



NIOSH

The Federal Mine Health Program In 1979

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

THE FEDERAL MINE HEALTH PROGRAM
IN 1979

ANNUAL REPORT
OF
HEALTH ACTIVITIES
UNDER THE
FEDERAL MINE SAFETY AND HEALTH ACT
OF 1977

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

August 1980

DISCLAIMER

Mention of company name or product does not constitute endorsement by the National Institute for Occupational Safety and Health.

DHHS (NIOSH) Publication No. 80-150

CONTENTS

EXECUTIVE SUMMARY 1

INTRODUCTION 3

RESEARCH AND OTHER ACTIVITIES 5

CONCLUSION 13

APPENDIX A 15

APPENDIX B 17

EXECUTIVE SUMMARY

Under the provisions of the Federal Coal Mine Health and Safety Act of 1969, as amended by the Federal Mine Safety and Health Act of 1977, the National Institute for Occupational Safety and Health (NIOSH) is responsible for conducting research to protect the health and safety of America's workers in coal, metal and nonmetal mines.

NIOSH recognizes the need to provide more effective means and measures for improving the working conditions and practices in the Nation's mines in order to prevent occupationally related injuries, diseases and deaths. The Institute's research in Fiscal Year 1979 (FY 79) furthered efforts to achieve this goal.

In FY 79 NIOSH laboratory investigations included studies on lung diseases related to occupational exposures in mines and studies on the specific substances causing such diseases. The Institute has also developed models of the lung to determine the pathophysiology of pneumoconiosis. Although much of this work is continuing, NIOSH research in FY 79 has helped significantly in the prevention and detection of occupationally related diseases of miners.

NIOSH epidemiologic investigations in FY 79 included studies on the health of miners exposed to diesel emissions, studies on the mortality rates of talc miners and respiratory health surveys at 21 metal and nonmetal mines. The Institute also conducted major environmental studies of workers engaged in various types of mining activity. These epidemiologic investigations enable NIOSH to determine which specific jobs result in increased occupationally related diseases and to recommend corrective measures.

During FY 79 NIOSH continued its program of providing chest X-ray examinations for underground coal miners and processed 33,000 examinations. In addition, NIOSH conducted seven Health Hazard Evaluations and responded to five requests for technical assistance from the Mine Safety and Health Administration. These studies resulted in the identification of several significant health problems in mining.

Future plans by NIOSH include a strengthening of the Health Hazard Evaluation Program for mining. This program will enable miners to readily request an evaluation of actual or potential health hazards in their work environment. In addition, NIOSH will use the findings from these evaluations to help set its priorities for recommending standards and conducting research. The Institute also plans to undertake an Occupational Hazard Survey of the mining industry. In this survey, researchers will take environmental measurements to determine exposure levels of workers to various substances. This information will enable NIOSH to determine the extent of exposure, to target specific problem areas and to recommend corrective measures.

INTRODUCTION

Under the Federal Coal Mine Health and Safety Act of 1969, as amended by the Federal Mine Safety and Health Amendments Act of 1977, the National Institute for Occupational Safety and Health (NIOSH) is responsible for conducting research to protect the health and safety of America's workers in coal and metal and nonmetal mines.

NIOSH research takes several forms, including laboratory research and clinical investigations to study how lung function and lung-related diseases are affected by the mine environment. In addition, NIOSH is continuing The National Study of Coal Workers' Pneumoconiosis, a large-scale epidemiologic study.

This report describes these major projects and the findings from other NIOSH mining research activities during Fiscal Year 1979 (FY 79).

LABORATORY INVESTIGATIONS

The validity of the technique of magnetopneumography, a method to measure the dust burden of the lung, is being studied. Freeze-dried lungs from the bodies of coal workers and asbestos workers have been magnetically mapped and the resultant magnetic fields compared with the amount of dust within the lungs. Preliminary results suggest that the technique is useful for measuring dust burden. This study will be completed in FY 81 and will allow medical specialists to determine if a worker is endangering his or her health by continued exposure to certain dusts.

In many occupational lung diseases fibrosis occurs. In order to study the fibrogenic potential of mineral dusts, a cell culture system which normally produces collagenous protein and which can be exposed to a variety of particulates has been established. Collagenous protein is the essence of the material that causes the lungs to become fibrous. Preliminary results using free silica indicate that direct exposure to particulates, while being highly toxic to the cell culture, does not influence fibrogenic activity in the model. Further studies are underway.

