that is inhaled or ingested. Also, as discussed in some detail in the next chapter, the early regulations under the Clean Air Act 20 years ago placed explicit limitations on air emissions from industrial facilities of mercury, asbestos, and beryllium, and requirements for removal of particulates from air emissions also reduced discharges of many chemicals. Benzene emissions soon became a particularly contentious issue since this chemical permeates every gasoline station. Vinyl chloride was added to the list of controlled air emissions, and in the 1980s attention turned to discharges of radioactive contaminants. Soon thereafter a list of 37 additional chemical pollutants, primarily carcinogens, became the center of heated debates concerning the approach for controlling "air toxics."¹³

During the 1980s, repeated surveys by the EPA throughout the country showed that air toxics are present at some level in almost every industrial area. However, only now has a major effort to reduce air toxics moved to the top of the priority list of federal and state regulators. The proposed 1990 revision of the Clean Air Act will, if enacted, at last require stringent measures to reduce toxic emissions. No longer will leaky valves and pumps be tolerated. Timetables for retrofitting old plants will be accelerated, and limitations on emissions from new plants significantly reduced. Several states are still not satisfied with action in Washington and have enacted more stringent legislation. Such legislation advances the regulatory timetable in those states by several years and requires a reduction of toxic air emissions of up to 50% by the early 1990s.

But, it was the sudden emergence of the problems of hazardous waste disposal which truly brought the issue of toxic chemicals onto center stage. Abandoned wastes were uncovered seemingly everywhere beginning in the late 1970s and early 1980s: for example, in the Valley of the Drums in West Virginia, in abandoned pesticide mixing areas in California, and even at shopping malls in New Jersey. And no one wanted to accept responsibility for cleaning them up. The wastes contained thousands of different types of chemicals which were leaking into the groundwater, seeping into the atmosphere, and even exploding as they were disturbed. Government inspectors and the press found toxic chemicals in rusty barrels, in abandoned ponds, and in mounds of

dirt. Just determining which chemicals were present became a Herculean task.

In response the Congress designed the Superfund legislation to provide a comprehensive framework for setting priorities and cleaning up hazardous wastes. The intent was to force responsible parties to pay the bill whenever possible. A trust fund—a Superfund—was established to be used for cleanups when the original dumpers could not be clearly identified or when emergency situations required immediate action. The trust fund receives money from taxes on crude oil and major commercial chemicals. Initially the state governments were supposed to pay 10% of the costs to the government at privately owned sites and 50% at those that were publicly owned. However, the ground rules for state contributions have been under frequent review and revision. Another goal of the Superfund program is to advance technological capabilities in all aspects of hazardous waste management, treatment, and disposal.

When the legislation was originally enacted, no one fully appreciated the enormity of the problems. More than 30,000 potential Superfund sites have been identified over the years. Although the EPA has already categorized a significant number as too minor to warrant Superfund status, the number of remaining sites of genuine concern is still overwhelmingly large.

The EPA also began discovering large quantities of hazardous chemicals in municipal landfills across the country along with garbage and other household wastes. Then in the mid-1980s we learned that hundreds of thousands of buried storage tanks containing heating oil, gasoline, solvents, and other types of chemicals were corroding. Some were already leaking and many more would eventually be threatening groundwater resources. The Congress enacted additional legislation to address these problems within the framework of the Resources Conservation and Recovery Act. The contamination of the land had reached unprecedented levels and continues to this day.

The costs of cleaning up abandoned wastes are enormous. The costs of safely disposing of the refuse are staggering. The costs of constructing and managing proper waste sites to avoid similar problems in the future are also very high. The costs of containing municipal landfills which punctuate every town and village are yet to be estimated.

The assessment, containment, and cleanup of hazardous wastes

tax the limits of understanding of every aspect of the science and economics of toxic substances. The problems faced by the EPA and the nation in implementing the Toxic Substances Control Act and the toxics provisions of the Clean Water Act, the Clean Air Act, and the Safe Drinking Water Act are formidable. But they seem small compared to the problems of cleaning up the toxic chemical debris simply dumped upon society in now abandoned waste sites by past generations.

Ecological Concerns Return to the Top of the Regulatory Agenda

The previous discussions have emphasized the dangers, both real and imagined, to human health from toxic substances. During most of the 1970s the public and the government agencies were preoccupied with the threat to people from inadequate control of toxic chemicals. But such a public health orientation, often to the neglect of broader environmental concerns, was not anticipated by many of the leaders of the environmental movement in the early 1970s who were concerned with disruption of ecosystems and destruction of flora and fauna by uncontrolled pollutants.

Indeed, ecology had been on center stage in Washington and around the country when the nation entered the current environmental era in 1970. Ecologists were concerned, and indeed outraged, over the impact of chemical pollution on natural resources. They witnessed fish kills near the discharge pipes of industrial plants in Tennessee. They deplored the contamination of shellfish in the Chesapeake Bay. They saw the forests disappear near the lead smelters of Missouri. They grimaced as wildlife breeding areas became chemical waste beds along the coasts. They reinforced the earlier protest of Rachel Carson in condemning the excessive use of pesticides which were disrupting nature's protective mechanisms in agricultural areas.

