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PB90130659



Statement of

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Before the

Subcommittee on Energy and Power
House Committee on Interstate and Foreign Commerce

May 26, 1977

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SPRINGFIELD, VA. 22161



Mr. Chairman and Members of the Subcommittee:

I am Dr. John F. Finklea, Director of the National Institute for Occupational Safety and Health (NIOSH). Accompanying me today are the Director of our Appalachian Laboratory for Occupational Safety and Health (ALOSH) in Morgantown, West Virginia, Dr. James A. Merchant, and the Director of our Office of Extramural Coordination and Special Projects, Dr. Kenneth Bridbord. We welcome the opportunity to testify before you today to discuss the occupational safety and health aspects of increased coal production, the conversion of oil and gas fired boilers to coal, and proposed coal conversion technologies.

Under the Federal Coal Mine Health and Safety Act of 1969, NIOSH conducts research directed toward protection of life and health, detection of respiratory impairment, and prevention of occupational diseases of coal miners. We also establish coal mine health standards and assure the availability of medical examinations for underground coal miners, while the Mining Enforcement and Safety Administration (MESA) of the Department of the Interior establishes coal mine safety standards and enforces both health and safety standards. NIOSH works cooperatively with MESA to test and approve air sampling instruments and personal protective devices for coal mine use. Under this program, our Testing and Certification Branch evaluates and approves respirators, including self-rescuers, coal mine dust personal sampler units, and gas detector tubes.

Morbidity and mortality studies show that coal mining continues to be one of the most hazardous occupations in the United States. Studies have shown that coal mines have excessive rates of chronic bronchitis and airway obstruction when compared with a control population. Coal workers' pneumoconiosis, both in its simple and complicated form, continues to be a

common finding in morbidity studies. Mortality studies have shown consistent excesses in death rates due to accidents and assorted respiratory diseases. In addition, a recent study of a large group of coal miners suggests significant excess in deaths from both lung cancer and stomach cancer.

Based on 1976 estimates, 44 percent of U.S. coal production is derived from underground mining which employs 71 percent of the coal mining population. Underground mining currently accounts for 82 percent of mining fatalities and 85 percent of non-fatal injuries. Recent chest X-ray studies of the prevalence of coal workers' pneumoconiosis for underground miners suggest that approximately 13 percent have the disorder, while the prevalence is only around 2.5 percent for surface miners. These figures are a conservative indication of the overall effect since prevalence studies cannot take into account sick miners who have left mining. Moreover, chronic obstructive airways disease which is detected by lung function tests has been found in 30 percent of underground miners as opposed to 19 percent of surface miners.

If U.S. coal production is increased from the current 620 million tons per annum to 1 billion tons per annum and the mining techniques utilized remain unchanged, we estimate the mining population will need to increase from the current number of 191,000 to 308,200. The immediate health impact of this increase would be most easily seen in the number of fatal and non-fatal injuries. Fatalities might increase by a total of 82 each year, while non-fatal injuries might increase by 7,983 each year. This represents an increase of approximately 60 percent over 1976 rates.

The respiratory hazards of mining usually do not become manifest until 10 to 20 years after exposure has begun and depend upon duration and

concentration of the dust exposure. To assess the health impact of increased coal mining on respiratory disease is more difficult as both dust concentrations and the average age of coal miners are decreasing. The effect of these decreases may not be fully apparent for another 5 to 10 years. Even by taking into account these trends in underground coal mining, several thousand additional cases of coal workers' pneumoconiosis and coal related obstructive airway diseases are expected among the current workforce of miners as they accumulate coal mine dust exposure in the years to come. Because of the excess mortality already observed for cancer of the stomach and, to a lesser extent, cancer of the lung in miners, it is anticipated that there could be increases in death from these diseases. Available data do not allow reliable prediction of the size of these increases.

It is unlikely that the increased amounts of coal currently being discussed would be obtained by the present split between surface and underground mining. If the increase in coal production is to be achieved by 1980, it is very likely that the majority of increased production would be derived from surface mines. A major factor in reaching this conclusion is that currently there is often a delay of several years in obtaining new mining equipment. This, of course, could change if emphasis on mining were increased. Increased surface mining, unless properly conducted, can of course, lead to degradation of environmental quality and to increased particulate exposures for nearby communities. We have considered a number of model systems based on achieving the target of 1 billion tons with 10 percent, 20 percent, and 30 percent of the additional tonnage required being derived from increased underground mining. In the situation where 10 percent of the increase is derived by increased underground mining, fatal

and non-fatal injuries can be expected to increase by 39 and 3,483 respectively. This represents an increase of approximately 28 percent.

