Symposium on Air Pollution

STATEN ISLAND, situated in the heart of the air pollution area of urban New York and New Jersey, was the site of the second annual symposium on air pollution control held March 1954.

The symposiums are sponsored by the department of bacteriology and public health of Wagner College, Staten Island, N. Y., in cooperation with the borough president's Committee for Air Pollution Abatement.

Symposium papers on the engineering aspects of air pollution control, toxicological research, the State control program established by New Jersey, and the industrial control equipment, particularly installations of utility companies, are presented in brief below.

In prefatory remarks, Natale Colosi, Ph.D., professor and chairman of the Wagner College department of bacteriology and public health, and chairman of the Committee for Air Pollution Abatement, summarized the air pollution problem confronting Staten Island and vicinity. Dr. Colosi referred particularly to the report of a preliminary study conducted by the Richmond County (N. Y.) Medical Society and the committee. The findings, he stated, indicate that air pollutants are having adverse effects on the health of Staten Island residents. He also reported the committee's observations on the damages to plant life ascribed to air pollution and confirmed by agricultural experts. Dr. Colosi said the consensus of the committee is that air pollution in the area is an interstate problem and should, therefore, be controlled by an interstate agency.

Interstate Study Proposed

The efforts New York and New Jersey officials have made to initiate an interstate study of air pollution were described by two New York State Department of Health officials, Earl Devendorf, P.E., director, and A. Rihm, Jr., P.E., senior sanitary engineer of the bureau of environmental sanitation. Solution of an interstate problem, such as air pollution, is complicated both legally and administratively, they pointed out.

In 1949, it was decided that a survey should include an epidemiological study of the ill effects people reported; location of the plants causing contamination and determination of the materials being emitted by the stack; and collection and correlation of meteorological data to determine the need for an air sampling program. The complicating factor was the lack of sufficient State and city funds to employ the 10 public health nurses, 8 engineers, and 6 to 8 chemists, and to purchase the equipment, supplies, and laboratory and office space needed in carrying out the proposed study.

Subsequently, the officials reported, the Interstate Sanitation Commission, set up by the legislatures of New York, New Jersey, and Connecticut to deal with water pollution affecting the metropolitan New York areas, agreed to make the survey if its functions were enlarged to include jurisdiction over air pollution and adequate funds were appropriated. The commission has estimated that $60,000 will be needed. Enabling bills have been introduced this year in the New York and New Jersey legislatures, the officials reported.

Catalytic Process

The function of catalysts in fume combustion as an air pollution control measure for some types of manufacturing processes was discussed by Paul H. Goodell, sales manager of the Catalytic Combustion Corporation, Detroit. A catalyst is a substance which accelerates a reaction

without itself entering into the end products. In fume combustion, the catalyst assists in the oxidation of hydrocarbons and organic gases, thus converting the noxious fumes into carbon dioxide and water vapor. The oxidation also results in energy recovery.

Catalytic oxidation is broadly applicable to hydrocarbon and organic type fumes, including alcohols, esters, ketones, ethers, acrolein, aldehydes, hydrogen, carbon monoxide, and mercaptans, Goodell reported. The process, he said, is considered unsuitable when the fumes contain large amounts of cinders, inorganic solids, or vaporized metals that would cause rapid deterioration of the catalyst—such as the gases from foundry cupolas, blast furnaces, or coal-fired boilers. Normal atmospheric dust, he said, causes no difficulty and, in some cases, low concentrations of process inorganics can be tolerated.

The largest single catalytic fume combustion installation, now under construction, will have a 160-square-foot catalyst bed to handle approximately 80,000 cubic feet per minute of furnace exhaust gases, Goodell reported.

An Engineering Job

PHR brief

In the last decade the public has awakened to the idea that the air has some form of boundary and that it is possible to overload the air of a city with waste substances, just as streams and harbors were overloaded years before.

But the discovery of the offending air pollutants in a particular locality and their source must await engineering investigation and analysis if we are to avoid prejudging industry without adequate evidence.

The drudgery and leg work necessary while accumulating information are considerable. The time required to establish the facts is measured in months or even years. The costs in manpower, equipment, and laboratory work are high.

It is much easier to guess at characteristics than to evaluate them. An old story, one that can be damaging to sincere engineering effort, is repeated when well-meaning but sometimes poorly informed persons accuse industry of being defilers of pure air almost to the exclusion of other less recognizable sources of air pollution.

