

out publicly and say this guy's wrong," complains Bibb, the AEC's Sternglass-watcher. "People don't want to get involved." A few prominent scientists, in fact, have privately encouraged Sternglass to plunge ahead with his work. One Nobel laureate, who was prominent in the development of the atomic bomb, told Sternglass in a letter last February that he found the evidence "very impressive," particularly the map showing excess mortality "downwind" of the Trinity site. The letter raised several questions about Sternglass' theory but said: "In view of the enormous statistical significance of the results you plot on your map of the United States, it is difficult to question your findings." Sternglass, not surprisingly, interprets this as an endorsement of his findings. But that same Nobel laureate told *Science* he thinks it is "highly probable" that Sternglass is wrong. He said he was simply encouraging Sternglass to publish his theory because "I'm very much against people speaking the party line—I encourage people who view things a little differently from anyone else."

The Sternglass case has raised the

perplexing question of whether it is "good" or "bad" to have a scientist yelling "fire" when there may not be any fire at all. On the negative side, some critics contend that Sternglass, by alarming the public without reason, has made it more difficult to reach rational decisions on such important issues as the ABM and nuclear power. Others contend that, if Sternglass is ultimately shown to be a fool, the public's confidence in the scientific method will be diminished. And if Sternglass has actually made selective use of the data to support a preconceived theory—as some critics allege—that, of course, cannot be defended.

On balance, however, the country probably has more to gain than lose by letting Sternglass have his day in court. If Sternglass is right, he has performed an incalculable public service. But even if he is wrong—and the weight of informed opinion seems to think he is—he has nevertheless served a useful function by forcing others to look into the question. Nobelist Joshua Lederberg, in a newspaper column attacking Sternglass' analytical methods, acknowledged that Sternglass' "expose" had

called attention to "a surprising lack of experimental work directed specifically at the genetic effects of Sr-90." And, much to the AEC's consternation, Tamplin, in preparing a detailed point-by-point rebuttal of Sternglass, has come up with an estimate of his own, namely that, in 1963, fallout could have accounted for more than 8000 fetal deaths. That's a pretty sizeable number, and while Tamplin's estimate is disputed on a number of grounds, it nevertheless raises the interesting possibility that Sternglass may be wrong in all his details but still be right in his general fear that low doses of radiation are more pernicious than previously believed.

Satterthwaite, past chairman of the FAS, believes Sternglass has raised enough questions to justify a "careful study" of the whole matter by the government. Such a study might well show that Sternglass is totally wrong. But in a world where government bureaucracies have a tendency to become complacent, it doesn't hurt to have deeply concerned citizens raise the question of safety—again, and again, and again.

—PHILIP M. BOFFEY

## Pollution Control: Sweden Sets Up an Ambitious New Program

*Stockholm.* Larger than California, but with a population of only 8 million, Sweden is far from being plagued by the pollution problems that afflict most industrialized nations. But the Swedes have not remained altogether unscathed, nor are they unmindful of the environmental ruin now found in places that once could follow the maxim that "the answer to pollution is dilution." As a consequence, Sweden has undertaken an ambitious and relatively expensive effort to clean up whatever mess now exists and to prevent further ones from developing. Not surprisingly, Sweden was the first nation to impose a total ban on the use of DDT, aldrin, dieldrin, and other chlorinated hydrocarbons, effective the beginning of next year. As one official explained, "It wasn't very difficult to do. Very little

if any of these are manufactured here, and besides, we made the farmers realize that they are the first to suffer from exposure."

In many respects, the Swedish approach to the problem is similar to the approach in other countries: research, the establishment of standards, and the provision of matching government grants to help industry and local communities buy antipollution equipment. But the Swedish effort also contains several special elements that are intriguing when viewed against the so-far doleful U.S. experience in dealing with pollution. First of all, though fairly strict legislation is on the books—as is the case in the United States—the Swedish government, recognizing the link between law enforcement and public opinion, has undertaken a sizable

adult education program aimed at creating in each community a corps of well-informed citizens who can organize public hearings and confront industrial and civic officials on what they are doing about pollution. Over the past year, under the auspices of the Ministry of Education, some 250,000 persons received at least a few evenings' instruction on the technical and legal aspects of pollution. From this number, about 10,000 accepted the offer of an additional 2 weeks' instruction, and, from this second group, about 1000 throughout the country were picked to conduct public inquiries and, in general, agitate in behalf of pollution control. The program is just getting out of the classroom stage, and its effectiveness remains to be demonstrated. But one of the country's most diligent antipollution crusaders, a young physician and researcher, Hans Palmstierna, who is secretary of the government's central coordinating board in the pollution field, is quite optimistic. "With the new laws that we have, and the public getting more and more aroused," he said, "we have every reason to make progress." And he added, "It's down to the level now where peo-

ple who never thought about this problem before are feeling angry about their fishing and other recreation places being ruined. And now they know they don't have to feel helpless about it. There's something that can be done."

