



AIR POLLUTION • HOW SUSCEPTIBLE ARE YOU?

Maybe a lot more or less than your neighbor, research is beginning to show

BY JOAN AREHART-TREICHEL

Protecting Americans against air pollutants is no small challenge, as the ongoing controversy over how to alter the Clean Air Act suggests (SN: 3/7/81, p. 151). Not only do the health risks of pollutants have to be assessed, but air pollution emission standards must be set on the basis of the health risks, and those standards enforced. And knotty questions, such as whether standards should be rigid or somewhat flexible or whether new plants in polluted areas should keep their pollution emissions especially low, have to be addressed.

Yet the job of safeguarding Americans against air pollutants will probably grow even tougher in the months to come. The reason? Americans vary considerably in their susceptibility to air pollutants, a small but growing field of environmental research suggests.

It has been known for several years, for instance, that asthmatics as a subpopulation of Americans are more likely to die in air pollution epidemics than are Ameri-

cans in general (SN: 11/3/73, p. 280). But only now is asthmatics' special sensitivity to sulfur dioxide, a major air pollutant, being explored and documented. Homer A. Boushey Jr., Jay A. Nadel and Dean Sheppard of the University of California School of Medicine in San Francisco exposed six adults with mild asthma and seven healthy adults to five parts per million of SO₂. As they reported in the *AMERICAN REVIEW OF RESPIRATORY DISEASES* (Vol. 122: 873-878), two-thirds of the asthmatics complained of chest tightness and wheezing, yet no healthy subjects made similar complaints.

Boushey and his co-workers then wondered whether asthmatics might be even more vulnerable to SO₂ during exercise. So they had seven asthmatic subjects inhale 0.50 parts per million of SO₂ while mildly exercising for 10 minutes, then inhale only filtered humidified air while mildly exercising for 10 minutes and measured the subjects' breathing abilities both times. None of the asthmatics showed any breathing

problems while breathing the filtered humidified air while exercising, but all developed lung constriction, and three experienced wheezing and shortness of breath while breathing the SO₂ during exercise.

"The results were expected," Nadel told *SCIENCE NEWS*, "because asthmatics have very irritable airways and react to things that healthy people do not, or because they react to the same irritants that healthy people do but in lower concentrations. The only thing that astounds me is that such studies as ours weren't done a long time ago."

Nonetheless, similar investigations with comparable results have also been conducted recently by two other scientists: Jane Koenig of the University of Washington in Seattle and William Pierson, a pediatric allergist in private practice in Seattle. Koenig and Pierson exposed nine asthmatic patients ages 12 to 18 years, as well as eight healthy adult subjects, to SO₂ levels of one part per million and meas-

ured the breathing abilities of each group. As they reported in ENVIRONMENTAL RESEARCH (Vol. 22: 145-153), the asthmatics had more difficulty when breathing SO₂ than did the healthy subjects. Koenig and Pierson then had eight adolescent asthmatics breathe one part per million of SO₂ while engaging in light exercise. As they reported in the August 1981 ENVIRONMENTAL RESEARCH, the asthmatics showed even more breathing problems under these conditions than they had while breathing one part per million of SO₂ and while not exercising. Finally, Koenig and Pierson repeated this test, but reduced SO₂ levels from one part per million to 0.50 parts per million. Even at this lower SO₂ level, all eight asthmatics showed breathing problems.

"We really weren't too surprised with these results," Koenig says, "because epidemiological studies had shown asthmatics to be especially sensitive to air pollutants. But nobody had ever documented asthmatics' vulnerability to air pollutants in such a precise way."

Americans with certain genetic quirks also appear to be especially susceptible to air pollutants. As Gareth Green of Johns Hopkins University School of Hygiene and Public Health in Baltimore explains, a number of labs have found that certain individuals have a defect in the cilia (tiny hairs) that impairs their ability to beat and

push fluids and foreign materials out of the lungs. The result: a greater sensitivity to air pollutants. Americans whose diets are deficient in protein, vitamin A or vitamin E may be especially vulnerable to air pollutants as well, Green and other scientists are finding. And still other Americans appear to be particularly susceptible to the harmful effects of air pollutants because of their lifestyles and environments.

