2. The control of rare metals by a mint paid for itself in one year.

3. The sale of sulfur dioxide recovered by a Canadian smelter yielded more profit than the original product.

Whether or not there is a profit or loss in the control of air pollutants is incidental to the fact that the day is fast approaching when management must consider the control of sources of pollution as an integral part of the cost of construction and maintenance of a plant.

## IV. Sources and Kinds of Air Pollution

Sources of pollution may be divided into two major classifications: (1) "natural" and (2) man-made contaminants. Three outstanding examples of natural air pollution in recent times are: the Katmai volcanic eruption, whose emissions clouded the Northern Hemisphere in 1902 and 1903; the MacKenzie forest fire of 1951, which obscured the sun across a great swath of Canada and the United States, causing street lights to be turned on at 9 A.M. in Philadelphia, Baltimore, and Cleveland; and the devastating dust storms that raged through Texas, Oklahoma, and Kansas in the 1930's, as well as the dust storms of the past few years.

TABLE 2

Estimated Emissions of Aerosols, Acid Gases, and Aldehydes to the Atmosphere, Los Angeles County

(In tons per day)

| Source | Aerosols[a] | Oxides of nitrogen[b] | Sulfur dioxide | Aldehydes[c] | Organic acids[d] |
|---|---|---|---|---|---|
| Chemical, paint, roofing, rubber, soap, food, fertilizer, metal & mineral industries | 61 | / | 27 | / | / |
| Fuel oil burning[e] | 3 | 85 | 170 | / | / |
| Transportation, diesel | 7 | 10 | 2 | 1 | 3 |
| Transportation, gasoline | 25 | 132 | 21 | 10 | 7 |
| Petroleum refining | 5 | — | 80 | — | — |
| Incineration, domestic | 90 | 21 | / | 10 | 5 |
| Incineration, commercial, industrial, municipal and dumps | 34 | 7 | / | 4 | 2 |
| *Total* | 225 | 255 | 300 | 25 | 17 |

[a] Includes smoke, dusts, fumes and mists.
[b] Reported as nitrogen dioxide.
[c] Reported as formaldehyde.
[d] Reported as acetic acid.
[e] Includes fuel oil burned in all categories except transportation. All values based on winter fuel oil usage, which is approximately one half of the winter usage.
/ Less than one ton.



It has been estimated that in Detroit approximately 40 per cent of the particulate pollution would remain in the area if all human activity stopped.[13] The pollution of the air from man-made activities ranges from the cooking odors at home to the effluents from large metal-smelting plants. It is unfortunate that, except in Los Angeles, little is known of the relative amounts from each of these sources. Table 2 gives an estimate of the amounts of emissions from in Los Angeles in 1951.[18]

### A. POLLUTION IN VARIOUS CITIES

*Sulfur dioxide* is probably the most common of the contaminant gases found in the community atmosphere, being formed in the combustion of most fuels, with some coals having a very high percentage of sulfur content.[14] Certain industrial processes emit several tons of sulfur dioxide per day.[15] Henderson and Haggard[16] state that the least detectable odor of sulfur dioxide is from 3 to 5 ppm; however, it may be "tasted" in much lower atmospheric concentrations. Sulfur dioxide is of interest to air hygienists because, in sufficient concentrations, it corrodes building materials, destroys cloth and leather, and affects vegetation and human health. The economic effects of sulfur dioxide have been the subject of much discussion. In London it is reported that the sulfur gases have seriously defaced the stone and other building material, as well as statues and other ornaments used to beautify the city. Also in London, library leather-bound books deteriorate as the result of sulfur dioxide.[17]

As for the effect of sulfur dioxide on human health, there are no acceptable data at the present time that incriminate it as the responsible agent in concentrations sufficient to cause sickness resulting in death.

The effect of sulfur dioxide on plant life is much better known. Setterstrom[18] lists factors influencing the effect of sulfur dioxide on plants are: (1) "Resistance was greater at 40° F. or below; (2) resistance decreased with increases in relative humidity; (3) ample water supply made them more susceptible; and (4) younger plants were more resistant than old ones."

The average sulfur dioxide concentrations found in various cities[10,19–21] range

[10] Air Pollution Control Dist., Co. of Los Angeles, Calif., *Second Tech. and Admin. Rept.*, 1950.
[19] A. R. Burdick and J. P. Barkley, Concentration of sulphur compounds in city air, *U. S. Treasury Dept., Circ.* No. **7066**, April, 1939.
[20] D. P. Barnard, *Industrial Toxicology*. Williams and Wilkins, Baltimore, 1949.
[21] Y. Henderson and H. W. Haggard, *Noxious Gases*. 2nd ed., Reinhold, New York, 1943.
[16] Conditions of library atmosphere, *Atmos. Poll. Bull.*, **16**, No. 1 (1948).
[18] O. Setterstrom, Effects of sulfur dioxide on plants and animals, *Ind. Eng. Chem.*, **32**, 1040 (1940).
[13] H. Richards, The measurement and survey of atmospheric pollution, *J. Roy. Sanit. Inst.*, No. 4 (1951).
[17] *Atmospheric Pollution in Leicester—a Scientific Survey*. H. M. S. O., London, 1945.
[18] O. Setterstrom, Sulphur dioxide content of air at Boyce Thompson Institute, *Contribs. Boyce Thompson Inst.*, **10**, No. 2, 183–187 (1939).