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Control of Sulfur Dioxide Emissions from Coal

During the next 5 years the United States must adapt to coal as its leading domestic energy source. Merely to make up for the decay in the availability of hydrocarbons, use of coal must at least double during the next decade. But prudence would dictate an even greater shift to coal while reserving hydrocarbons for more crucial purposes than for boiler or process heat. The shift to coal will not be without problems. For example, control of the emission of SO_2 accompanying the burning of coal will be difficult and costly.*

There is abundant evidence that SO_2 alone is less toxic than many pollutants. But SO_2 was present on several occasions when lethal air pollution occurred a decade or more ago. Moreover, SO_2 was present during pollution episodes in major cities where a detectable excess of morbidity occurred. Partly because SO_2 is easy to measure and other components of pollution are unknown or difficultly determined, it became the focus of attention. In the United States one of the first regions to take action with respect to pollution was the metropolitan area of New York City. In 1967 regulations were enacted which in effect banned the use of coal and led to enhanced use of natural gas and low sulfur fuel oils. The measures were effective in reducing SO_2 concentrations by 85 percent. But despite this dramatic change there has been no significant decrease in sulfate levels or demonstrable effect on morbidity attending air pollution episodes.

Most of the coal mined and burned in the United States is consumed in the area north of the Ohio and east of the Mississippi rivers. In that region, the average sulfur content of much of the coal is about 3 percent. On burning, about 5 pounds of SO_2 are released per 10^6 Btu. The Environmental Protection Agency (EPA) has adopted a national standard which limits SO_2 emissions by each new stationary source (installation commenced after August 1971) to 1.2 pounds of SO_2 per 10^6 Btu. In addition, some states have adopted even more stringent regulations (0.2 pound of SO_2 per 10^6 Btu). Coal meeting the federal regulations is in short supply and expensive. During the next several years in many cases older plants will be burning high sulfur coal, and compliance with the federal standards and state regulations will be waived on new plants, for the public will not stand for drastic curtailment of its electricity.

To attain long-term compliance with its regulations, EPA has been pushing hard for installation of flue gas desulfurization systems. Some of the installations that were promising at first have not proved reliable. The leader at present involves the use of a slurry of lime. The process gives rise to a soupy sludge containing $CaSO_3$, $CaSO_4$, soluble salts, trace elements, and fly ash. For each ton of coal burned about a third of a ton of sludge is formed. During the next 10 years, if EPA standards were to be met generally for all new stationary sources, the annual production of sludge would rise to about 300 million tons a year. In 20 years such an output would form a body of sludge 10 feet deep covering an area of about 240,000 acres. Much of the coal would be burned in urban areas where waste disposal sites are already scarce. The total cost of scrubbing, including capital costs, lime, and other operating expenses, would amount to $8 to $30 or more per ton of waste, depending on costs of disposal.

There must be and there are better solutions. First, at comparatively low cost the principal sulfur component of coal, pyrite (FeS_2), can be removed. Thus, a large-scale reduction in sulfur emissions (though probably not enough to meet EPA standards) could be achieved comparatively quickly. A good preliminary removal of pyrite would facilitate subsequent cleanup, using technology now under development. Particularly interesting are closed-cycle processes (*Science*, 11 July, page 128) that produce elemental sulfur.

It is clear that the United States will spend tens of billions of dollars fighting air pollution. Isn't it about time a serious effort was made to identify the crucial pollutants, learn how to measure them, and proceed to abate them in ways that take into account costs and benefits?—PHILIP H. ABELSON

*A useful source of information is a report prepared by the Commission on Natural Resources, National Academy of Sciences, National Academy of Engineering, and National Research Council, *Air Quality and Stationary Source Emission Control* (Government Printing Office, Washington, D.C., 1975).