I would like at this point, Mr. Chairman, to focus specifically on the problem of pollution of the atmosphere by the oxides of sulfur. The presence of the oxides of sulfur in the atmosphere and their deleterious effects on health and welfare can be detected in virtually every part of the United States. In the next several years the problem can only worsen unless available means of alleviating it are used to the fullest extent, while at the same time the development and application of control technology are accelerated.

The principal source of sulfurous pollution is in the combustion of sulfur bearing fuels, and in the Clean Air Act the Congress has specifically called on our Department for research on the removal of sulfur from flue gas and on removal of sulfur from fuels.

Considerable worldwide effort has been devoted to the development of low cost techniques for removing sulfur from flue gases, and some progress has been made.

In Germany, the emphasis is on a process that uses activated carbon to adsorb the sulfur oxides from the flue gas. In Japan, one process under development first catalytically converts sulfur dioxide to sulfuric acid and then to ammonium sulfate; another process chemically reacts the sulfur oxides into a regenerable manganese sulfate. In Czechoslovakia, an ammoniacal washing process, which yields ammonium sulfate as the end product, is under consideration. Because of their immediate application to existing power plants, in all these countries and in the United States there is interest in processes which react alkaline materials with sulfur oxides to produce solids which can then be removed through filtration or precipitation. The Department of Health, Education, and Welfare has a contract with Battelle Memorial Institute to study sulfur fixation by lime and magnesia to elucidate the thermodynamics and kinetics of the reactions involved. Past efforts to remove SO_2 from combustion gases by reacting the SO_2 with alkaline materials such as limestone and dolomite have been handicapped by our inability to inject these materials into power boiler systems with assurance of good reaction efficiency.

In the United States two processes have reached the pilot plant stage. The first of these is an alkalized alumina process for scrubbing sulfur dioxide from stack gases and recovering the sulfur in acid or elemental form. The Department of Health, Education, and Welfare has transferred funds to the Bureau of Mines for the development of this process. In 1967, the operation of a larger, continuous alkalized alumina pilot plant will provide more reliable data on the performance and life of the absorbent and will reveal the parameters affecting SO_2 removal over a prolonged, continuous period. Work will begin on the preparation of absorbents which will resist attrition and lead to longer life and cheaper operation. New and more efficient methods of regenerating the absorbent will be investigated.

The second process to reach the pilot plant stage in the United States is a catalytic oxidation process which is being developed by private industry. The key to economic operation of this process lies in the recovery of the acid in a concentration of commercial value and at a high enough temperature to prevent corrosion of process equipment. The feasibility of various high-temperature acid recovery systems must be studied and related equipment-corrosion testing performed.

In both the United States and Japan, processes employing manganese oxide as an absorbent are being considered for removing sulfur oxides from stack gases. The difference in the processes lies in the method of regeneration of the absorbent. In the Japanese process, the absorbent is regenerated chemically to form calcium sulfate. The American process regenerates the absorbent electrolytically and yields a dilute sulfuric acid. Both of these products are of lower commercial value in this country than other possible sulfurous end products. Therefore, the economics of these processes would be improved if regeneration systems were devised to yield more desirable products at lower cost. A Department of Health, Education, and Welfare project for Fiscal Year 1967 is designed to find such means of regeneration.

Research into methods for desulfurizing fuels has been primarily concerned with residual oil and coal. The technology of the removal of sulfur from oil and gas is well known and extensively utilized in producing the almost-sulfur-free gas, gasolines, lubricating oils, and light fuel oils that constitute the bulk of the products of the oil and gas industry the world over.

Although an equivalent technology exists for desulfurizing residual fuel oil, its cost, as a percentage of the selling price of the product, has been so high as