and pine. Table 1, prepared by Zimmerman, shows comparative susceptibility of various species.

TABLE 1

Comparative Susceptibility of Various Species to Hydrofluoric Acid Gas[a]

Time of exposure	Concentration (av. p.p.m.)	Buckwheat	Sweet potato	Peach	Tomato	Corn	Bean	Pine
2 hr. 10 min.	1.48	4	—	4	4	4	4	4
2 hr. 10 min.	0.67	3	3	3	1	3	1	2
4 hr.	0.27	3	2	2	0	—	0	2
7 hr. 30 min.	0.135	3	3	3	0	3	0	2
4 hr.	0.13	1	1	1	0	1	0	2
6 hr. 40 min.	0.085	1	1	1	0	0	0	2
4 hr.	0.07	0	0	0	0	0	0	2

[a] Extent of injury is indicated as follows: 0, no injury; 1, slight; 2, medium; 3, considerable; 4, severe injury.

Ammonia, hydrogen sulfide, mercury vapor, ethylene, and carbon monoxide gases are also toxic to plants in relatively high concentrations. However, the number of reputed cases of injury involving these gases is not sufficient to warrant detailed discussion here.

From the foregoing, it is apparent that air pollutants in small concentrations can and do affect vegetation, that certain plants are more susceptible than others, and that each pollutant often produces a characteristic damage, which is identifiable.

These factors very often make plants ideal "instruments" for measuring air pollutants. The aluminum industry has for years planted gladioli and other plants and trees in circles as far as 10 miles from the plant, in order to assess fluoride damage. The use of indicator plants for evaluating the air pollution prior to the construction or enlargement of a plant, where the effluent is known to be injurious to plants, is sound practice. It is especially so, if the proposed plant is in an industrial area where the effluent from other plants may already be sufficient to cause damage under unfavorable meteorological conditions. Indicator plants can be used for routine evaluation of certain air pollutants.

D. EFFECTS ON STRUCTURES

Another familiar effect of atmospheric pollution is discoloration of buildings, including stone, brick, and painted surfaces. Blackened surfaces and encrustations of sooty material frequently obliterate essential lines and decorations. They disfigure a building and seriously reduce its aesthetic and decorative value. More serious, however, is the corrosive action of acid gases on buildings. One of the effects of this reaction is the formation on stone surfaces of hard, impermeable skin that tends to blister and exfoliate. It has been reported that sheets of galvanized iron had a life span of 3 to 6 years in Pittsburgh, prior to its active air pollution control program, as compared with 7 to 14 years in a smoke-free community, and that, at the same time, copper would last only 10 to 20 years in Pittsburgh, whereas it would be good indefinitely where there is relatively little atmospheric pollution. The effect of certain acid gases on paint is well known, as exemplified by the blackening of white lead-base paint by hydrogen sulfide.

III. Economics of Air Pollution

It is not possible to state a figure that would accurately proclaim the cost of air pollution to urban dweller, farmer, retailer, and industry. No one can deny, however, that air pollution has a serious effect on the economics of an industrial community, although the extent varies by community, and even by individual company and person. Some industries, because of their air pollution, have been ordered by the courts to close their plants or install expensive control procedures. In these cases the economic hardship due to air pollution is almost overwhelming. A number of people suffer physically because of an allergy to some contaminant in the air and must leave the community in order to obtain relief.

Several organizations have given "guesstimates" of the cost of damage due to air pollution in the United States. The Commerce Department estimated the cost ranged from 8 to 20 dollars per inhabitant annually. The United States Geological Survey reported that smoke damage to merchandise and buildings was 500 million dollars per year. In 1953 an economic loss of 3 million dollars on only eleven crops was attributable to smog in Los Angeles. Gibson[11] estimates the direct economic loss to the United States to be at least $1^1/_2$ billion dollars annually.

The part air pollution plays in causing the decay of certain areas of our communities, where businesses move to outlying areas of the city, is impossible to determine, it is safe to assume, however, that it is an important consideration and causes tremendous loss of tax revenue to the local government. One of the principal causes of this large economic loss is sulfur dioxide. It has been estimated[12] that the amount of sulfur compounds emitted to the atmosphere from various sources is greater than the present world production of native sulfur and pyrites combined. This raises the question as to the extent air pollutants can be recovered and used to assist in amortizing the cost of installation of control equipment, or to provide a product that is a definite asset to the company. Some instances of recovery that might be cited are:

1. A large utility company achieved control of fly ash at a considerable cost, now sells the fly ash at a substantial profit.

[11] W. B. Gibson, *Proc. Natl. Air Pollution Symposium, 1st Symposium, Pasadena, Calif.*, p. 109.

[12] Markus and R. J. Cole, *Ind. Eng. Chem.*, **42**, 2258 (1950).