However, as new environmental laws were passed and cost-benefit arguments dominated discussions of strategies for carrying out these laws, most of the attention of the regulators and the press turned away from ecology to issues of public health. No one questioned the importance of protecting nature's resources. Nonetheless, protecting lives seemed a far more urgent matter. Human suffering has always been

front-page material, and impending death and disease certainly have great impact in arguments over larger federal budgets. By 1975 protecting human health was the dominant environmental issue with preservation of the ecology considered a secondary concern. In many ways, the EPA had become a health agency.

No words provoked greater reactions on Capitol Hill than “cancer,” “birth defects,” and “genetic damage.” It seemed that almost every chemical that was leaking into the environment suddenly had the potential for causing the most dreaded form of human agony, according to some environmental extremists. Laboratory scientists were discovering tumors and deformed offsprings in their experiments with rats and mice with increasing frequency. Reports reaching the government and the public of industrial workers suffering from cancer were on the rise. Government agencies published long lists of chemicals which showed carcinogenic tendencies in tests conducted in scientific laboratories in the United States or abroad. Court litigation targeted at recovering costs for pain and suffering due to exposure to environmental chemicals was on the increase. Medical doctors had replaced ecologists as the most important experts on the risks associated with chemical pollution.

By 1980, however, ecological problems had returned to the mainstream of environmental debates. Of course, attention to the health effects of chemicals, and particularly cancer, continued. But ecological hazards such as acid rain began to emerge as major problems. Lakes in New England that had been biologically alive were becoming sterile, and healthy forests bathed in ozone and other pollutants in several parts of the country were losing their foliage. The sport fishing industry was suffering, and timber sales were threatened.

Still, the worries were far more profound than the declining contribution to the economy of fish and timber from a few lakes and forests. Americans who lived in New England or who regularly visited the impacted areas persuasively argued that the eventual effects of permanent acidification of the countryside could not be predicted and that a price tag could not be attached to the long-term losses of ecological resources. Furthermore, America was experiencing a politically charged phenomenon: the activities of people living in one part of the country were destroying ecological resources in other regions hundreds or even thousands of miles away. In particular, the power plants of the Ohio Valley, using low-cost coal from the Northwest, were indicted as

the principal cause of the death of New England lakes. Who should pay the bill to arrest the problem?

A few years later, even more ominous ecological concerns arose. Scientists found a hole in the stratospheric ozone belt over Antarctica. This hole was directly linked to the continued use of chlorofluorocarbons. Also, scientists theorized that we were becoming encased in a greenhouse constructed by chemical pollutants, and the hot summers of the late 1980s seemed to provide the evidence they needed to document their theories. Today scientists clearly recognize that global ecosystems are changing due to human activities. Because of heating induced by air pollutants, low-lying coastal areas may be flooded during the next century, agricultural lands parched, and skin cancer rates increased, some warn.

Society needs as never before the expertise and dedication of highly skilled ecologists who appreciate the complex webs which weave together man's synthetic habits and the surrounding ecosystems. Ecologists led the surge of interest 20 years ago in promoting greater awareness of the interactions between man and nature. They raised critical questions, and now they must be key players in the search for answers that currently elude us.

The Many Dimensions of the Toxics Problem

As we have seen, during the past two decades synthetic chemicals have been discovered in trace amounts in every conceivable part of our environment. Even the air in some American living rooms contains formaldehyde, and the milk of many nursing mothers reveals minute levels of pesticide residues. The sediments in some rivers have become repositories for toxic metals, and pine needles are being discolored under the weight of chemical fallout from cars and factories. These fingerprints of human activity are the inevitable consequences of our industrialized culture.

Neither ecologists nor other types of scientists know the extent of the risks posed to humans or to natural resources by the very low concentrations of chemicals which we encounter every day. Most Americans assume that these risks are trivial in comparison with the risks from smoking and from poor nutritional practices. Some of us

may gain distorted comfort in knowing that timber losses from fire and parasites are a more immediate problem than losses from acid rain and that projects to divert rivers for agricultural purposes may be greater threats to the water supplies of many communities than trace levels of chemical contaminants. But the bottom line is that no one really knows the seriousness of the problem of toxic chemicals in the environment, and chemical contamination will clearly be one of the central political and scientific issues of the 1990s.

As discussed, the regulatory responses to concerns over chemicals in the environment have been manifold, and in many instances pollution emissions have fallen. More than one dozen federal laws with explicit provisions for controlling chemical pollutants are on the books. Every state has general environmental legislation which encompasses chemicals, and several have special legislation to limit toxic chemical releases into the environment. Hundreds of general regulations are now in effect, and hundreds of thousands of regulatory permits have been issued to individual facilities for controlling discharges of chemicals. The country has taken great strides in developing the procedural framework for controlling chemicals during the 1990s.

