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TOXIC AIR POLLUTION:
NEW SOLUTIONS TO OLD PROBLEMS

by

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This most excellent canopy, the air, look you,
this brave o'erhanding firmament, this
majestical roof fretted with golden fire--
why it appears no other thing to me than a
foul and pestilent congregation of vapours.

Hamlet, Act II, Scene 2

As this dismal Shakespearean view attests, medieval methods of producing heat and energy generated considerable air pollution. Coal and soot-ladened walls in excavations from the middle ages provide evidence of the smokey, squalid human environment of days past. From the thirteenth century onward efforts were made to ban the burning of coal in central London, and to control its use elsewhere, but air pollution and urban life remained synonymous.

By the modern industrial era, studies of air pollution in Donora, Pennsylvania, in November, 1948, and London in December, 1952, confirmed Shakespeare's suspicion that bad air injured and even killed people. Acute peaks of exposure to domestic coal burning and industrial pollution in these areas with long established high levels of exposure, caused excess deaths in persons with pre-existing chronic diseases. Atmospheric inversions, analogous to putting a lid on the pot of all air pollution, prevented pollutants from dispersing and produced enhanced and prolonged exposure to the gemisch for days at a time.

With the intent of reducing the burden of air pollution, along with modern industrialization citizens of democratic societies sought laws to ensure their right to a clean environment. As early as 1955, the U.S. Congress passed legislation to provide greater research and development of the science of air pollution. The Public Health Service administered the early clean air programs, which essentially sought to supply missing scientific information about the health effects and extent of air pollution in the U.S. This early legislation embodied the notion that science would, ipso facto, lead the way to cleaner air--or as one corporate motto then held, "better living through chemistry."

Continuing work begun elsewhere, this paper discusses the genesis of the notion that better and more science would provide the basis for a cleaner environment. It notes the increasingly strong role played by economic analyses in the development of regulations of air pollution, and the cynical legacy of past exaggerated estimates sometimes developed by affected industries. This paper examines the enduring dilemmas that this uneasy relationship of science, the law and economics produces for policy makers. It reviews the scientific bases for past air pollution legislation and discusses the recent emergence of environmentalism with an industrial face, evident in a number of the proposed amendments to the Clean Air Act that address toxic air pollutants.

Science and the History of U.S. Air Legislation

Frustrated by continued and dramatic evidence of air pollution in California and elsewhere, the Clean Air Act of 1970 proposed the first of the modern, comprehensive regulatory laws. A broad-based regulatory statute, the CAA of 1970 stipulated deadlines and standards for pollutants and sources, forcing automobiles and power plants to develop appropriate technological controls. Despite protests that such controls would bankrupt or severely damage the American economy, within six years catalytic converters on cars, electrostatic scrubbers on power plants, and other appropriate control technologies had been widely introduced into U.S. industry.

A veritable shotgun wedding of science, economics and the law ensued, in the early development of basic science forcing Federal environmental laws in the United States. Moreover, within the U.S. Congress, committees that developed legislation held two decidedly different perspectives on the rationales for environmental law. Thus, the U.S. Senate Committee on Environment and Public Works, which produced the Clean Air Act, the Resource Conservation and Recovery Act and Superfund, tended to focus principally on health-based matters. In contrast, the Committee on Commerce undertook its deliberations on the Toxic Substances Control Act, the Safe Drinking Water Act and Ocean Dumping legislation with an industrial perspective. While both committees produced laws that involve some balancing of economic analyses and health risk assessments, the tilt of each provides a different legacy to those laws of which it is the primary author.

As a health-based statute, the CAA established a program to deal with "criteria" pollutants, also called conventional pollutants, which were defined as those pollutants "the presence of which in the ambient air results from numerous or diverse mobile or stationary sources." Criteria pollutants included sulfur dioxide, oxides of nitrogen, particulate matter, carbon monoxide and photochemical oxidants. Together these pollutants account for close to 98 percent of all air pollution.

In fact, these criteria pollutants can also be toxic to humans and the environment. Their association with the combustion of fossil fuels for energy and transportation lend them an air of universality--hence the term conventional pollutants has arisen.

The 1970 amendments explicitly required the regulation of another class of air pollutants. These were called "hazardous air pollutants," and are also known as toxic air pollutants. A hazardous air pollutant is one which (1) is not a criteria pollutant but which (2) "causes, or contributes to, air pollution which may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness."

