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Editorial & News Contacts
North America 1200 New York Avenue, NW, Washington, DC 20005 Editorial: 202-326-6501, FAX 202-289-7562 News: 202-326-6500, FAX 202-371-9227 • Bureaus: Berkeley, CA: 510-841-1154, FAX 510-841-6339, San Diego, CA: 760-942-3252, FAX 760-942-4979, Chicago, IL: 312-360-1227, FAX 312-360-0537
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Airborne Particulate Matter

Philip H. Abelson

Improved judgment is now influencing the quality of research conducted on health effects of airborne particulate matter. This is a consequence of congressional legislation requiring the Environmental Protection Agency (EPA) to contract for and to follow advice of the National Academy of Sciences (NAS). Congress acted when repeatedly informed that the EPA had promulgated standards for particulate matter (PM) of doubtful efficacy in safeguarding health but ultimately likely to cost hundreds of billions of dollars.

The congressional mandate led to action. The National Exposure Research Laboratory of the Office of Research and Development of the EPA expanded its efforts in seeking detailed knowledge about particulate matter. On 31 March 1998, a National Academy of Sciences committee delivered an informative and useful report. Some of the many complexities involved in setting standards for PM were outlined. The committee identified 10 research areas that merited high priority efforts and pointed out that the EPA had been devoting most of its funds to creating and installing equipment to collect outdoor particles of unknown composition, size, and surface. People spend most of their time indoors and distant from the outdoor monitors. The report stated, "...the committee concludes that EPA should immediately devote more intramural as well as extramural resources to investigating the relationships between fixed-site outdoor monitoring data and actual human exposures to ambient particulate matter, and to identifying the most biologically important constituents and characteristics of particulate matter through toxicological studies." At this time, we have little information about these matters or about health effects due to outdoor or indoor pollution.

> **...particulate matter differs in origin, composition, size, surface, and toxicity.**

On 22 and 23 June, the NAS committee was briefed about EPA's actions with respect to PM. It was apparent that the EPA has made a substantial effort to increase its research on the characteristics of PM. It has entered into extramural agreements involving first-rate scientists. Many activities have been stimulated by the NAS report and its 10 research priorities. If the research outlined by the EPA is carried out and the lessons learned are implemented in an orderly and timely fashion, control measures for particulate matter will have a more solid scientific basis.

A substantial part of the 22–23 June briefing was devoted to regulatory matters. Costly new equipment is being procured by EPA that is designed to sample the outdoor air at about 1000 locations around the country. Airborne particulate matter having a dimension less than 2.5 micrometers (PM 2.5) will be captured and later weighed. Weighing will yield a minimum of needed information without monitoring of composition or size. Even particles having dimensions of about 0.02 micrometer weigh very little, but they are numerous and have a relatively large, potentially reactive, surface.

Creation of a national ambient air quality standard for particulate matter is a problem that differs from that of most of the major pollutants. For individual chemicals such as carbon monoxide or lead, a single nationwide standard can be defended as logical. In contrast, the composition of airborne particulate matter varies from place to place and includes thousands of entities that differ in size, surfaces, and toxicity. The composition of PM 2.5 also changes with the seasons.

The PM 2.5 in midsummer in the farm belt differs drastically from that in the canyons of a major city. In the South, organic chemicals emitted by vegetation in rural areas during hot weather exceed those by industry and automobiles. Natural emissions of unsaturated hydrocarbons, including isoprene, are highly reactive. They participate in processes leading to ozone and toxic particulate matter. In northern states during the autumn and winter, the burning of wood in stoves and fireplaces creates large numbers of particles and polluting chemicals, including dioxin.

When detailed analytical measurements are made in various areas of this country, enormous complexity will be documented. A question will arise. Does it make sense to have a single national ambient air particulate standard? Congress may find it desirable to ask NAS to address the matter.