

AMERICAN ASSOCIATION FOR
THE ADVANCEMENT OF SCIENCE

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Editorial Board

ROBERT L. BOWMAN	WILLARD F. LIBBY
MELVIN CALVIN	GORDON J. F. MACDONALD
JOSEPH W. CHAMBERLAIN	EVERETT I. MENDELSON
FARRINGTON DANIELS	NEAL E. MILLER
JOHN T. EDSALL	JOHN R. PIERCE
DAVID R. GODDARD	COLIN S. PITTENDRIGH
EMIL HAURY	KENNETH S. PITZER
ALEXANDER HOLLAENDER	ALEXANDER RICH
ROBERT JASTROW	DEWITT STETTIN, JR.
EDWIN M. LERNER, II	EDWARD L. TATUM
	CLARENCE M. ZENER

Editorial Staff

Editor

PHILIP H. ABELSON

Publisher

DAEL WOLFE

Business Manager

HANS NUSSBAUM

Managing Editor: ROBERT V. ORMES

Assistant Editors: ELLEN E. MURPHY, JOHN E. RINGLE

Assistant to the Editor: NANCY TEIMOURIAN

News and Comment: DANIEL S. GREENBERG, JOHN WALSH, ELINOR LANGER, MARION ZEIGER, ROSEMARY GALLI

Europe: VICTOR K. McELHENY, Flat 3, 18 Kensington Court Place, London, W.8, England (Western 5360)

Book Reviews: SARAH S. DEES

Editorial Assistants: ISABELLA BOULDIN, ELEANORE BUTZ, BEN CARLIN, SYLVIA EBERHART, GRAYCE FINGER, NANCY HAMILTON, OLIVER HEATWOLE, ANNE HOLDSWORTH, MARCIA JODLBAUER, RUTH KINGERLEE, KATHERINE LIVINGSTON

Advertising Staff

Director

EARL J. SCHERAGO

Production Manager

RAYMONDE SALAMA

Sales: New York, N.Y., 11 W. 42 St. (212-PE-6-1858): RICHARD L. CHARLES, ROBERT S. BUGBEE

Scotch Plains, N.J., 12 Unami Lane (201-889-4873): C. RICHARD CALLIS

Chicago, Ill., 6 W. Ontario St. (312-DE-7-4973): HERBERT BURKLAND

Los Angeles 45, Calif., 8255 Beverly Blvd. (213-653-9817): WINN NANCE

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. ADVERTISING CORRESPONDENCE: Rm. 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE 6-1858.

Air Pollution

Air pollution is becoming a serious national problem. Formerly it was a local issue largely connected with industry, but today a principal source of increasing pollution is the ubiquitous automobile.

When motor vehicles burn fuel they produce a number of products in addition to carbon dioxide and water. Important amounts of carbon monoxide and nitrogen oxides are formed. The fuel is not entirely consumed. Part is exhausted unchanged, part appears as hydrocarbons of smaller molecular weight, including reactive olefins.

At a concentration of slightly more than 1000 parts per million carbon monoxide kills quickly. Most people experience dizziness, headache, and other symptoms at approximately 100 ppm. Concentrations as high as 72 ppm have been observed in Los Angeles, and values above 100 ppm have been measured in Detroit. In almost every metropolitan area peak concentrations of carbon monoxide approach the 100-ppm level.

In California efforts have been made to decrease the amounts of carbon monoxide emitted by motor vehicles by use of devices such as catalytic after-burners. At the same time there has been a trend toward higher combustion-chamber temperatures. These efforts result in more complete combustion but also contribute to an increase in the production of oxides of nitrogen. Nitrogen dioxide is a poisonous brown gas. The threshold level for toxic effects is not well known, but it appears to be about 5 ppm. On one occasion a concentration of nitrogen oxides of nearly 4 ppm was observed in Los Angeles.

Automobile exhaust products interact to produce physiological and chemical effects which are greater than the sum of the parts. Synergistic effects of carbon monoxide and nitrogen oxides on respiration have been noted. Light hydrocarbons alone are not very toxic, but in the presence of nitrogen dioxide and sunlight hydrocarbons give rise to noxious substances. Nitrogen dioxide acts as a photoreceptor and is decomposed to nitrogen oxide plus atomic oxygen. This reactive form of oxygen attacks hydrocarbons. The products may react with molecular oxygen to form peroxy radicals. These in turn react with oxygen to form ozone. The oxidants react further with the original materials as well as with their reaction products. The result is a complex mixture of toxic substances.

As yet there is little evidence of chronic effects from air pollution. However, a large fraction of our population is now being exposed to significant concentrations of a variety of toxic chemicals. These levels are often a substantial fraction of those which produce acute effects. There is a possibility that our people may be sustaining cumulative insidious damage. If genetic injury were involved, the results could be especially serious.

At present we cannot accurately evaluate the hazards of air pollution. The toxicity of even some of the simple important chemicals is not well established. It is clear that there are acute synergistic effects, but these have not been thoroughly examined. Even so basic a problem as establishment of good methods for measuring the concentrations of pollutants has not been completely dealt with.

The automobile and the automotive industry are central to our way of life and to our economy. Can we live with a constantly increasing level of pollution, or will we be forced to take drastic steps to protect the nation's health? At present the federal government is spending about \$24 million a year on the study of all aspects of air pollution. Considering the potential seriousness of the problem, this sum seems much too small.—PHILIP H. ABELSON