A technical survey of the industries and fuel burning equipment in New Haven, Conn., revealed, for instance, that no more than 20 to 35 percent of the dustfall was from tall industrial chimneys. The primary problem could have been in blackness rather than total quantity of dustfall. The burning of No. 6 fuel oil contributed a high proportion of carbon.

In the Los Angeles area millions of dollars have been spent and years have passed since the initial investigations. Much information has been obtained and many aspects of the problem of control have been dealt with, but some evaluation is still to be made. The addition of unburned hydrocarbons from automobile exhausts and tonnage of organics contributed from burning refuse loom as significant factors in the air pollution picture. Although the effects of petroleum industry operation are not to be minimized, it is now apparent that those who accused that industry years ago without benefit of engineering data were only partly right.

Industrial Surveys

The actual content of an industrial survey will depend on the variety of industry and type of process, on the source of fuel for combustion apparatus, on the design features of equipment, and on the quality of operation of any and all installations.

Manufacturing establishments in an area may be classified by principal products. For example, the following classification of industry has been used in Louisville.

Ceramic products	Public service corporation
Chemical products	Textile products
Distilleries	Tobacco
Food products	Miscellaneous plants
Printing and publishing	

By William T. Ingram, associate professor of public health engineering, New York University College of Engineering.

The industrial survey should have some or all of the following information and perhaps more for special conditions.

1. Maps should show the process layout and location of principal sources of emission together with pertinent dimensions for estimating discharge flow rates and volumes. Process flow diagrams should be detailed enough to show both normal and emergency points of discharge and conditions under which they operate.

2. Flow charts should be constructed to indicate the raw materials and their points of addition; the losses from process as waste, with sufficient information to determine the character of waste and the quantity that is lost; the method of treatment of each loss and the means of disposal; the finished products; and the operating schedule.

3. Maintenance of process and treatment should be indicated in order to show the circumstances under which unusual emissions may occur when repairs are being made or equipment is out of service.

4. Fuels and fuel-burning equipment should be itemized so that quantitative data are available on fuel analyses, boiler ratings, dust and ash produced, stack temperatures, and gas volumes maintained.

5. Specific information on all air cleaning equipment should be listed to show the kind of cleaner, its rating, efficiency of cleaning, and periods of bypass, or nonoperation.

A catalog of industrial air cleaning equipment would include devices that remove particles of all sizes from wood splinters to aerosols, neutralize acids and alkalies, adsorb gases, and convert vapors. The air cleaning equipment required will depend on the industrial process.

Not all atmospheric pollutants are exhausted through a smoke stack. Some are expelled from ducts at or near ground level. Some find their way to the outer air from the ports of natural ventilation such as windows, louvres, and roof vents. Control of all such outlets may be indicated under certain conditions. Air cleaning devices suitable for cold processes may be unusable on hot processes. Devices suitable for noncorrosive substances are probably not satisfactory if strong acids or alkalies are formed. Those suitable for low velocity and small volume may be inadequate if the process gas flow is high velocity or high volume.

Installations suitable for constant input operations may be inefficient if the input quantity or quality is variable.

The engineer must observe and record the facts about processes and process operations that will allow him to design workable air cleaning devices. When an industry is faced with the necessity of meeting standards of particle content, smoke density, chemical concentration, and other standards included in legal controls, the importance of competent selection becomes clear.

The engineer who is responsible for equipment selection in the first place should not be employed by the agency that checks the operation of a device for conformance with legal standards. In blunt language, the municipal air pollution control engineer should never be put in the position of passing on his own design. If industrial staff cannot do the required design, consultants should be employed for the work.

Choice of Control Method

Economics of corrective measures are part of the engineering. It costs approximately $600,000 to control emissions of a 50-ton capacity open hearth furnace. Precipitator installations at large powerplants have amounted to $1 million per boiler unit. Incinerators cost from $2,000 to $4,000 per ton of rated daily capacity. A rubber plant on the west coast has spent $150,000 on the development phase of pollution control equipment. The equipment requires water that is not yet available and a sewer that has to be built before any installation can be made.

It should be quickly recognized by both industry and municipal agency engineer that the removal of noxious materials before they reach the outside air is an effective step in air pollution control, but one that requires the exercise of competence and judgment in its accomplishment. Atmosphere can serve effectively as a diluent, and the degree of efficiency to which process air cleaning is geared must be determined so that neither the industry nor the public is penalized unduly. We have not yet reached that Utopian stage of standardized air

cleaning in which filters, cyclones, washers, bag units, or precipitators can be ordered out of stock. Each control unit is practically custom made for particular needs.