In FY 79 a NIOSH study of interferon, a cellular defense mechanism, induced by influenza virus revealed that this mechanism was inhibited in Rhesus monkeys when their kidney cells were pretreated with diesel emissions and metallic particles. The study also revealed that metallic particles of respirable size severely inhibited interferon synthesis. The results from these studies suggest particles on interferon production. The results from these studies suggest that metallic and diesel particles could affect the susceptibility of some miners to infectious disease. NIOSH will continue its study in this area in FY 80.

Accordingly, NIOSH began an interagency study with EPA in FY 79 to conduct toxicological studies on laboratory animals subjected to a combined exposure of diesel exhaust and coal dust. The project has four objectives. The first is to determine if exposure to diesel exhaust and coal dust, singly and in combination, changes the incidence of neoplastic disease. The other three objectives are to investigate the pulmonary functional damage, immune potential and mutagenic potential of exposure to coal dust and/or diesel exhaust. During FY 79 a facility appropriate for generating and controlling the diesel exhaust and bituminous coal dust exposures was completed, and exposure facilities for experimental animals constructed. The diesel motor chosen for use is a commercial unit used in some aboveground mining operations. Bituminous coal typical of the eastern coal region was obtained. Actual animal exposure studies will commence in FY 80 and continue through FY 82.

An understanding of the pathophysiology of pneumoconiosis requires knowledge of the mechanisms involved in the deposition of inhaled dusts. Pulmonary dust deposition has been studied in some detail. However, subsequent transport from the sites of deposition to other regions of the respiratory system and consequent systemic distribution are less well understood. Deposition and retention models have been described for the pulmonary clearance of inorganic compounds but few data are available to validate the model. Through contracts and in-house research, NIOSH is studying different models and conducting

experiments with animals in its effort to develop an effective model that will help in the study of pneumoconiosis.

Biological availability of various components of inhaled complex dusts (e.g. metals in slag, smelter and mining dusts and coal) is perhaps one of the most important determinants in the disease processes. Pulmonary diseases, such as emphysema and fibrosis, which are thought to result from pulmonary dysfunction and systemic toxicity, are probably dependent on the biological availability of the metallic components of the dusts. Therefore, in FY 79 a project was begun to determine the biological availability of inhaled dusts by using the perfused lung system developed by Niemeier and Bingham. With this system, blood absorption and tissue distribution in the lung can be determined. In addition, researchers using electronic methods are investigating the chemical nature of the particles trapped in the lung and determining their location. From this study, researchers will develop a better understanding of the effects of inhaled dusts on the lung and will be able to more readily detect miners afflicted by lung diseases related to the inhalation of complex dusts.

In FY 79, a project was initiated to investigate workers' fatigue as a result of various design features of respirators. A problem in the use of respirators has been the significant discomfort which contributes to fatigue under actual working conditions. Increased breathing resistance, high levels of carbon dioxide, and heat buildup in the mask are important contributing factors in the development of workers' fatigue. This project involves study of the physiological responses to the stress imposed by respiratory protective devices under simulated working conditions. Resulting recommendations, which will be completed in FY 82, are expected to provide information for design changes and preventive work practices to be incorporated into the respirator standards.

EPIDEMIOLOGIC STUDIES

A cross-sectional study of over 700 coal miners exposed to diesel emissions was completed in FY 79. In a preliminary analysis, significantly more coal miners exposed to diesel emissions reported symptoms of persistent cough, persistent phlegm, and exacerbations of cough and phlegm than did matched controls. Likewise, their pulmonary function performance was generally poorer. In addition, increases in the years of diesel exhaust exposure were associated with a tendency towards increasingly poorer health for coal miners. These conclusions must be viewed with caution, however, due to the lack of complete environmental data. NIOSH is further analyzing this data and conducting animal experiments in an attempt to confirm these results.

A large scale longitudinal study of working coal miners was analyzed to determine biases due to studying only working miners and only volunteers. This is important because many potentially diseased workers may have left after working only a short time, leaving only healthier workers for the study. Thus, studies of coal miners may actually underestimate the extent of adverse health effects from working in coal mines. Symptoms, pulmonary function indices and chest radiographs were obtained from the first part of the National Coal Study (NCS) and rates and means were compared among those who

participated in the second part, those who had left the industry before the second part and those who simply did not participate in the second part of the NCS. The bias was calculated as the difference between those sampled twice and the entire group. Biases were present in nearly all variables studied, but the biases were fairly small.

