Proceedings • National Conference on AIR POLLUTION

Washington, D.C. *November 18–20, 1958*

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

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MESSAGE FROM THE PRESIDENT OF THE UNITED STATES

Please give my greetings to the delegates attending the National Conference on Air Pollution.

To maintain our industrial and scientific progress without impairing the purity of the air we breathe is of primary concern to the Nation. Government, industry, and individual citizens have mutual responsibility in this vital area. I am sure the goals and guidelines coming out of this discussion will help us to fulfill them.

It is a pleasure to send my best wishes for a successful conference and a pleasant stay in the capital city.

Dwight D. Eisenhower

a higher priority. For, without fresh, uncontaminated air, people will not congregate or remain in thickly-settled communities. In that event, the demand for ever-larger water supplies might easily be altered.

The foundation for future growth and development of many American communities may well rest on solution of the smog problem. Suggestions already have been thrown out that air zoning be undertaken. This would attempt to make certain that industrial expansion—vital and welcome as it may be—is so directed as to take advantage of prevailing winds or features of terrain in reducing potential air pollution.

Likewise, the public stake in cleansing our atmosphere may warrant radical innovations in traffic engineering. Admittedly, our Nation as a whole, and most of its major cities, confront real headaches in constructing and rebuilding streets, highways, freeways, and other arteries to handle the furiously-mounting traffic volume. But unless other means can be found to control the way mechanical horses emit foul-smelling breaths, it is conceivable that we one day will ask engineers to channel fume-spouting automobiles, buses, and trucks away from smog-prone centers.

The obvious public interest in relieving air pollution appears to be multifaced. In promoting that interest, I sincerely trust this conference will be dedicated to the principle of pooling resources in the traditional American fashion so that the public welfare may be benefited to the greatest degree of which we are capable.

Social Aspects of Air Pollution

Dr. Chauncey D. Leake
Assistant Dean, College of Medicine
Ohio State University, Columbus, Ohio
Representing the American Association for the Advancement of Science

The purity of the air we breathe is a basic right we all acknowledge. In order to maintain it we have to work together, all of us, all over the world. Individual and group responsibility for the purity of our common air makes this matter a social problem, of interest to society generally, in every part of the world. The social aspects of air pollution concern every one of us, as individuals and as citizens of the societies in which we live.

Air pollution was of little significance before the industrial revolution which has been exploding since the late 18th century. Yet even primitive peoples were quick to realize the importance of keeping down smoke from fires or dusts from traffic. Good air was sought in making settlements, and the ancient Greek physicians of the Hippocratic School appreciated the value of good air in preventing disease.

Vitruvius, the great Roman architect under Augustus, gave detailed instructions for the ventilation of buildings to assure wholesome air. He even had a glimpse of what green plants might do in keeping good air in cities, for he recommended tree-lined streets, to help keep fresh air in crowded areas.

The popular (or social) fear of bad air as a factor in disease is reflected in our word "malaria," the fever long associated with polluted and stagnant dank places. The smog of cities was known in the Middle Ages. It became commonplace as populations increased. Edinburgh was long known as Auld Reekie from its belching chimney pots, and London fog became notorious as industrialization expanded.

By the beginning of this century, smog had become a civic calamity for Pittsburgh. It was excused as an index of prosperity, notwithstanding personal discomfort and housekeeping expense. Air pollution was distressing in Chicago, St. Louis, and Baltimore. When soft coal replaced anthracite for home use and industry during World War I, New York City and Philadelphia began to suffer.

Gradual replacement of coal by oil and gas seemed for a while to reduce the grime. There was improvement in bad spots like Pittsburgh and St. Louis, especially when Cottrell smoke-precipitators were installed in the black belching stacks of industry. These became acceptable to industry either through enlightened management or as a result of social pressure. But in some small communities the smoke ruined all, as in Perth Amboy, where no one seemed to care.

Since World War II, however, there has been a steady rise in air pollution of cities, recognized all over the world. That keen word, "smog," has been most publicized in Los Angeles, where even the chamber of commerce could not hide it. But it was also noted around San Francisco, around Houston, over Cleveland, Boston, Birmingham, and Buffalo. Those who traveled by air could easily spot it, trailing from stacks and hanging over cities everywhere, from Liverpool to Moscow, from Milan to Osaka, from Detroit to Sao Paulo.

The really serious social aspect of air pollution came dramatically with the thousands of deaths in London in the black smog of 1952, in the disasters of Poza Rica in Mexico, of the Meuse Valley in Belgium, and of the Donora Valley in Pennsylvania.

Meanwhile a highly controversial social aspect of air pollution came with nuclear weapon testing. Here is a subtle, not easily seen, but potentially very dangerous sort of air pollution, involving all living things, now and to come. One has only to spend a day or so in Japan to realize how serious a social aspect of air pollution this can be in terms of human fear and anxiety. The Japanese people, most of them quite innocently, have really tasted it.

