Environmental Health Perspectives
Vol. 30, pp. 9–11, 1979

Environmental Health Research and Regulation

by David P. Rall* and Philip E. Schambra*

This symposium will present the results of our joint research effort. These reports will deal with the effects of both chemical and physical factors in the environment as they interact with organisms through a variety of pathways and produce a multiplicity of biological effects. However diverse these studies appear to be, they all have one common objective: to produce experimental data which will help our understanding of the effects of environmental agents on human health. The results from these studies will be used in a number of ways to protect man from environmental hazards, including the development of better testing and prediction methods for agents not yet introduced into the environment, treatment modalities for use after exposure to hazardous agents, and the development of standards and other criteria that can be used to control the quantity and quality of pollutants released into the environment by industry and other sources. These first two products of our studies—tests and treatment modalities—because they are closely based on effects seen in biological systems, will be similar in both the United States and the Soviet Union and indeed in all countries around the world where environmental science is well developed. In the area of standards and other criteria to prevent environmental pollution, however, the approaches taken by our two countries and by other countries may be very different. Being scientists and working on a common set of scientific problems, we understand fairly well the similarities in our approaches to solving environmental health problems. But it is clear that we do not very well understand each other's approach to the process by which we regulate and control pollutants at their sources. It might be useful, therefore, to describe the approach taken by the United States in controlling the release of toxic substances into the human environment.

The usual approach in setting environmental standards has been to consider the medium through which the pollutant reaches man, mainly the air, water, and land.

Air

In the United States, the Federal Clean Air Amendments of 1970 (Public Law 91-604) comprise the principal law through which the National Government, working through the Environmental Protection Agency (EPA), controls atmospheric pollution. The U.S. approach to protecting human health from air pollution has been to mount a broad-based research program to yield data on all potentially hazardous emissions to the atmosphere. National ambient air quality standards have been adopted only for those pollutants which can be found in nearly every city and which are emitted from a large number of sources. It is for this reason that only six national ambient air quality standards, for SO_2, particulates, CO, HC, NO_x, and photochemical oxidants have been adopted to date. EPA will soon adopt a national ambient air quality standard for lead.

The law puts the responsibility on the 50 states of the United States to prepare control plans to meet and enforce the national ambient air quality standards. When these plans are approved by EPA, they become federal law. The states' plans to meet these standards require polluters to install appropriate control technology, as determined by each state. In addition, state and local governments are required to adopt whatever laws may be necessary to control the use of land for commercial and industrial purposes, and to control traffic in order to reduce emissions to levels which will permit the ambient air quality standards to be achieved. This approach,

* National Institute of Environmental Health Sciences, P. O. Box 12233, Research Triangle Park, North Carolina 27709.

while necessary to control these pervasive and damaging pollutants, is also very demanding and bureaucratically cumbersome. Any time a new national ambient air quality standard is adopted, as it will be shortly for lead, all 50 states must prepare plans for achieving the standard which must be met everywhere, regardless of cost, within 3 to 5 years. In addition, a comprehensive monitoring network is required for that pollutant throughout all 50 states.

It is not necessary, however, to take the approach of adopting ambient air quality standards in order to effectively protect public health. Other provisions of the Clean Air Amendments give EPA the authority to limit or eliminate the emissions of health-damaging pollutants at their source. All of these approaches are, of course, based on some knowledge of the levels of the pollutants which will damage health. Under the Clean Air Amendments, EPA can declare many types of air pollutants to the "hazardous" and can go directly to the industries emitting these substances and require the installation of appropriate controls. Using this authority, EPA has placed emission limitations on the most significant sources of mercury, asbestos, vinyl chloride, and beryllium. These substances are not found everywhere but are significant pollutants found around particular industrial sites. Emissions of these substances to the environment surrounding these plants can be reduced—through application of appropriate controls—to the point where harm to human health is believed to be minimal.

Additional requirements, called "new source performance standards," are placed on new plants and plants which are being rebuilt or expanded. These plants are required to install the most stringent controls possible for the emission of pollutants covered by the national ambient air quality standards, as well as for pollutants defined as hazardous, and for other pollutants such as fluorides and sulfur compounds, including the acid mist released by sulfuric acid plants.

A special class of emission standards comprises those standards applicable to mobile sources: cars, trucks, buses, and aircraft. An important factor in achieving air quality standards for HC, CO and NO_x are the emission controls which have been required on all cars since 1969 and have become progressively more stringent with each year's production run. When the final goals are achieved, emissions of these compounds will be reduced by over 90% from uncontrolled levels. Ambient air concentrations of lead will also be reduced by rules which will require its phase-out as an additive to gasoline and by requirements on the gasoline industry to produce lead free gasoline to protect the lead sensitive catalytic converters installed on many new cars.