The public should not become overly impatient because it takes time to complete an air cleaning installation, but it has every right to insist on competent engineering and progress on any installation in order to obtain the anticipated degree of pollution protection in the completed unit.

Toxicological Studies

As with any problem in toxicology, the effects of air pollution may be divided into the acute and the chronic.

Although in one instance chronic beryllium poisoning was reported among persons living near a beryllium manufacturing plant, the evidence is not sufficient to permit conclusions about the chronic effects of air pollutants on the health of urban dwellers. This isolated instance does, however, demonstrate that an air pollutant can have chronic effects on health. It also demonstrates that these effects were obtained from concentrations of the chemical pollutant many times below those considered as "safe" for occupational exposures.

We have more information about acute effects from studies of the Meuse Valley disaster of 1930, which was responsible for 60 deaths; the smog of 1948 in Donora, Pa., which killed 20 persons and caused symptoms of varying degrees of severity to 40 percent of the population; and the London fog of December 1952, which accounted for the death of a large number of persons. One fact is clearcut. The deaths and illness observed during these incidents were due to chemical pollutants of the atmosphere and not to other causes.

By Mary O. Amdur, Ph.D., formerly research associate of the Harvard University School of Public Health.

Special Group Affected

The greatest number of fatalities and the most severe illness were found in the older age groups and in persons with heart disease, chronic bronchitis, bronchial asthma, and pulmonary emphysema. During such disasters, the young, healthy, normal individuals will be inconvenienced possibly, but a smaller percentage of them will suffer major injury.

Whether or not persons with pre-existing cardiac and respiratory pathology are harmed by the normal levels of urban air pollution we do not know. That they are damaged by the levels of pollution during the special situation of these fogs has been established. When an explanation of such disasters is sought, these unusually susceptible persons must be kept in mind.

Measurements of the concentrations of sulfur dioxide and smoke made in London during the fog and calculations made after the Meuse Valley and Donora incidents reveal that the concentration of pollutants was not excessively high. They were, of course, much higher than those normally found in the atmosphere, but they were nowhere in the range normally considered lethal or injurious. The concentrations did not even approximate the so-called maximum allowable concentrations—the levels industrial hygienists regard as safe for an exposure of 8 hours a day for workmen in industry.

The maximum allowable concentration of sulfur dioxide is 10 p.p.m. The calculated concentration was about 8 p.p.m. for the Meuse Valley and 0.5 p.p.m. for Donora. The measured average sulfur dioxide for the peak day of the London fog was 1.3 p.p.m. This concentration is about 10 times the amount normally found in London, but on the other hand, it is still only a tenth of the maximum allowable concentration.

How then can atmospheric pollutants produce such widespread injury and mortality at concentrations not normally considered harmful? At first glance it seems surprising that this should be so. To some it is even tempting

to conclude that this pollutant or that one could not possibly have contributed to the overall picture because industrial exposures to much higher concentrations have supposedly caused no harm to workmen over a period of years.

But are the industrial workman and the person injured during the fog really comparable? For several reasons, I feel that the answer is no.

These maximum allowable concentrations are intended as a guide for levels of exposure of individuals healthy enough to be engaged in factory work in the first place. Persons with cardiac or respiratory pathology of any severity are not as a rule found in occupations in which respiratory irritants are encountered routinely. Hence, the MAC values are designed to protect the average and not the highly susceptible individual. It is these very persons, however, with whom we must be concerned in fog disasters.

It is also a well-known fact that a tolerance of a sort is developed by persons working routinely in the presence of respiratory irritants, as witness the pathologist who works happily in a concentration of formaldehyde vapor which at once brings tears to the eyes of his visitor.

Atmospheric Mixture

In addition to dealing with a special group of persons in fog disasters, we are also faced with a very special atmospheric situation. A meteorological inversion has stabilized a mass of air over the area. This same air remains there for 3 or 4 days. The situation can be likened to a pot of a given volume containing a mass of cold foggy air sealed in by a lid.

Since the volume remains constant and many pollutants continue to be added, the concentration of pollution continues to rise until the meteorological situation changes and the fog is dissipated. There is every possibility of interaction among the various pollutants. Gases may be adsorbed on solid particles such as smoke or dust. The water particles provided by the fog itself offer another medium to dissolve gases and promote various interactions. A great deal more information is needed about the chemistry and physics of such a mixture.