One need only spend a few hours in California or in Nevada to recognize the growing public apprehension over radiation fall-out. Unfortunately, the confusion over security matters has weakened popular confidence both in the pronouncements and in the judgment of the Atomic Energy Commission. Here is an instance where failure of satisfactory communication between a scientific agency and the people has resulted in serious social disturbance. Let this lesson be clear to us in regard to other aspects of air pollution.

Social Factors in the Scientific Aspects of Air Pollution

With contamination of the air we breathe a subject of individual and social concern all over the world, it is heartening that there fi-

nally has come wide scientific activity directed toward understanding the physical-chemical factors involved, so that effective and generally satisfying control may be instituted. We all want pure air to breathe. We need it. It is the business of scientists to tell us how this can be obtained. It is the business of all of us to apply the scientific knowledge we can get on air pollution to the simple proposition of conserving pure air for all of us and for our descendants.

Here is a job on which every one of us may work together to accomplish what is necessary for us all. In this job no vested or selfish interest, whether individual, commercial, advertising, industrial, political, or national, can be allowed to stand in the way, if we all really want the pure air we must have if we are continue to live heathily.

Thanks largely to the stimulus of the Los Angeles Air Pollution Control District, which was organized and functioning soon after World War II, we have a large amount of detailed scientific information on the multitudinous and surprising factors contributing to smog. This has been skillfully and wisely analyzed by Prof. A. J. Haagen-Smit.[1]

The example set by Los Angeles has been followed by efforts at control of air pollution by most of the major American cities. In some places the results are impressive. In others official apathy or special privilege nullify the program. In Cincinnati there is a broad research program, supported by the U.S. Public Health Service, at the Robert A. Taft Engineering Center. Here it has recently been shown by R. N. Mendenhall and his associates how air contamination, particularly from automobile exhaust, leads to an extraordinary complex of an amazing number of highly irritating and toxic volatile chemical agents. A broad program of study on air pollution has been well conducted by Dr. H. H. Schrenk in Pittsburgh, Pa.

The Committee on Social Aspects of Science of the American Association for the Advancement of Science has considered pollution of airs and waters to be among the most serious social consequences of the current scientific explosion. We planned a general symposium to discuss pollution of airs and waters. Lack of funds and of staff made it difficult to organize the effort. We are grateful indeed that Surgeon General Leroy E. Burney of the Public Health Service of the U.S. Department of Health, Education, and Welfare called this conference to consider this problem, and to try to reach agreement on the best ways of solving it. Wisely also did the Assistant Surgeon General, Mark Hollis, dramatically call the situation to public attention by a carefully considered, cautiously worded, and solidly informative interview, which was widely circulated.[2]

The Public Health Service is clearly taking the lead, as we all recognize it should, in affording an opportunity to consider all the factors concerned in air pollution and to plan ways and means whereby contamination of the air we breathe may be brought satisfactorily under control.

[1] A. J. Haagen-Smit, Air Conservation, Science, 128: 869–878, October 17, 1958.

[2] Mark D. Hollis, Fresh Air Getting Scarce in U.S.?, an Interview in *U.S. News and World Report*, October 17, 1958, pp. 70–81.

Factors in Air Pollution and Their Consequences

The various physical-chemical factors involved in air pollution include dusts, some of which are radioactive, soot, carbon particles, ash, oxides of carbon, of sulfur, of nitrogen, and of many metals, mixed hydrocarbons, aldehydes, ketones, organic acids, and the highly irritating ozone.

Under the action of sunlight, heat, water vapor, and atmospheric conditions, a complex of organic compounds may develop, some of which are carcinogenic. Ozone and the compounds which it can produce may cause widespread trouble for all living things in the area, with local irritation of eyes, of nose, and of respiratory organs. These may also injure all growing things, and cause damage to machinery, and to any type of rubber material. They may act in very small concentrations, involving only a few parts per million of air. What may happen if the concentrations tend to increase?

Mendenhall and his associates from Cincinnati find that tolerance develops to the acute effects of ozone and of ketene, but how about the danger of continuing inhalation of small amounts of these toxic agents every minute of every day, year after year?[3]

Most of air pollution is referable to combustion. This was realized centuries ago. England had laws regulating the burning of coal in the early 19th century. Air pollution from burning has nevertheless steadily increased with industrialization. Now, however, as Haagen-Smit shows, about half of air pollution is referable to exhausts from internal combustion engines in automobiles. Here is a challenge.

In Seattle, autos and trucks dump 100 tons of hydrocarbons, 32 to 80 tons of nitrogen dioxide, and 4 tons of sulfur dioxide into the city's air every day. When are the auto and truck manufacturers going to turn from the foolishness of fins, from silly style whims, from oversized models, and from too much horsepower, to the essential but tough job of controlling exhausts?

This is a pressing matter to each of us personally, and to our community society. In addition to eye and respiratory irritation, the increasing incidence of lung cancer is quite as referable to increased city auto traffic exhausts as to cigarettes. Russian public health officials, I learned a couple of years ago, claim their rising occurrence of lung cancer in the cities goes along with the increase of auto and truck traffic.