For instance, Joseph Brain of the Harvard School of Public Health in Boston and his colleagues exposed mice to various levels of ozone to see how much was necessary to damage their lungs, then repeated the experiment while the mice were exercising. The researchers found that if the animals were exercising, they needed only about a third as much ozone to hurt their lungs as if they weren't exercising, implying that people who exercise in the presence of ozone (and perhaps in the presence of other pollutants as well) may be more adversely affected by pollutants than are more sedentary individuals. Brain, along with David Cohen of the Massachusetts Institute of Technology, also examined how fast iron oxide (a dust present in air everywhere but especially in steel cities such as Gary, Ind.) was cleared from the lungs of cigarette smokers and nonsmokers. More of the dust was in the lungs of the smokers than in the lungs of the nonsmokers at a year after acute expo-

sure. This finding suggests that smokers are more susceptible to the harmful effects of iron oxide (and perhaps some other air pollutants) than are nonsmokers.

Even more Americans who are particularly susceptible to air pollutants will probably be identified during the next several years as this area of research intensifies. Boushey and his colleagues will extend their SO₂ susceptibility studies from asthmatics to other groups—such as children, the elderly, bronchitics and heart disease patients—whom epidemiological studies have suggested are particularly sensitive to air pollutants.

What's more, new techniques will be deployed to identify especially vulnerable persons. For instance, when a subject is now tested to see how the lungs react to an air pollutant, a mouthpiece or noseclip is put on to measure breathing three or four times over a three- or four-hour period. Marvin Sackner and colleagues at Mount Sinai Hospital in Miami Beach have developed a noninvasive technique (two transducers wrapped around the rib cage and abdomen) to measure a subject's reaction to breathing an air pollutant in a continuous way, as would normally occur. For a 15-minute period, with an average subject breathing at the rate of 20 times per minute, 3,900 bits of information are obtained. This information is then analyzed by a computer in order to provide a genuine picture of how the air pollutant is affecting the subject's lung. Or as Sackner puts it, "We can now get statistically valid information of what is happening in an individual subject rather than relying on group means which can mask individual responses." Toward the end of the year Sackner and his colleagues hope to start using their method to study individual susceptibility to SO₂ and to have preliminary results from their study by the summer of 1982. Boushey, Nadel and Sheppard also look forward to using the technique of Sackner and his team for their own forthcoming studies of SO₂ susceptibility.

Meanwhile, insights into individual susceptibility to air pollutants are starting to provide practical benefits. Boushey presented his group's findings at a recent hearing by the Senate Environmental and Public Works Committee, which plans to introduce a bill soon to alter the Clean Air Act, and also presented this testimony before the Committee: "On the whole, I believe that present air quality standards protect the American public against adverse health effects. . . . However, the evidence in the 20 to 25 asthmatic subjects that we have studied suggests that people with asthma may develop bronchospasm on brief exposure to levels of SO₂ that may be exceeded with the current standards. If additional research on asthmatic subjects with differing degrees of severity of disease shows that this is true for a large number of people, a short-term standard for SO₂ may need to be added to the current 24-hour and annual standards." □

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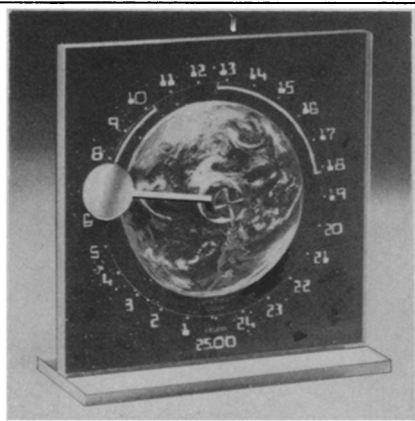
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