We also know very little about the physiological action of the various individual pollutants at concentrations corresponding to those occurring in the fogs. And we know very little about the interaction of two or more pollutants.

Working out methods of establishing and sampling experimental atmospheres containing known concentrations of pollutants can be time consuming, especially when very low concentrations are needed. To control, establish, and measure accurately concentrations of two or more materials at once poses even more problems. Careful control of physiological measurements is also an essential of such studies since various psychological factors must be eliminated if the results are to have any real meaning.

From such research will come no dramatic "answers" to the fog, but rather, bit by bit, information will accumulate on the effects of low levels of the common pollutants and on the interactions among them. It has been agreed that there was no single causative agent in the fog disasters studied. On the other hand, to claim that a given pollutant did not contribute to the picture because it was not the whole answer would be fallacious.

Experimental Studies

In Los Angeles the research group, headed by Haagen-Smit, has worked out methods for detailed chemical analysis of the atmosphere so that reasonably complete information is available about the compounds and the amounts present.

Further studies have shown that in Los Angeles the smog constituents responsible for eye irritation and injury to plants result from the interaction of ozone or nitrogen oxides with unsaturated hydrocarbons. The resultant organic peroxides and other oxidized compounds have a high irritant potency. These reactions have been studied under controlled laboratory conditions and the experimental atmosphere thus produced has had effects similar to those observed during the fog. The study of individual organic compounds has made it possible to determine which ones are the most likely to cause this type of trouble and which ones should be reduced to a minimum during smog conditions. Through this work a definite group of

airborne organic substances has been linked with injury to man for the first time.

The Army Chemical Center, Edgewood, Md., has demonstrated the effect of physiologically inert aerosols on the toxicity of irritant gases. In cases in which the aerosol increased the penetration of the gas to the lungs, the toxicity was increased. Formaldehyde was an example of this type. When the aerosol decreased the penetration to the lungs, it also decreased the toxicity. This was true for nitric acid fumes. With acrolein vapor, the aerosols had a variable effect on the toxicity. This experimental demonstration that the toxic effect of a gas may be influenced by the presence or absence of aerosol particles had practical as well as theoretical value.

A group of investigations in progress at Harvard University during the past 4 years have been concerned in general with the physiological effects of the sulfur compounds on guinea pigs and man. It has been well established that nobody in industry seemed to suffer any harm from routine exposures to sulfur dioxide concentrations up to 10 p.p.m., but data were lacking on whether or not any physiological response resulted from the exposure of unacclimated persons to the concentrations found during the fog disasters. The industrial concentration of sulfuric acid mist had been set at 1 mg. per cubic meter. It had been suggested by various authorities that these two sulfur compounds had done their bit in contributing to the Meuse Valley and Donora episodes.

We found that 1 p.p.m. of sulfur dioxide breathed through a face mask for 10 minutes had a significant effect on the pulse rate, respiration rate, and tidal volume (volume per respiration) of normal persons. Under the same experimental conditions, a concentration of 5 p.p.m. of sulfur dioxide had no apparent effect on workmen routinely exposed to concentrations of above 10 p.p.m. Thus, the reaction of workmen accustomed to an irritant gas is not the appropriate standard by which to judge the reactions of an unacclimated individual, especially a highly susceptible one.

We found that sulfuric acid mist produces a response similar to that of sulfur dioxide at concentrations as low as 0.3 mg. per cubic meter (equivalent approximately to 0.1 p.p.m.).

Hydrochloric acid and acetic acid did not produce similar effects at low concentrations. Hydrochloric acid produced reactions at concentrations of 10 p.p.m. and above, but at this level the sharp smell is annoying. Acetic acid did not produce these responses at any level up to the 30 p.p.m. tested.

If each of the sulfur compounds alone has an effect, what do they do when both are present together? This is being studied on persons, but the experiments have not gone far enough for the results to be evaluated. Some preliminary information on guinea pigs showed that a given concentration of sulfur dioxide is much more damaging when a small amount of sulfuric acid is present with it. This showed up in the growth of the animals following exposure, in the pathology found in the lungs, and in the marked respiratory response of the animals to the combination. The concentrations used in this work were about 10 times the MAC values and about 100 times those found in the fog disasters. Either of the compounds alone at the concentrations used was relatively harmless to the guinea pigs when exposure was limited to 8 hours (see *Public Health Reports*, May 1954, p. 503).