What about the tremendous increase in the blanket of carbon dioxide that we are throwing above us, and which will inevitably tend to increase heat capture from the sun? What will we do if this occurs, with gradual melting of the huge polar ice caps, and the gradual rise of our oceans, drowning out still further our shore lines?

Perhaps we can prevent possible accumulation of carbon dioxide, which even in a very slight degree may alter the extent of heat capture, by extensive planting of trees and other green things. Maybe 10 trees planted for every automobile, with 100 for every truck, would help. Our cities could certainly benefit from such tree planting, re-

[3] R. N. Mendenhall, Tolerance and Cross-Tolerance Development to the Atmospheric Pollutants, Ketene and Ozone, Ohio Valley Section Society for Experimental Biology and Medicine, Columbus, Ohio, October 31, 1958.

gardless of their possible aid in reducing the contamination of the air we breathe.

The increasing urgency of our common air-pollution problem may be gaged from the detail to be offered by this conference. The status of current knowledge on air contamination will be broadly reviewed by Herbert McKee, "What's In the Air?"; Leslie Chambers, "Where Does It Come From?"; James Dixon, "What Does It Do To Us?"; Reuben Gustavson, "What Are the Costs To Us?"; and Charles Gruber, "What Can Be Done?" There will be a survey of accomplishments by control agencies, and significantly, we will hear from industries on plans for the matter. Details will be considered on the extent of air pollution, on the sources, on the health effects, on economic and social effects, on control methods and procedures, and on administrative problems.

Then what? Will this all be neatly printed in a thick volume, to be filed away and forgotten? After all, what was accomplished by the interdepartmental conference which was so well organized in 1950, by Dr. Louis McCabe? Certainly a conference like this can mean much to our social organization, and to us individually, if we can somehow communicate to the people generally what we are talking about.

The Los Angeles Air Pollution Control District has given an excellent example of how the essential facts about air pollution, with their consequences for individual and social welfare, can be communicated to the people. In Los Angeles skillfully prepared informative pamphlets are freely available in public buildings, transportation centers, and in many large stores. The newspapers cooperate very broadly, and there is excellent support from local TV and radio channels. This kind of example might well be followed more generally. Nevertheless, if air pollution is successfully to be reduced, we all have to get busy and actually do something about it, or else we are all going to continue to suffer from it.

To close my rambling comments, it might be remembered that the social factors of the scientific aspects of air pollution are mainly concerned with getting the facts to the people, obtaining understanding of the individual and social consequences of the facts, and then securing motivation to get busy and help clear the situation. The responsibilities in the manner of air pollution are individual as well as social, political, and industrial. Let's make sure that the discussions of this conference are as widely distributed as possible and that there may be effective translation in popular language of what we talk about, so that the people generally may benefit from the recommendations that may be made and the agreements that may be reached.

Technical Aspects—The 1950 Assessment

Dr. Louis C. McCabe
President, Resources Research, Inc.
Washington, D.C.

Many of you gathered in this same place more than 8 years ago at the U.S. Technical Conference on Air Pollution which was called by the President "for the purpose of summarizing our knowledge of this difficult subject and . . . preparing recommendations for cooperative effort of public and private interests to minimize atmospheric pollution and its ill effects." The President directed that the most highly qualified persons in this field in industry, government, research institutions, and other lines of endeavor should be invited to participate and that a report should be made available to the public. Ninety-seven papers were presented in seven panels grouped under agriculture, analytical methods and properties, equipment, health, instrumentation, legislation, and meteorology. Publication of the proceedings brought together in one volume an authentic body of information on the nature and control of air pollution.

The subject of air pollution was not new for there were many examples in the years prior to the 1950 conference of the successful application of the scientific method to specific atmospheric contamination problems. Great emphasis had been placed on smoke prevention for a long time but only recently had there grown up a store of theoretical and applied information which could be employed in air-pollution work. Much of this information grew out of research and development programs of the civil and military agencies of government, the universities, and industry.

In the course of the discussions there were papers on the characteristics of aerosols and methods of determination of particle size and number. The limitations in the use of the light microscope and the electron microscope for characterization of particles were discussed. The changes of air pollutants during dispersion and during collection were noted and it was observed that when two chemicals are dispersed each may not be of any great importance, but the combination of the two in the air may be of serious consequence. This phenomenon encountered in dispersion was also a major problem after collection. The need for the development of methods for measuring air pollution in situ or analyzing for the unchanged molecule was recognized.

By 1950 the high overall oxidizing power of the Los Angeles atmosphere had been established in contrast to the reducing atmospheres of many other metropolitan centers. Haagen-Smit had shown that in the presence of sunlight, ozone and hydrocarbons formed a dense aerosol having such similarities to Los Angeles smog as its oxidizing capacity and eye-irritating effect. Peroxides, aldehydes, and acids had been identified as significant in this type of air pollution. The need for further knowledge of organic pollutants was apparent.

The sulfur-bearing contaminants held a special position in nearly all air-pollution investigations and the analysis and collection of