Many institutions have responded to chemical problems in a number of ways. Mortgage companies which finance homes near waste sites, insurance companies with industrial customers, and wholesalers who handle agricultural products from contaminated areas have adjusted their policies and their prices to cover their increased risks. Industrial companies and municipalities have invested enormous financial resources in retrofitting polluting facilities and in installing new facilities which pollute less. Waste minimization has become the byword of the environmental movement.

Still, by any measure, progress in containing potentially harmful chemical contaminants has been modest. As each trash truck goes to the landfill and as each smokestack releases emissions, the environmental burden of man-made chemicals increases. Many chemicals quickly decompose into harmless products, but others do not. In many localized areas, and even on a global basis, the capabilities of streams or the atmosphere to dilute pollution to acceptable limits and to continuously absorb synthetic chemicals have been exceeded.

In 1989 the nation received a jolt when the public learned that industry was still discharging billions of pounds of chemicals into the

environment every year. These releases into the air, water, and land are all within legal limits. “What was the purpose of all those laws, regulations, and permits anyway?” many Americans ask.

Leading up to the revelations in 1989, the EPA had responded to a new law by undertaking a systematic survey of industrial discharges of chemicals. The results were surprising to many cities and towns when the principal offenders were identified. While confirmation of Texas and Louisiana as the locations of the heaviest discharges was to be expected, few would have guessed that Salt Lake County in Utah was among the ten counties most affected. Environmentalists were quick to point out that within the 7.5 billion pounds of legally emitted chemicals were large quantities of 39 known or “probable” carcinogens. Industry questioned the relevance of aggregated data, arguing that since the discharges were so widely dispersed, the pollution levels at any single location were well below the thresholds of concern.¹⁴

The press coverage was extensive, and it certainly promoted the belief that toxic discharges posed a significant threat. For example, under the headline “The Many Uses of Toxics—and Dangers They Pose To You,” *USA Today* described the health effects of 60 of the most prevalent chemicals included in these discharges, including the following five “common” chemicals with discharges exceeding 100 million pounds per year:

Toluene: Solvent used in preparation of perfumes, medicines, dyes, explosives, detergents, aviation gasoline, and other chemicals. Hazard: highly flammable and explosive; toxic by ingestion, inhalation, and skin contact.

Sulfuric Acid: In fertilizers, chemicals, dyes, rayon, film; widely used by the metals industry. Hazard: strong irritant.

1,1,1 Trichloroethane: Solvent for cleaning precision instruments; also in pesticides, textiles. Hazard: irritating to eyes and skin.

Methyl ethyl ketone: Solvent in making plastics, textiles, paint and paint removers, adhesives. Hazard: flammable, explosive; toxic by inhalation.

Dichloromethane: Industrial solvent and paint stripper; in aerosol and pesticide products; used in photographic film production. Hazard: carcinogen.¹⁵

As indicated, the press identified the hazards associated with each chemical but failed to note that the chemicals must survive in the environment and be present at sufficiently high levels to do damage.

These chemicals are not confined to a few locations but are present in many areas of the country. Clearly, a better characterization of their pervasiveness, together with assessments of their concentrations in the environment, is now in order to effect rational control of the sources of undesirable pollutants.

Controlling Chemical Pollution in the 1990s

What are the challenges of the next decade when the American public will have no alternative but to live with an even heavier burden of environmental chemicals? The chapters which follow begin with a critique of the past approach of trying to control chemicals one by one and with suggestions for future approaches to cope with thousands of chemicals.

This book emphasizes the changing trends and the outlook for the 1990s. We will explore the central issue of risk with all of its uncertainties. The popular misconception of the ease in separating the science of assessing risk from the art of controlling risks is highlighted. Also, better communication between government agencies and the public about risks and corrective actions is underscored as deserving much higher priority in the future. The public doesn't want simply to listen. It is demanding to be heard.

A chapter on the chemical waste problems confronting the nation suggests modified approaches to handling the growing pyramids of debris accumulating around us. Individual states are now becoming more important focal points for controlling chemicals at waste sites, in rivers and streams, and in the atmosphere. Some of their past and current efforts deserve greater attention.

This book investigates the schism that has developed between the regulators and the regulated industry. This divisiveness must be tempered if real progress is to be made in cleaning up the environment.

Environmental problems are no longer simply national problems. They cross international frontiers with increasing regularity. Thus, the global setting for the national and international environmental debates during the 1990s is given high priority in the discussions.

In conclusion, we ask whether science and technology will come to the rescue and cut the costs of cleaning up the nation.

This book attempts to help set the stage for more aggressive action by government, by industry, and by citizens to limit damage to our nation and the world from the use of chemicals that have raised the standard of living everywhere. If each of us is willing to make modest economic sacrifices, we can enter the 21st century on a wave of hope and optimism that the quality of life as we have known it will continue.



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