Acid Rain, A Year Later

Close scrutiny by several technical groups had not made the problem go away, just made the case for regulation stronger

The Administration's policy of nonregulation of acid rain seems to have collapsed. It was propped up for more than a year on the rationale that the problem was too vaguely understood to be remedied. Now some scientific reports have kicked the prop away, and William Ruckelshaus, director of the Environmental Protection Agency (EPA), is aiming to develop a new strategy by 1 August.

Several independent groups in recent weeks have described the problem with considerable clarity and reached the same general conclusions, as follows. In the northeastern United States, acid rain (used here to mean dry and wet deposition) derives chiefly from man-made pollutants. The acid is doing significant damage to the environment, among other things, killing off species of freshwater fish. Controls on sulfur pollution before it enters the atmosphere would reduce this damage.

The most thorough of the reports, also the most recent, was issued on 29 June by the National Research Council, the report-writing arm of the National Academy of Sciences (see p. 254). The review was funded entirely by the Academy after an expected government grant failed to come through. The chairman of the report committee, Jack Calvert, director of the National Center for Atmospheric Research in Boulder, Colorado, said that "a more competent and widely representative committee would be very difficult to assemble." It was his way of saying that this will be the definitive study on acid rain for many years.

The group concluded unanimously that 90 to 95 percent of the Northeast's acid rain comes from man-made sources, such as industrial smoke and car exhausts. The scientists found that sulfur compounds are a more significant part of the problem than nitrogen compounds. They concluded that the acid in acid rain varies in direct proportion to the amount of sulfur in air pollution. The importance of their finding is that it makes regulatory action look more attractive. The government can be confident that a given effort to control pollution will bring about a like amount of improvement in the environment.

The Calvert panel also concluded that the area in which acid formation and deposition takes place is large, perhaps 1000 kilometers across. Most of the rain, like most weather formations in the Northeast, arrives coming from the south or southwest. Beyond this, however, the panel could say little about the sources of pollution. Because there is no good way as yet to identify the exact origin of the chemicals landing in a particular spot, there is no way of determining which of many polluters in the 1000-kilometer mixing area are most responsible for the damage. The process can be described only on a regional scale. Thus, in broad terms, the report says that the more sulfur one releases into this northeastward-moving pollution, the more one contributes to acid rain. The panel made no policy recommendations.

Scripps Institute of Oceanography

William Nierenberg

Urged the White House to act now

Earlier in the week, on 27 June, a review panel created by White House science adviser George Keyworth released some strong opinions of its own on acid rain. The chairman, William A. Nierenberg, director of the Scripps Institution of Oceanography, and one panel member, Kenneth Rahn of the University of Rhode Island, briefed reporters on some advice they are volunteering to Keyworth. As Nierenberg explained it, the group had been called together to review the quality of acid rain papers going into a joint U.S.-Canadian treaty document. Somewhere along the line, "We began to wonder whether it wouldn't be helpful to the Administration for us to make some general recommendations," Nierenberg said. Keyworth agreed, and as a result, the report (due this fall) will include not just a critique of the treaty documents but also comments on policy and specific recommendations for future research. It may favor more money for economic impact research and less for computer modeling.

The general comments on policy were released on 27 June, obviously because the subject was ripe for comment. Nierenberg explained when asked about this that the section was being released early because the whole report was long overdue, and panel members wanted to have their say.

The panel concluded that although the science is weak on some points, the indications of potential trouble are so numerous that "steps should be taken now which will result in meaningful reductions in the emissions of sulfur compounds into the atmosphere, beginning with those steps which are most cost effective in reducing total deposition." As an example, the group suggested using "fuel of different sulfur content during different seasons, since the efficiency for wet sulfuric acid depositions seems to be much less in winter in North America." The panel also suggested more intensified coal washing and proposed that emissions from nonferrous smelters be reduced.

The scientists recommended strong measures, Nierenberg said, because some of the effects of acid rain may be severe, possibly irreversible. Apparently, many committee members were concerned about the effects of acid on the microorganisms in soil that degrade natural wastes, essential for recycling nitrogen and carbon in the food chain. This is such a "worrisome thing," according to Nierenberg, that "you're not going to sit around and wait for 20 years" to get conclusive proof of the danger.

The Nierenberg panel's statement was preceded by a report several weeks earlier from the federal Interagency Task

Force on Acid Precipitation. Although far more cautious, it also concluded that man-made pollution was the chief source of trouble (*Science*, 24 June, p. 1359).

None of these reports spells out a strategy for controlling the problem. However, attention is focused on the electric utilities more than other polluters. There are several reasons. As burners of sulfur-laden coal, they contribute significantly to acid rain, dumping over 16 million tons of SO_2 into the atmosphere east of the Mississippi each year, over 70 percent of the total SO_2 in the East.* From a managerial and economic point of view, it is simpler to regulate what comes out of several scores of smokestacks than to control millions of automobiles. Politically, as well, it would be easier to impose controls on the utilities than on the family car.