Environmental assessments and cross-sectional respiratory disease studies were conducted in talc mines and mills throughout the United States. Analyses of these data for talc workers in New York exposed to fibrous tremolite and anthophyllite, the most common contaminants in talc work, have been completed. A mortality study of talc workers in New York State was also completed.

In the study of New York talc workers, chest roentgenograms, pulmonary function assessment by spirometry, respiratory symptoms, smoking history and occupational history by questionnaire were obtained from 121 male talc miners and millers exposed to talc containing tremolite and anthophyllite asbestiform fibers. Ninety-three of the employees had worked with talc only at the plant under study. The talc workers were then compared to a group of potash workers to compare the health effects of workers who were exposed to mineral dust that does not contain asbestos. Symptoms were only slightly more prevalent in talc workers in comparison with potash miners. However, pulmonary function of talc workers was significantly decreased in comparison to that of potash miners. The prevalence of pleural calcification and pneumoconiosis in talc workers with 15 or more years of employment was higher than in potash miners. The prevalence of pleural thickening was 31 percent in those who worked with talc more than 15 years and was significantly increased when compared to potash miners. NIOSH is still analyzing this data and plans to recommend new labeling requirements for talc that clearly indicate whether asbestiform fibers are present.

The mortality study conducted at these same talc facilities included 398 workers employed between 1947 and 1960. Among this cohort, 10 deaths due to respiratory system cancer were observed, whereas only 3.5 would have been expected based on U.S. mortality rates. An approximately four-fold increase in non-malignant respiratory disease mortality was also observed. After the data is studied, NIOSH will make recommendations necessary to provide adequate health protection for talc workers.

Respiratory health surveys were carried out at 21 metal and nonmetal mines. Over the same period, detailed environmental surveys were carried out by the Mine Safety and Health Administration (MSHA). The purpose was to study the effect of exposure to silica and to diesel exhaust. A marginally higher prevalence of small rounded pleural opacities (thickening in the membrane lining the lung) was found in the metal as opposed to nonmetal miners. Dust and quartz exposures were not clearly related to symptom prevalences and lung function, and the findings for exposure to diesel exhaust were mixed. A higher prevalence of persistent cough was associated with exposure to aldehydes, the primary contaminants in diesel fuel, but this trend was not confirmed by the lung function data. Four indicators of diesel use failed to show consistent trends with symptoms and lung function; however, analyses are continuing for each metal and nonmetal segment separately.

Other major studies underway include environmental and mortality studies of crushed stone workers; environmental, morbidity and mortality studies of

cement workers; and environmental, morbidity and mortality studies of miners and millers exposed to fibrous minerals. The fibrous minerals studies are concentrating on workers exposed to attapulgite clay.

NIOSH commenced research in FY 77 that has examined the effects of segmental vibration from vibrating hand-held tools used by workers. The purpose of the research is to determine the incidence and prevalence of vibration white fingers disease (Raynaud's Phenomenon) in various worker groups and ultimately to prescribe intervention measures, such as the use of personal protective equipment and changes in tool design, appropriate to prevent vibration-induced disease. During FY 79 a study of Raynaud's Phenomenon in uranium miners in New Mexico was conducted. Approximately 150 miners who use jack-leg drills were examined. For each participant, medical examinations of the hands and fingers were performed, plus: 1) sensory tests specific for touch, temperature, depth sense and pain; 2) measurement of peripheral circulation; and 3) X-rays of the hands. An occupational history and health interview was obtained for each participant. Measurements of the vibration impinging the workers' hands were obtained using specially-designed vibration transducers. Though the results from this study will not be available until FY 80, previous work has shown a higher than expected prevalence of Raynaud's Phenomenon in workers using such vibrating hand tools as grinders and chipping tools.

NATIONAL STUDY OF COAL WORKERS' PNEUMOCONIOSIS

The major NIOSH study of respiratory health effects of coal mining is the National Study of Coal Workers' Pneumoconiosis, a large-scale epidemiologic study designed to: (1) relate coal workers' pneumoconiosis progression to levels of respirable coal mine dust exposure, (2) provide a scientific basis for determining the progression of the disease by use of serial X-rays, and (3) estimate the industrywide prevalence of coal workers' pneumoconiosis. In FY 79 NIOSH began the Third Round of this study, which involves approximately 10,000 coal miners. This study includes giving the miners a chest X-ray and pulmonary function test and recording their work histories.