Unlike criteria pollutants, which are emitted from "numerous and diverse sources", the number of hazardous air pollutants were expected to be quite small. Senate committee report explained how wide-ranging, but limited in application, this provision was expected to be: "It is clear that the above definition of hazardous air pollutants will encompass a limited number of pollutants. Asbestos, cadmium, mercury, and beryllium have been identified as pollution agents which could be subject to emission prohibitions or standards," said the Committee report accompanying the original version of section 112.

Further, the CAA of 1970 stipulated that the Administrator of EPA publish a list of hazardous air pollutants, on which standards would be issued and finalize such standards after public hearings. Emission levels must provide an "ample margin of safety" to assure protection of public health, without mention of sensitive populations. New sources may be constructed only if they meet such standards. Waivers may be granted for existing sources, only where such waiver is necessary for installation of control equipment, and the health of persons is protected from imminent danger by other means.

In writing a relatively restrictive definition of hazardous agents, the Committee recognized that a total prohibition on emissions is a step that ought to be taken only where a danger to health, as defined, exists. "air pollutants whose presence chronically or intermittently, in trace concentrations in the ambient air, either alone or in combination with other agents, causes or will cause, or contribute to, an increase in mortality, or an increase in serious irreversible or incapacitating reversible damage to health."

"Predictions of technological impossibility or infeasibility are not sufficient as reasons to avoid tough standards and deadlines and thus to compromise the public health."

Regarding the conventional pollutants, by the beginning of this decade real successes have been achieved under the succession of CAA modifications. Federal and state standards required technological changes of mobile and stationary sources of these pollutants and increased energy efficiency. Early provisions effectively forced technology to develop means to reduce emissions of these conventional pollutants. In the name of protecting public health and the environment, industry generated catalytic converters for automobiles, scrubbers and electrostatic precipitators for utilities and other stationary sources, and other control technologies.

Evolution of Toxics Regulation

Once efforts to control large sources of conventional air pollutants were well underway, renewed public attention focused on the potential adverse consequences of small amounts of toxic or hazardous substances in the air and other media. Accordingly, by the mid-1970s a number of federal laws addressed such toxic pollutants, leaving large scope to those charged with administering such laws as the Toxic Substances Control Act, the Clean Air Act Amendments of 1977, and the Clean Water Amendments of 1977. Original expectations were that TSCA would protect the public from "unreasonable risk" due to toxic chemicals, but in fact the law, as implemented, became an information gathering and generating statute.

Episodes such as Kepone contamination of the James River, polybrominated biphenyl contamination of feed grain in Michigan, and polychlorinated biphenyl contamination of the Hudson River, with their bans on affected food stocks and their enormous consequences for the public, fueled pressure for congress to take steps to prevent future episodes of toxic pollution. Toxic doses to the environment riveted public attention.

Among the little known and arcane debates prior to the passage of the Toxic Substances Control Act, was the matter of whether the term "toxic substance" should be used, rather than the term "chemical." The point was made by some that all chemicals in some doses can be toxic, including water and salt. As Paracelsus observed several centuries ago: "all substances are poisons. . . The right dose differentiates a poison and a remedy." The term toxic substance prevailed, in part because of the growing reports of uncontrolled exposures, industrial accidents, such as chemical factory explosion in Seveso, Italy, and consequent popular concerns that such materials represented an insufficiently controlled aspect of modern life.

Ironically, these early toxic substances laws became primarily information gathering and retrieval acts, reflecting the poor state of scientific knowledge and the naive belief that more knowledge, per se, would show the way to improved regulation. At the time that TSCA was passed, it was estimated that about 1,000 trained toxicologists worked in the United States, and most of these were in industry. Moreover, the law could be triggered into action based on findings that a chemical caused cancer, birth defects, or reproductive effects. At that time, reliable methods to predict these effects were themselves undergoing development and standardization--a status they currently retain. For these reasons, EPA, a regulatory agency with a modest research budget in the best of times, became the chief developer and proponent of scientific methods to assess such risks--further testimony to the uneasy partnership between science and law on which many toxic laws rests.

The case for administrative discretion in implementing toxics control laws became self-evident, as the laws embraced basic-science forcing concepts in order to predict and ultimately prevent adverse impacts on public health and the environment. Thus, in developing standards, taking enforcement actions, or requiring additional test data, the EPA administrator necessarily relied on interpretations of experimental evidence, inferences from models, and occasionally on direct evidence of effects on public health and the environment. The dearth of data on the public health and environmental consequences of toxic pollutants was construed by congress as a justification for the strong preventive thrust of these statutes.