New Jersey's State Program

PHR brief

An air sanitation program has been added to the industrial hygiene and radiological health activities of the New Jersey State Department of Health. The trio of programs is administered by the bureau of adult and industrial health.

In line with the philosophy of placing most of the responsibility for public health activity in the hands of local officials, the air sanitation program is designed to assist local governmental units in establishing control measures. It will also provide research facilities for evaluat-

By William A. Munroe, principal public health engineer of the New Jersey State Department of Health.

ing the degree of air pollution existing throughout the State and will develop air sampling and testing procedures to meet State problems.

Assistance in Local Control

The State air sanitation program plans to provide local governments with the facts available about air sanitation control. When the condition warrants, studies will be made to determine the nature of the problem and to determine the extent of legal or technical control currently practical. From time to time, the department will develop model ordinances which can be adopted by local boards of health by simple legal process. The 1953 smoke control code of New Jersey is one example of this form of legislation.

This smoke control code is designed to provide local boards of health with a form of smoke control they can enforce with personnel and facilities available to them. Replacement or elimination of more detailed and specific local smoke control ordinances which the larger cities or heavy industrial areas may have or require is not intended.

When requested by municipal officials, the State air sanitation officials will express opinions on plans for new structures or on air pollution controls proposed for old structures.

Air Sanitation Research

The development of techniques for measuring air pollution is a big job and one that is being carried out by many organizations in the country. However, we feel that we can make some contribution to air sampling methods as the needs are indicated by specific problems in New Jersey.

The program has developed or modified numerous devices for outdoor air testing, usually as the result of some particular field problem in which the need for a method was indicated. Two experimental field mobile air sampling units have been constructed for use as field laboratories. The equipment in both of these units is the result of applied research and field experience with the type of air sanitation problems existing in New Jersey. Much of the scientific equipment used in field studies are air sampling and testing devices or modifications of the type of device used in industrial hygiene inplant evaluation of air contamination.

The importance of meteorology in concentrating or dispersing air contaminants has been well established. The health department field units are equipped with recorders for making continuous records of local meteorological conditions for correlation with atmospheric sampling data.

The most promising device developed by the program is an automatic directional air sampler that is capable of collecting air samples, by conventional sampling devices, in such a manner as to correlate the sample with a specific sector of the compass. The department is also working on an attachment for the Thomas recorder which will automatically collect a gas sample when a pre-established level of sulfur dioxide is indicated on the recorder and will automatically correlate the sample with wind direction.

Field studies will also be made to correlate cause and effect of industrial air pollution. One such study is in the advanced planning stage and will be started as soon as facilities permit.

Technical Assistance

Many municipalities in New Jersey have ordinances which control air pollution from the viewpoint of nuisance as well as health hazard. However, no municipality in New Jersey is equipped to get the technical evidence needed for legal action. When requested, the facilities of the department of health will be made available to assist in the collection of technical evidence.

The State air sanitation officials are frequently requested by local officials to meet with them and representatives of industrial management to discuss a local problem. We have found this to be most satisfactory and plan to continue the procedure.

The State program is also frequently requested to evaluate the effectiveness of one form or another of air pollution control on a plant process. It is equipped with stack sampling facilities and provides this service within the limits of time and staff upon request by a local government. In some instances, stack sampling

is performed at the request of plant management.

The air sanitation program is not a law enforcement program. Rather it is set up to provide a service to local governments and to provide a latitude for research on the problem as it exists in New Jersey. But definite legal control is available in State public health law if, or when, an air sanitation problem becomes a health hazard. Whenever such a condition exists, the State department of health is obligated to use the legal powers available to it and to enforce existing provisions of State law.

However, no form of legislation has yet been successful in eliminating all forms of objectionable air contamination. There is much to be learned about the techniques of air sanitation control from the viewpoint of human tolerance, nuisance levels, and practical and economic engineering methods for abatement.

The forms of air contamination to be considered by the air sanitation program are: chemical pollutants from industrial processes; smoke from industrial, commercial, or domestic heating facilities; smoke from industrial or municipal incinerators or dumps; exhaust gases from motor vehicles; objectionable pollens; and other forms of manmade or natural contamination.

Contributions of Industry

PHR brief

The utility companies, I found in my trips about the country the past year, are the leaders in air pollution control, as they should be, even when the plants are quite a distance from residential areas.