In addition to the actions which have been taken to reduce emissions of the chemicals previously mentioned, over 600 chemical compounds have been screened for their prevalence in the atmosphere and potential toxicity. A number of these chemicals, including volatile and polycyclic organic compounds, nitrosamines, and heavy metals, have been given more detailed study for possible regulatory action. Generally, these chemicals are found in the environment at levels several orders of magnitude below permissible occupational exposure levels and far below any levels where health effects would be noted. Where this has been found not to be true, such as in the case of dimethyl nitrosamines around a rocket fuel production facility in Baltimore and an amine production facility in West Virginia, through cooperation among state and local air agencies, EPA, and relevant industry, the two offending facilities have been closed or controlled. In the case of polycyclic organic matter, studies indicate that ambient air concentrations have been decreasing since 1966 as a result of control of smoke and general particulates and that no additional regulatory efforts are needed at this time. Polychlorinated biphenyl (PCB) production is being phased out in the United States because of the hazards of this compound. Attention is now centering on PCB emissions from municipal and sludge incinerators with the view to assessing the need for possible PCB controls on incinerators. Arsenic, which is suspected of being a cause of excess lung cancer among smelter workers and employees of pesticides plants, is also being reviewed for possible regulatory action.

Thus, a variety of mechanisms is available to federal, state and local air pollution control authorities to reach safe levels. While these different approaches do not depend upon the formal establishment of ambient air standards, they clearly do depend upon sound knowledge of the actual or possible health effects on humans.

Water

While the various states of the United States have had laws to control water pollution for many years, it was not until the 1950's and 1960's that the National Government passed laws to protect and improve water quality. At first these laws were aimed at helping state and local governments achieve their water quality goals mainly through funding part of the cost of the construction of sewage treatment plants and by providing technical assistance and monitoring services. In 1965, the Federal Water Pollution Control Act was adopted which required the states to agree upon how rivers and streams

would be used—whether for industry, fish and wildlife, swimming, etc. National specifications or "criteria" were adopted for the content of various chemical and biological pollutants in these waters depending upon use. The law was substantially strengthened by the adoption of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) which required all industries to adopt the best practical control by 1983. The law also required all municipal sewage discharges to receive at least secondary treatment by 1977 and be treated by the best available technology by 1983. The levels of control required by 1983 are those that would be safe for fish, shellfish, wildlife, and human recreational purposes. Thus far, water treatment requirements have been placed on 50 major industries of all types and on all municipal sewage disposal plants. These regulations are enforced by requiring all plants, whether industrial or municipal, to obtain a federal permit before discharging into rivers and streams. So far, approximately 40,000 industrial plants and 30,000 cities and towns have been issued permits and have been placed on a compliance schedule.

Even with controls on industrial and municipal effluents, there are other substantial sources of water pollution. Agriculture, for example, is a major source of suspended solids, dissolved salts, nutrients, herbicides, and pesticides in water. Urban storm water run-off contributes these same pollutants, plus carbon and cadmium from auto tires, lead and other particulates from exhaust and industrial smoke stacks, drainage from small industry and services, detergents from laundry, petroleum in various forms, other absorbed organics and heavy metals. Plans are under development for dealing with pollution from these sources through such means as curbing excess use of fertilizers and pesticides, trapping soil run-off from construction sites, and treating rain water run-off from urban streets.

A new Safe Drinking Water Act (Public Law 93-523), enacted in 1974, requires the establishment of Federal standards for substances in drinking water. Standards for a variety of substances were proposed in 1975 on an interim basis and, following review by the National Academy of Sciences, will be promulgated as law. Additional standards dealing with non health-related problems such as disagreeable taste and odor will also be adopted.

Pesticides

Other national laws enable the control of pesticides. The Federal Environmental Pesticide Control Act of 1972 (Public Law 92-516) established a program of controls to ensure that pesticides are used by trained people in a manner that will not be hazardous to health. New pesticides must undergo thorough testing before being declared safe for use under these controls. Pesticides already in use for which experiments have indicated a significant health and environmental hazard can be removed from the market. Several pesticides have already been eliminated on this basis. Most uses of DDT have been banned since 1972. In 1974 aldrin-dieldrin, heptachlor, and chlordine were banned on the basis of animal experiments which indicated these pesticides were carcinogens.

Toxic Substances

A more recent and very significant law, the Toxic Substances Control Act (Public Law 94-469) of 1976, requires the testing of potentially hazardous substances before they are produced by industry. Testing can also be required for chemicals already in production if their hazard is suspected. On the basis of the results of these studies, the production and use of these substances can be prohibited or their use limited.

Another law, the Resource Conservation and Recovery Act of 1976 (Public Law 94-580) requires that all toxic wastes must be controlled. Using the authority under this law, EPA will set standards for the handling, transportation and disposal of hazardous wastes.

Environmental health research must be effectively coupled to standard setting and regulation. We have tried to describe how this occurs in the United States. But whatever approach is adopted, there can be no effective standard setting or regulation unless and until there is adequate research. It is the design, conduct and interpretation of this research that is the job of the environmental health scientists of both of our countries.

The authors wish to acknowledge the very helpful contributions to this overview by Bernard Steigerwald, Alan Cywin and Lawrence Plumlee of the U.S. Environmental Protection Agency, and the Annual Reports of the Council on Environmental Quality.