Reaction to the new reports was fairly predictable. The National Clean Air Coalition was particularly pleased, taking the Calvert report as vindication of its campaign to reduce sulfur emissions by 50 percent. The president of the National Coal Association, Carl Bagge, read the report in just the opposite way, finding that it confirmed that "the sources of acid rain cannot be pinpointed," leading to his conclusion that "it is premature to impose additional emission controls." The Edison Electric Institute stressed the cost of controls, reporting that a survey of 24 eastern utilities found that the per-household cost of electricity will rise by several hundred dollars in the first year if proposed legislation is put into effect. These cost figures are challenged by the environmental groups and by the sponsors of acid rain bills. They are going to be closely analyzed and debated this year as Congress begins to consider in earnest the prospect of a major new environmental program.

Although several proposals were offered last year, none passed either house of Congress. The bill with the most seniority is the one introduced by Senator George Mitchell (D–Me.). It has been modified and adopted by the Senate Environment and Public Works Committee again this year. It aims to prevent the creation of new sources of pollution and to reduce SO_2 emissions by 8 million tons below the 1980 level (estimated to be 22.5 million tons). This would be done through a complex agreement formed among the 31 states east of the Mississippi, either voluntarily within 18 months or by federal fiat afterwards. The cleanup is due to be finished by 1995.

Another major proposal was introduced in the House on 27 June by Representatives Gerry Sikorski (D–Minn.), Judd Gregg (R–N.H.), and Henry Waxman (D–Calif.), chairman of the subcommittee on health and the environment. Their approach is broader and more direct. Copying the model of the nuclear waste cleanup program, they would impose a 1-mil-per-kilowatt-hour fee on nonnuclear electricity, creating an acid rain trust fund. They would use the money to carry out a mandatory scrubber installment program on the 50 largest SO_2-emitting utilities in the 48 contiguous states. The states would also be required to develop a program of their own to reduce emissions by 3 million tons, all of which is to be done by 1993.

Neither of these approaches has fans in the utility industry. And environmental groups, although supportive, argue that the programs would move too slowly. Given the attention the subject is getting, however, Congress could adopt one of these proposals this year.

—ELIOT MARSHALL

*Figures from the Office of Technology Assessment.

The Apology of Yellow Rain

William Sarver, chief of the methodology research team investigating yellow rain samples for the Army's chemical R & D center in Edgewood, Maryland, said, in an interview with *Science*, that "the evidence strongly supports" the conclusion that bees are somehow involved in the story. Yellow rain samples collected from Southeast Asia have been found to contain significant quantities of pollen. Sarver was reluctant to put forward an explanation for this, but said, "one possibility that cannot be ruled out" is that bees' pollen is being used as a carrier for toxins. Pollen grains are the correct size for maximum retention in the body.

According to this theory, toxin-coated grains are used because they are caught in the nose and throat (not the lungs) and filtered into the digestive system. This theory is strengthened, Sarver believes, by the fact that pollen has reportedly been used as a carrier in weapons before now.

Sarver agreed to an interview in order to clarify that data on some of the government's yellow rain samples. The conditions were that questions be screened in advance and that a security officer sit in on the discussion.

Sarver did not rule out the hypothesis advanced by Harvard professor Matthew Meselson, that some or all of the yellow rain samples might actually be bee feces (*Science*, 24 June, p. 1356). He thinks this is unlikely, but says "we are open to all kinds of advice." However, Sarver did rule out a third explanation for the pollen, the theory that it is used as a medium for growing toxin-producing molds in the laboratory. He does not think this is possible because none of the pollen samples he examined is heavily contaminated with spores of the mold. It would be inconsistent for yellow rain to be a crude mixture containing the mold's growing medium but not the mold itself. Sarver also argues that the absence of spores makes it less likely that the toxins were produced by molds in the natural environment.

Going over the statistics, Sarver reported the following data. (His lab is the most important of several looking at samples of yellow rain.) He said that "over 60" discrete samples have been analyzed for trichothecenes, the fungal toxin suspected of doing the damage. Of these, "about 40" were bits of foliage, 11 were yellow powders, and 11 were water samples. "This area is not an exact science yet," he cautions: "if you don't use exact numbers, you won't get it wrong." The tests showed positive for trichothecenes on two of the foliage samples, two of the powders, and one water sample. In addition, two Soviet gas masks from Afghanistan were tested, and one of them showed positive for a trichothecene. The lab also looked at 16 control samples similar to those containing toxins, none of which showed positive.

Sarver has not yet been able to test all the samples for pollen, and this is especially difficult with foliage. However, five of the powders have been checked and all five contained pollen. (One contained both pollen and trichothecenes.) Up to 20 different families of pollen were identified in the five samples, lending support to the contention that the pollen was collected by bees. Sarver says there is no efficient technique that he knows of for determining whether or not the pollen grains have been emptied in the process of being digested by bees.—ELIOT MARSHALL