Thus far miners in 13 mines have been examined during the Third Round. Intensive efforts have been made to encourage miner participation in the study. Studies at the remaining mines will be completed during FY 80.

CHEST X-RAY EXAMINATIONS OF COAL MINERS

Underground coal miners have been provided chest X-ray examinations since December 30, 1969, as mandated by Section 203 of the Federal Coal Mine Health and Safety Act of 1969, as amended by the Federal Mine Safety and Health Amendments Act of 1977. The X-rays are provided at no cost to the miner and are paid for by the coal mine operators.

Each miner who enters underground coal mining for the first time after December 30, 1969, must receive an initial examination as soon as possible after commencing employment. The examination consists of a posterior-anterior chest roentgenogram (X-ray) and the completion of an identification document which includes an occupational history. Examinations are given by facilities which are approved by NIOSH and located at a place convenient to the miner. Facilities are approved when they demonstrate their ability to take high-

quality X-rays which can be accurately classified for pneumoconiosis. A second X-ray three years later is required and also a third, two years thereafter, if the second X-ray shows evidence of the development of pneumoconiosis. New miners who have been given these examinations, as well as miners employed prior to passage of the Act, are to be given the opportunity for examinations at intervals not to exceed five years.

Physicians who wish to participate in the program as either "A" or "B" readers must demonstrate their proficiency in interpreting X-rays for pneumoconiosis. Physicians who want to become "A" readers must accurately classify six X-rays of varying degrees of pneumoconiosis which they select from their files, or must take a course approved by NIOSH. Physicians wishing to become "B" readers must pass a proficiency examination designed for NIOSH by Johns Hopkins University. The examination tests a physician's ability to classify a chest film for pneumoconiosis via the ILO/UC 1971 Classification of Radiographs of the Pneumoconioses, to identify other diseases on the radiograph and to distinguish radiographs of acceptable and unacceptable quality for the proper classification of pneumoconiosis. These trained physician readers ("A" or "B") interpret all chest roentgenograms according to the ILO/UC Classification of the Pneumoconioses before they are submitted to NIOSH. They also notify the miner's physician of any significant finding.

After NIOSH receives the X-ray and documents, it sends the X-ray to a "B" reader for final interpretation and the miner and his physician are again notified of any significant findings. NIOSH also notifies the U.S. Department of Labor's Safety and Health Administration (MSHA) of the findings of pneumoconiosis, and MSHA notifies the miner of any benefits he or she may be entitled to under the Act.

Under current regulations, any miner whose X-ray shows evidence of category 2 or 3 simple pneumoconiosis is afforded the option to transfer to an area of the coal mine where the dust concentration is less than one milligram of coal mine dust per cubic meter of air. If such an area does not exist, the miner may transfer to an area where the level of coal mine dust does not exceed two milligrams per cubic meter. Miners who have X-ray evidence of category 1 are afforded this option if they have worked less than 10 years in coal mining. Miners who choose to exercise their option must contact MSHA, which requires the coal mine operator to transfer the miner if he or she is not already working in a safe atmosphere.

Although the X-ray examination program is continuous, it is divided administratively into "rounds" (as is the National Study of Coal Workers' Pneumoconiosis). The period beginning August 19, 1970, the date of publication of the regulations governing the examinations, and ending December 30, 1971, is known as the First Round. A Second Round began when the revised regulations became effective on July 27, 1973, and ended on March 31, 1975. The Third Round began on August 1, 1978, and ended on March 31, 1980.

During FY 79, 33,000 examinations were processed. Efforts are underway to further analyze these data to determine if a decrease in the prevalence of coal workers' pneumoconiosis is possibly attributable to improved working conditions.

