

FEDERAL RESEARCH AND DEVELOPMENT ACTIVITIES

The functions of conducting and supporting research have been an integral part of our Department's air pollution activities ever since the establishment of the Federal air pollution program in 1955. In Fiscal Year 1966, which ended on June 30, about \$14 million was invested in research activities. This sum represented some 55 percent of the funds appropriated for the air pollution program. For the current Fiscal Year, our budget requests includes about \$18 million for research activities.

Of the total for Fiscal 1966, about 30 percent was allocated for research in our own facilities, mostly at the Robert A. Taft Sanitary Engineering Center in Cincinnati. About 10 percent was used to support research by other Federal agencies—the Environmental Sciences Services Administration and the National Bureau of Standards of the Department of Commerce, the Bureau of Mines of the Department of the Interior, and the Tennessee Valley Authority. Contracts with non-Federal institutions and agencies, including industrial firms, accounted for 20 percent. The largest single portion, about 40 percent, was awarded to non-profit institutions, mostly universities, to support needed research projects.

This research effort includes a broad range of investigations of the nature, extent, sources, effects, and control of air pollution, and the scientific disciplines involved include many branches of the physical and biological sciences. Among the more important elements of the program are laboratory studies of the adverse effects of air pollutants on animals and clinical studies of effects on man, epidemiological and statistical studies of the occurrence of illness and death in relation to various measurements of air pollutions; field investigations of the effects of pollutants on materials and structures, engineering investigations of the nature and control of pollution from such major sources as motor vehicles, fuel combustion, and manufacturing activities, and studies in the social sciences. I want to discuss some of these research areas briefly.

In the areas of medicine and biology, studies are being conducted to determine the biological responses of laboratory animals living in ambient air in urban areas over a long portion of their life span as compared with those living in cleaned air. In related laboratory studies, animals are being exposed to synthetically derived polluted atmospheres, e.g., irradiated and non-irradiated auto exhaust, mixtures of auto exhaust with added sulfur dioxide and nitrogen dioxide, and various pure gases and particulates, singly and in combinations. Preliminary experiments suggest a lowering of fertility and infant survival of animals exposed to irradiated exhaust. Biochemical changes in the lungs and activation of spontaneous disease appear to result also from chronic exposure to irradiated exhaust.

Other studies involve effects of potentially cancer-producing materials derived from combustion and industrial sources and found in polluted air; the potentiation of infectious disease (e.g., bacterial pneumonia) by exposure to air pollutants such as nitrogen dioxide or ozone; changes in electroencephalogram patterns in rats on exposure to air pollutants such as carbon monoxide and ozone; clinical studies to define more specifically the components in photochemical smog that produce eye irritation and define the increased oxygen requirements of patients with pulmonary disease exposed to ambient or filtered air; and phytotoxic effects of pollutants such as auto exhaust, ozone, nitrogen oxides, and sulfur dioxide with a number of plant species and exposure conditions.

Epidemiological studies are focused on the effects of air pollution on health, with emphasis on respiratory diseases. In field studies, some of the health effects that might be attributable to air pollution (and other environmental factors) are measured, as are the levels of air contaminants. In Nashville, effects on patients with asthma were correlated with atmospheric pollutants. These correlations indicated that the asthma attack rate varied significantly on days of high and low concentrations of sulfur dioxide. In Seward and New Florence, Pennsylvania, statistically significant differences in average airway resistance were found in residents of the two communities which differ greatly in ambient air pollutant levels sulfur dioxide, dustfall, and soiling. In New Orleans, the incidence of asthma outbreaks has been studied in relation to wind speed and direction, types of pollutants in the atmosphere, allergic reactions, and possible sources of pollutants. Results thus far show that samples taken