Within the government, the operating agency for dealing with pollution is the National Nature Conservancy Office, which is possibly unique among such national organizations in that it exists as a branch of the Ministry of Agriculture. This placement was largely accidental, having grown out of the Ministry's concern over fish poisonings from mercury compounds used as fungicides in Sweden's huge pulp and paper industry. In 1965, after it became clear that the mercury did not decompose but simply continued to accumulate, restrictions were imposed, and the beginning of this year brought an end to the use of mercury compounds. But in the meantime the Ministry of Agriculture had become increasingly involved with the pollution issue, and finally, in 1967, its interest culminated in the creation of the Conservancy Office, which has a current staff of about 175 and annual funds, controlled directly or shared with other organizations, of about \$50 million.

#### Benefits of Structure

Though the Conservancy's position as a branch of the Ministry of Agriculture was the result more of chance than of design, it is said to offer several important benefits. As an official explained it, agriculture is in a relative state of decline in the Swedish economy and now employs only about 10 percent of the labor force. Interest in pollution control, on the other hand, is on the way up, and so are expenditures. "In this situation," he said, "the Ministry is delighted to have a new and expanding responsibility." Serving as the national policy-making body for antipollution activity is the Consulting Board for Environmental Problems, whose 24 members include ten scientists, plus representatives of labor, industry, finance, and the press. Communities and regions have authority to deal with their pollution problems. But the guiding force is the Conservancy Office, with its branches for nature conservation, water and air, and research. And the guiding principles are to be found in fairly stringent legislation that went into effect last July. Titled The Environment Protection Act, the new law contains provisions for the use of money to work against existing sources

of pollution, and for the use of authority to prevent new pollution. Thus, under the Act, an experimental fund of about \$50 million, to be spent over a 5-year period, has been created to pay 25 percent of the cost for providing antipollution equipment for established industries. (Some Swedish conservationists complain that this undercuts the principle of the polluter paying for abatement, but otherwise they seem to be quite pleased with the Act.) For industrial plants yet to be built, the Act requires that permission first be obtained from a specially created body, the Concessions Board for the Protection of the Environment, a four-member group with authority to set limits on how much pollutant may be put out into the environment. The Board consists of a chairman trained in the law, a technical specialist in the area of pollution, and two persons without any particular affiliation. Because of its newness, the Board is yet to reveal any pattern of operations, but since one of the members will be drawn from the Nature Conservancy Office, a stronghold of antipollution fervor, it is unlikely that the Board will become a tool of evasion, as has been the case with similar organizations in the United States.

Though the Baltic Sea is severely polluted from sources within Sweden as well as from other countries, and since the mercury problem had reached serious proportions before the total ban went into effect, the striking thing about the Swedish antipollution effort is that, by and large, it reflects foresight rather than emergency response to an intolerable situation. Thus, in a paper that the Nature Conservancy prepared for presentation at the European Conference on Nature Conservation, to be held in Strasbourg next February, it is noted that, in major Swedish cities, "The content of sulphur dioxide is less than in the most polluted regions in the USA, England, and Germany by a factor of two, and the values for soot are five to ten times less than corresponding English values." Nevertheless, under the new law, the Swedes have limited the sulfur content of fuel oil to 2.5 percent by weight, and municipalities are free to set even lower limits. Next year, progressively more severe limitations will go into effect on pollution from automotive vehicles, starting with a limit of 0.7 gram per liter for lead content in motor fuel. Though few, if any, of Sweden's inland waterways have reached the stage of being too thick to navigate and too thin to cultivate, it is planned to have

sewage purification plants serving all built-up areas within a few years. Communities will be eligible for grants of 30 to 50 percent to meet the cost, and backing up this assistance is the new law, which states that municipal waste may not be discharged without a permit.

#### Industrial Concentration a Boon

Industrial trends are also expected to provide an important boost for Sweden's antipollution program. Though pulp- and paper-making are on the increase, production in these fields is being concentrated in fewer, larger plants; this makes it a simpler matter to treat and to police the handling of effluents. There is also a trend toward centralized community heating plants. This arises mainly from economic considerations, but it also makes it easier to cut down on pollutants. With hydroelectric sources fairly well exploited by now, Sweden is planning a major move into atomic energy, with the expectation that possibly as many as 15 large power plants may be built in the south and central parts of the country before the end of the century. But, if the Nature Conservancy has its way, these plants will be sited in conformity with a comprehensive master plan designed to minimize their ecological effects. And, thereby, a high value will be placed on what is referred to as "the social aspect" of conservation. As the Nature Conservancy states in its presentation to the forthcoming Strasbourg conference, the pleasure that people derive from the countryside merits just as much attention as anything else in planning a clean environment.

Though the Swedes probably excel in foresight, will, and resources for dealing with pollution, there are aspects of the problem that go beyond their reach. It is estimated that from 15 to 50 percent of the sulfur dioxide in their atmosphere originates in other countries; some of it, it is believed, comes from Britain, which has been looking after its own problems by introducing taller smokestacks so as to get the stuff carried off by winds. The Baltic Sea is in sad shape, but none of its major polluters show as much fervor as the Swedes for getting things cleaned up. To the extent that matters are within their own control, the Swedes apparently possess an unmatched determination to avoid the damage that other nations have inflicted upon themselves. The effort is just beginning, but it could be an inspiring one.—D. S. GREENBERG