Considering the chronic health effects, it can be expected that there would be several hundred additional cases of coal workers' pneumoconiosis and several thousand additional miners with coal dust associated obstructive airway diseases. The estimates for 20 percent and 30 percent of the additional 380 million tons being derived from underground mining fall between two cases outlined. Our estimates are based on current methods of mining and do not take into account the possibility that there could be improvements in mining techniques which could minimize the occurrence of accidents and adverse effects on the health of miners.

Changes in mining techniques could also be accompanied by other health risks. The introduction of diesel-powered equipment into coal mines is of particular concern to NIOSH because of the possible health effects of long-term exposure to a combination of coal dust, known to cause pneumoconiosis, and the gases and vapors of diesel exhaust, many of which are known or suspected pulmonary irritants. NIOSH is working cooperatively with MESA to study the health effects of exposure to dust and diesel exhausts found in non-coal underground mines. We also plan to conduct a second phase of the study in coal mines where diesel engines are regularly employed underground.

Although standards currently exist for coal mine dust and for nitrogen dioxide and other components of diesel exhaust, these are based on controlling health effects of single exposures. We cannot be confident that adherence to these individual standards will protect the miner subject to mixed exposures. In fact, we have scientific evidence that the absorption of certain irritant gases to respirable-sized particles can potentiate

their effect upon the lung tissues. The possibility is that such synergism exists between respirable coal dust particles and known or suspected respiratory irritants. We also know very little about the possible carcinogenic potential of chemicals which may be formed by the interaction of gases and vapors from diesel exhausts and organic substances which may be present in the coal mine atmosphere.

Unfortunately, none of the potential benefits of diesel use have been scientifically and objectively documented at this time. NIOSH and MESA are currently assessing the environmental and biological effects of diesel now operating in metal and non-metal mines and in a limited number of coal mines. In addition, NIOSH is sponsoring an international workshop designed to address key issues involved in the possible use of diesel engines in underground coal mines. Based on available evidence concerning underground exposure to diesel emissions, NIOSH has advised MESA to caution all concerned in the coal mining industry against further introduction of diesel equipment into underground mines until the health and safety production of implications have been scientifically assessed.

Conversion to Coal-Fired Power Plants

Numerous studies have documented the community public health hazards of emissions from coal combustion including excess mortality during air pollution episodes. Since the National Institute of Environmental Health Sciences is sponsoring research in this area, I will focus on the occupational safety and health aspects of coal combustion, which have been given little attention.

A number of coal pretreatment steps are being proposed to decrease sulfur and trace metal emissions from coal-fired power plants and these may

pose significant hazards to workers. Pretreatment techniques include physical and chemical coal cleaning and involve, for example, pulverizing the coal and cleaning it with organic solvents. The dust generated is likely to be a lung toxicant. The solvents employed in pretreatment or in pollution control may be hazardous themselves or may concentrate even more harmful substances in the liquid streams. This can cause a health problem for workers who maintain these systems and handle and dispose of the wastes.

Coal with varying levels of toxic trace elements is likely to be increasingly utilized in these plants as new coal sources are exploited. Potential toxic metal emissions associated with coal combustion, which pose potential hazards to workers, as well as the general population, include mercury, selenium, arsenic, lead, cadmium, nickel, beryllium, and chromium. Incomplete coal combustion in industrial boilers could also be a significant source of polynuclear aromatic compounds, many of which are documented carcinogens.

Exposure to sulfur dioxide also poses a potential problem to workers in coal-fired power plants, as do noise and asbestos or other fibrous materials used for insulation. For example, a recent study of a 5,000 ton per day coal-burning power plant revealed that over one-third of the working population were exposed to unacceptably high noise levels. Exposure to old insulation materials may pose a significant problem during the process of converting oil- and gas- fired power plants and industrial locations to coal.