The utility companies serving Boston, Chicago, Cleveland, Baltimore, Charleston, W. Va., and Sunbury, Pa., for example, are all engaged in about the same type of air pollution control as the Consolidated Edison Company, main supplier of gas and electricity for factory, business, and home use in New York City and its environs.

Unlike most other large cities, New York City does not have many large industrial plants generating their own electricity. To a large extent the stacks of industry in New York City are the stacks of Consolidated Edison. The company uses approximately one-third of all fuel, one-half of all coal, and two-thirds of all bituminous coal burned in the city.

Control Equipment Costly

In 1937, Consolidated Edison embarked on an ambitious program of installing modern devices and revamping older control equipment. From 1937 to date the total cost of the control program for work completed and authorized comes to $31 million. Four million dollars of this amount is earmarked for work scheduled but not yet done.

During the past year substantial progress was made in the continuing program of installing improved control equipment at five stations of the system. At the East River station alone, for instance, the installation of mechanical control equipment and the revamping of older type electrostatic precipitators on three 1-million-pound boilers installed about 1929 has cost nearly $900,000 and is two-thirds completed.

As new generating units are added, a large part of their cost will be for modern control equipment. At the new Astoria station in Queens, for example, the cost of air pollution control equipment, both mechanical and electrostatic, was well over a million dollars for each of the two boilers installed. At Astoria, the investment in plant is about $160 per kilowatt of installed capacity. Of this amount $5.94, or 3.7 percent, is for air pollution control equipment.

Solution for Low Stacks

Because of the proximity of the Astoria station to the LaGuardia Airport, where safety regulations limited the height of the new station's stacks to 300 feet above sea level, special

By George T. Minasian, director of community relations of the Consolidated Edison Company of New York, Inc.

engineering problems were presented in getting sufficient velocity into stack emission to lift it high above the surrounding buildings. To find the solution, research engineers built a special wind tunnel, and for 2 years tests and analyses were made at New York University. As a result, we built a new type of stack with a nozzle installed on the top. Inside this nozzle, and concentric with it, is a second nozzle with damper. This damper is operated to increase the velocity when weather, wind, or plant conditions might create an unpleasant situation. Part of the installation is an atmosphere analyzer located in the direction of the housing development near the plant and a wind velocity and direction gauge on top of one of the nearby gas holders. A television viewing monitor on the central control board shows the operators at all times the condition of the stacks.

I also have a good report on our Staten Island plants. Livingston, a standby and peak-load station, burns oil, and the modern, highly efficient Arthur Kill station is equipped with electrostatic precipitators, and we have a beautifully clear stack (which I am afraid distinguishes it from many of its neighbors on the other side of the Kill; I am not giving away any secrets as any of you who travel the New Jersey Turnpike can testify).

Automatic load frequency control is now operative systemwide, an investment, incidentally, of $288,000. On the console at the control center, it is possible to preset the system for proportional participation by the various stations in load changes, including ties to the north and to Long Island. This device helps greatly in controlling the effect of load swings on stack discharge since the settings are made with this in view.

Consolidated Edison's problem is not smoke in the engineer's sense—unburned carbon—since we burn our fuel efficiently. It is not noxious fumes since products of combustion are discharged high in the air at high velocity and are so dissipated that any concentration from such sources is infinitesimal at habitable levels compared with other sources such as automobiles and buses. Our problem is fly ash, the unburnable part of our fuel, most of which would find its way into the atmosphere if it were not caught. With our control equipment we are catching about 95 percent of the fly ash.

Notes Progress

How about industries other than the utility plants? It may not be so uniformly apparent that they are making progress in air pollution control, but I am convinced that they are. I have been particularly interested in "The Magic Valley," in Charleston, W. Va., where the many large companies include Union Carbide, DuPont, American Viscose, Libby-Owens-Ford, and Libby-Illinois. All of these companies have extensive air pollution control programs and have the support of the citizens and the press.

At Baltimore, during the meeting of the Air Pollution Control Association in May 1953, there was of course the usual evidence of a heavy industrial concentration. However, programs were being set up in the various industries. By far the worst smoke that we saw was on the pleasure boat on which most of the smoke control officials took an inspection and pleasure trip on Chesapeake Bay.

I might also mention Pittsburgh, which is still getting bouquets I sincerely believe it deserves. However, these bouquets also are deserved chiefly for the great progress made and should not be interpreted to mean that the millennium has come and that the city is free from air pollution. I feel quite optimistic about industry as a whole insofar as it is cooperating and showing sincere interest in doing its part for cleaner air.