In 1984, a National Academy of Sciences panel confirmed how little information existed on most chemicals, noting that fewer than 20 percent of the 48,500 chemicals listed in the TSCA inventory of chemicals in commerce had been adequately tested as to their toxicity. Fewer than 20 percent had been tested for acute effects, and fewer than ten percent had been tested for chronic effects, such as cancer and birth defects.

Economic Analyses of Toxic Air Pollutants

In the context of much public debate on air pollution control, economic analyses presented by industry often served the role of a captured spy: "torture him long enough and he will say, whatever you want to hear." While economic factors merit careful review in the development of any regulatory regime to reduce air pollution, a cynical response often greets such analyses today, because some industries consistently overstated economic impacts and understated environmental consequences of proposed regulations. For instance, industries argued that efforts to de-lead gasoline and reduce the use of chlorofluorocarbons would bankrupt or severely hamper U.S. industry. In contrast, the regulatory impact assessments conducted on these proposed regulations indicated that their benefits greatly exceeded their costs.

In the matter of removing lead from gasoline, the vice chairman of the Ethyl Corporation assailed such proposals as uneconomic and unnecessary. Testifying before the Senate Committee on Environment and Public Works, on June 22, 1984, Lawrence E. Blanchard, Jr., said that "even though lead has been used in gasoline for 60 years, not a single person has ever been discovered to have any harmful effects from lead from automobiles in the general atmosphere. " Blanchard warned the Senators that "we have contended since the beginning of this debate in 1970 that removing lead from gasoline would increase its cost to the public by 5 to 10 cents per gallon."

These assertions were proved wrong just this past year. In September, 1989, ARCO products Company of Anaheim, one of America's largest oil companies, began sales of an "environmentally engineered gasoline" tradenamed ARCO EC-1. This gasoline contains no lead, less benzene, and hash an octane rating better than leaded gasoline. It sold in the Los Angeles area for about 5 cents a gallon <u>less</u> than leaded gasoline.

Efforts to control chlorofluorocarbons have had a similar history. On July 23, 1981, the Alliance for a Responsible Chlorofluorocarbon Policy, an industry coalition of 500 users and producers of CFCs, told a Subcommittee of the U.S. Senate that regulation of CFCs would have "an enormous adverse impact on our economy, which there would be no reason to endure." The industry coalition insisted that there would be <u>"risk in waiting"</u> because ozone trend analysis was such a sensitive scientific technique that it could detect a change as small as 1.3 percent per decade. "Evidence shows that the ozone content of the stratosphere has probably <u>increased</u> over the decade of the 1970s."(emphasis in original)

Regulating the chemicals beyond the aerosol ban which had at the time already been in place for three years would "have a permanent and enormous adverse impact on our economy and on the quality of our lives," the Alliance added, noting that "more than 780,000 jobs are directly dependent on CFC use." There would be energy consequences as well, warned the Alliance, emphasizing that "a complete ban on CFCs might result within 10 years in an annual increase in U.S. energy consumption equivalent to 226 million barrels of oil. That corresponds to 12 percent of the total U.S. crude oil imports in 1980, or about 43 percent of the current oil production from Alaska's North Slope."

Such exaggerated claims of economic consequences have left their own legacy, placing a burden on those who would present such evidence in the current discussions.

Failure of Toxics Regulation

As to the so-called hazardous or toxic air pollutants, even in their general guidance, the laws defied effective implementation.
This failure has as much to do with the evolving scientific understanding of hazardous air pollutants, as with the cumbersome regulatory net that was devised to reduce them. Obviously, the sheer number and volume of toxic pollutants greatly exceeds original assumptions that guided the 1970 legislation.

Further, the distinction between two types of pollutants--one small class which causes serious injury in contrast to another, larger class which causes considerably less serious harm--is no longer valid. However, this distinction did serve the purpose of allowing policies to be developed that addressed the more easily identified sources of the latter class.

Recent advances have established that criteria pollutants can cause quite serious injury, including death, at relatively low ambient levels. Other data have established that the number and concentration of pollutants which can cause "serious irreversible, or incapacitating reversible, illness" is exceedingly large. Specifically, the release of the toxics inventory under the right to know provisions of the Superfund Amendment and Reauthorization Act, shows that 2.7 billion pounds of toxic chemicals are emitted annually, including 280 toxic compounds emitted in quantities that pose risks to human health, and 205 industrial facilities in 37 states that are associated with cancer risks for the most exposed individual that may exceed 1 in 1000.