The use of coal presents new potentially more hazardous conditions in these converted plants in the materials handling and coal preparation processes. These hazards are principally related to increased risks of

injury or death due to coal transport, storage, conveying, and crushing and the attendant potential for fire and explosion. The reconstruction phase is an important area of concern also, as major changes to an already complex and relatively massive plant may be required. NIOSH and the TVA are cooperating in occupational safety and health studies of workers in coal-fired power plants, and recently the Institute has undertaken a project to evaluate the potential for increased safety risks in the construction and operation phases of oil-and gas-fired power plants which are converted to coal.

With regard to current practices and experience in the coal, oil-and-gas-fired power plant sector, NIOSH is studying both the details of current safety practices in this industry and evaluating the incidence rates of recordable injuries and fatalities. This program will establish an information base so that we can better evaluate the impact of emergency energy technologies in future years.

Coal Conversion Technologies

The hazards to human health associated with large-scale coal conversion can be divided into three areas: (1) hazards to workers in the conversion plant itself; (2) hazards to people living in the vicinity of the plant due to the effluent discharges or spills resulting in atmospheric exposure and contamination of drinking water and food; and (3) hazards to workers in downstream industries, to distributors, and to users of coal conversion products or by-products.

Perhaps the most serious environmental threat to workers and the general public is from chemical carcinogens. For example, during the operation of a coal hydrogenation plant, the strongly carcinogenic compound benzo(a)pyrene was detected at high concentrations near blowdown and steam

cleaning operations. More recently, carcinogenic compounds such as benz(a)anthracene, benzo(c)phenanthrene, and unspecified mono and dibenzopyrenes have been reported in the hydrocarbon streams of two coal conversion processes currently under development.

Coal conversion also results in the formation of a number of inorganic gases which can be toxic at sufficiently high concentrations. These include hydrogen sulfide, carbon monoxide, ammonia, and metal sub-sulfides and metal carbonyls. The nature of the other gases will vary from process to process, but a substantial portion may eventually be vented along with some residual sulfur compounds. Trace amounts of many elements (chromium, manganese, lead, and antimony) in coal may also pose a potential problem to workers in coal gasification and liquefaction facilities.

In addition, coal dust itself and common industrial hygiene problems such as noise and heat stress from industrial processes involving crushing, high pressure, and high temperature operations pose potential problems to workers in those industries.

The problems associated with organic pollutants are basically different from those associated with other fuel production processes such as petroleum refining. The most prominent difference is the greater concentration of chemical carcinogens in the heavier and more aromatic fractions of coal-derived synthetic fuels. For example, polycyclic aromatic compounds are present in coal pitch in concentrations several orders of magnitude higher than that found in similar petroleum products such as asphalt.

Flowsheets for the various proposed processes do not generally indicate whether significant quantities of polycyclic compounds will be released via liquid and gaseous waste streams. Compounds such as phenols

and cresols will be found in some aqueous process wastes as well as small amounts of less soluble organic compounds. It is extremely difficult to trap aerosols generated by the rapid cooling of high boiling vapors. Therefore, all effluent gas streams should be considered as potential sources of particulate polycyclic compounds. Particular attention should be given to the effluent from catalyst and catalyst regenerator systems because polycyclic compounds have been found to be emitted in significant concentrations during the regeneration of petroleum cracking catalysts and because some catalysts such as nickel are toxic.

NIOSH strongly supports the principle that before a new technology is introduced or an existing technology is modified, its occupational health and safety impact should be evaluated. Historically, advances in technology have been accompanied by new hazards which are often apparent only many years later, after workers become sick or die. One such example is in the styrene-butadiene rubber industry. In the 1940's with 90 percent of the natural rubber supply cut-off, the government financed the building of 15 styrene-butadiene rubber plants. Almost 35 years later, we find that styrene-butadiene rubber employees have a six-fold risk, as compared with other rubber workers, of dying of cancer of the lymphatic and hemopoietic system. If occupational and public health and safety are considered in developing coal conversion technologies and in the mass conversion of oil and gas fueled power plants to coal, these plants should not have contributed to serious health problems in 20 or 30 years.

We do not believe that the occupational health and safety problems involved in increased production and use of coal are insurmountable. In addition to our own research under the Federal Coal Mine Health and Safety Act of 1969, we are working cooperatively with the Environmental Protection

Agency and the Energy Research and Development Administration to find practical solutions to the new problems. In terms of worker protection, the proposed new coal conversion technologies hold special promise in that they offer the opportunity to design controls into the processes rather than attempting to correct problems after the fact.

Mr. Chairman, we will be pleased to answer any questions that you or members of your Subcommittee may have.