Nearly 75 percent of the total pounds of toxic pollutant are volatile organic compounds (VOCs), which are principally emitted from cars and small sources, such as gasoline stations and dry cleaners. VOCs pose a double-edged hazard, being toxic at the ground-level or troposphere, where they are neurotoxic and carcinogenic to humans and form precursors for ozone, and providing gases in the stratosphere, such as methylene chloride and carbon tetrachloride, which may contribute to the greenhouse effect. About 30 industrial categories, including steel mills, rubber, pulp and paper plants, chromium electroplating, electric utility cooling towers, and solvent users, emit a majority of the carcinogens.

This accumulated knowledge is forcing policy-makers to acknowledge that the current law inadequately regulates air pollutants--especially hazardous pollutants which are now almost invariably referred to in common usage as "toxic" pollutants. Moreover, there are basic inequities in exposure to these pollutants, as some citizens may be exposed to high levels.

Some chronic health effects of toxic air pollutants

Breathing fulfills the vital function of exchanging the gases of oxygen and carbon dioxide. In the course of a year, an adult breathes approximately 7 million liters of air, including essential oxygen and whatever else is in the air. Normal respiratory function is itself highly variable, depending on age, genetics, other diseases, and other factors. Subtle difference in pulmonary function do occur and chronic pulmonary problems afflict one of every five persons.

Beginning in the 1960s researchers directed their studies to chronic problems of air pollution for public health, expanding their concerns from the gross effects of peak exposures to those more subtle and chronic health problems linked with long-term low dose exposures. Indeed, recent studies show that elevations of so-called conventional air pollutants, such as particulate matter, are directly linked with increased rates of hospital admissions for asthma and other respiratory illness, and with premature deaths in those with pre-existing cardio-respiratory diseases,--a finding that was first noted in London in the early 1950s.

Ambient air pollution can either cause or exacerbate a number of chronic diseases in humans, including chronic bronchitis, asthma, or other pulmonary problems, cardiovascular illness, neurological disorders, such as those linked with heavy metal pollutants, and respiratory infections. Table 1 shows the estimated extent of respiratory morbidity and mortality linked with air pollution in the U.S., according to the National Center for Health Statistics. While pulmonary problems are most obviously linked with air pollution, as the portal of entry to the body, the lungs also provide a route of exposure throughout. Thus, inhaled pollutants can equilibrate in the lungs, enter the blood stream, and cross the blood brain barrier, and affect other organ systems throughout the body.

Throughout the industrial world, urban areas have higher rates of cancer than rural areas--a finding that may reflect differences in air pollution, nutrition, access to health care, and a variety of other factors. In the U.S. an estimated ten million persons suffer from chronic obstructive pulmonary disease, placing them at risk from the added burden of polluted air. Response of any individual to pollutants, depends on a variety of factors, including their preexisting genetic risk factors, their occupation, smoking habits, nutritional status, exposure to other chemicals, and social class.

Experimental studies with atmospheric smog, or mixtures of common air pollutants, indicate that synergies may also be important. For instance, exposure to nitrogen dioxide, ozone, and particulate matter, such as occurs with diesel exhaust, produces a toxic response in laboratory animals that greatly exceeds that produced by the individual compounds administered separately. A number of studies with a variety of animals exposed to common ambient levels of air pollution, showed a range of adverse effects on pulmonary function in dogs, mice, rats, and guinea pigs.

Key to any assessment of the public health or environmental impacts of toxic air pollutants is an estimate of typical exposures to these pollutants. Recent pilot studies in a number of cities in the United States, conducted by the Total Exposure Assessment Method (TEAM) have found that indoor exposures to side-stream cigarette smoke, pesticides and volatile cleaning compounds, such as solvents, typically provide far greater average exposures, than do those in the ambient, outdoor environment. Thus, in the Kanawah Valley of West Virginia--where several major chemical production facilities are located--average indoor exposures to benzene are determined more by exposure to cigarette smoke or other indoor pollutants, than to outdoor sources of this industrial toxicant.

THE CHALLENGE OF CLEAN AIR ACT REVISIONS

If the early CAA legislation suffered from the lack of technical information about the nature and extent of air pollution, no such problem occurs today. Under Section 313 of the Superfund Amendments and Reauthorization Act all sources releasing more than threshold quantities of toxic chemicals to the air reported to EPA that in 1987, they released more than 2 billion pounds. Of special concern to the public and Congress, are reports that in the U.S. since 1980, 17 accidents occurred with potential for health impacts worse than those that accompanied the tragedy of Bhopal. While the long-term chronic effects of exposures to airborne toxics may well be subtle, the devastating consequences of rare disasters are blatant and long lasting.

Section 112 of the current CAA requires that concentrations of hazardous air pollutants be reduced to the level at which they protect human health with an ample margin of safety. This concept of "ample margin of safety" admits of no economic consideration whatsoever. Toxicologists, epidemiologists, and other public health scientists concur that for airborne carcinogens for which no exposure is without some risk, the only safe level of exposure is zero. Industries and some regulators assert that it is impossible to achieve a level of zero. Therefore, the regulatory process stalls at the very outset, because regulators are unwilling to target a pollutant for controls which will be impossible to implement.

A draft briefing analysis of the hazardous air pollutant provisions of the Clean Air Act prepared by the Domestic Policy Council began an analysis of the current law with the following statement: "The DPC is in agreement that the current law is unwieldy, fraught with contradictions, and provides such little regulatory discretion that it is impossible to administer." The analysis concluded with the following statement: "In summary, the DPC believe that the zero tolerance level mandated under current law is suboptimal and if continued would be extremely costly, politically difficult and would threaten the shutdown of many plants in several industries from court mandates." (Draft, "Air Pollution Control", Domestic Policy Council, Washington, D.C. [May 3, 1989]). Therefore, the regulatory process stalls at the very outset, because regulators are unwilling to target a pollutant for controls which will be impossible to implement."

Some believe that this is an intellectual conundrum being used by regulators because they wish to avoid the emotion and controversy which would result from the initiation of truly effective controls. Whether or not this is so, these supposed defects in the existing law and the failure to regulate more than a handful of toxic air pollutants have been cited as the reason for fundamentally altering the current legal approach of the Clean Air Act.

Efforts to revise the Clean Air Act must confront this complex history of competing factors. First of all, the same forces that drove the original laws to clean up the air remain strong and vital in the U.S.—namely public pressure to ensure that a clean environment with clean air remains a right, not a privilege. Recent history of industrial accidents and spills continues to fuel public demands for regulation in this area. In addition, scientific innocence or lack of information, ipse solus, will not deter Congress from setting broad policy guidelines for the agencies. The absence of adequate control technologies can hardly be expected to deter a government that has effectively compelled into being the entire industrial control technology applied to automobiles and power plants.

Against these science forcing factors the relative benefits that can be estimated from reducing ambient toxic air pollution must also be weighed. Indeed, the realization that much indoor pollution greatly exceeds that of the ambient environment has led some to argue that such outdoor pollution does not merit tremendous regulatory attention. Others argue that it is feasible to control ambient toxic air pollutants, and there are a host of environmental benefits as well, including the reduction of catastrophic risks. In addition, volatile organic compounds, such as methylene chloride, chloroform and carbon tetrachloride are greenhouse gases that can increase the heat trapping effect of stratospheric gases involved in global warming, as well as neurotoxins and carcinogens for persons exposed to ambient levels.

Influenced by the evolving scientific findings of the field and by the failure to implement previous laws effectively regarding toxic air pollutants, a number of proposals have been advanced. Given the fluid state of the legislation at the time of the winter recess of 1989, it is not worthwhile subjecting these to detailed review. Whatever legislation ultimately passes this Congress will continue to embody science forcing principles, and provide general guidance to the regulatory agencies.

The central distinctions that appear likely to be introduced into new air toxics legislation will involve: a specified timetable for setting control technologies to reduce listed toxic emissions from major sources and from special, smaller area sources, such as dry cleaners, degreasing and solvent cleaning operations, gasoline stations, and pesticide applications; special attention on the catastrophic potential of uncontrolled emissions; the issuance of health-based standards for a number of specified pollutants; and requiring the consideration of economic factors in developing these standards.

These proposed regulations of toxic air pollution offer environmentalism with an industrial face. Widely hailed by a coalition of environmentalists and industry, such proposed amendments allow the consideration of such factors as nuisance value, and technical feasibility in the development of standards for specified toxic air pollutants. Gone are the absolute strictures for an ample margin of safety for public health, that never were implemented fully. In its place are likely to be deadlines for technology forcing standards, intended to provide broader protection against catastrophes and cleaner air. Congress and the agencies will determine how this science forcing process will unfold.