HEALTH HAZARD EVALUATIONS

Under the provisions of Section 501 (a) (11), of the Federal Mine Safety and Health Amendments Act of 1977, the Secretary of Health, Education, and Welfare is responsible "to determine upon written request by an operator or authorized representatives of miners, specifying with reasonable particularity the grounds upon which such request is made, whether any substance normally found in a coal or other mine has potentially toxic effects in the concentrations normally found in the coal or other mine or whether any physical agents or equipment found or used in a coal or other mine has potentially hazardous effects, and shall submit such determination to both the operators and miners as soon as possible." The responsibility for this program was delegated to NIOSH. During FY 79, NIOSH conducted seven mining hazard evaluations and responded to five requests for technical assistance from MSHA. These studies resulted in the identification of several significant health problems in mining, including accelerated silicosis among workers producing silica flour. It is anticipated that requests for mining health hazards will increase significantly during FY 80, at which time NIOSH will devote additional resources to this program.

MINING SURVEILLANCE

NIOSH has also been delegated responsibility for environmental and health surveillance activities in mining. During FY 79, NIOSH conducted an extensive literature review of data on exposures in mining, including compliance exposure data gathered by MSHA. This effort identified health hazards, documented environmental levels and associated toxicities for chemical and physical agents found in mining worksites. An initial report was transmitted to the Secretary of Labor in July 1979. The report identified 35 agents that occur at potentially toxic levels in mines. The report also pointed out the need for more complete information on many substances that are found in mines but have not been evaluated environmentally. NIOSH will begin evaluating these substances in FY 80 through its Target Mining Surveillance Initiative.

AUTOPSY SERVICE

The Federal Coal Mine Health and Safety Act of 1969 provides for an autopsy of any underground coal miner, regardless of whether he or she was active in coal mining at the time of death. Pathologists are reimbursed up to \$200 for their services if they submit the forms and tissue specimens required by the subpart of Part 37 of Title 42, Code of Federal Regulations, entitled "Autopsies of Coal Miners." NIOSH has available approximately 2,500 cases from the autopsy program. During FY 80, lung cancer cases among this group will be studied as to histology and association with coal dust exposure.

TESTING AND CERTIFICATION

Under authority of the Federal Mine Safety and Health Act of 1977, the Testing and Certification Branch, Division of Safety Research, has the primary responsibility for the testing and certification of personal protective equipment and hazard measuring instruments to insure that these instruments and devices used for the control and evaluation of occupational hazards meet performance requirements sufficient to protect workers' health and safety. The Testing and Certification Branch presently certifies respirators jointly

with MSHA and has sole responsibility for certifying coal mine dust personal sampler units.

MSHA's program to sample coal mine dust is the largest Federal program for monitoring a single workplace pollutant. Yet reviews by the General Accounting Office and the Office of Technology Assessment, as well as testimony in MSHA hearings, have publicized serious doubts that the sampling program is accurate enough to prevent future cases of coal workers' pneumoconiosis. Part of the doubts center on the accuracy of the personal sampling units. In order to improve the monitoring of mine dust, NIOSH is developing better laboratory procedures to use in certifying the dust samplers. In FY 79, NIOSH designed and began tests on several procedures for measuring the accuracy of samplers and pumps. This testing program will extend into FY 80.

CONCLUSION

A major NIOSH responsibility is to conduct research to protect the health and safety of America's coal miners. In FY 79 NIOSH made significant progress toward that goal. NIOSH laboratory investigations included work on diseases of the lung caused by occupational exposures during mining activities. fatigue caused by the use of respirators, and the causes of lung disease. This research will help to prevent diseases related to work in mines and to detect respiratory problems of working miners.

In FY 79 some of the epidemiologic work NIOSH conducted included studies to determine the extent of various occupationally related diseases, the types of these diseases, and the mortality rates of miners. This work will enable NIOSH to determine which specific jobs result in increased occupationally related problems and recommend corrective measures.

NIOSH also continued its work of monitoring coal workers through its National Study of Coal Workers' Pneumoconiosis and its X-ray examination program. These efforts, in addition to monitoring miners' health, will help the Institute determine changes in the prevalence of coal workers' pneumoconiosis.

APPENDIX A

Mine Research Grant Activity - FY 79

In FY 79, NIOSH awarded one mine related research grant for \$75,815 to the Colorado School of Mines for Dr. Franklin Schowengerdt to investigate "Coal Dust Control by Condensation Enlargement."

The investigation, a two-year project, is aimed at applying the concept of condensation enlargement to the problem of controlling respirable coal dust in underground mines. A laboratory prototype dust collection system will be designed, constructed and evaluated. The proposed concept has advantages of very high efficiency, quietness of operation, no high voltages or potential for sparking, low water consumption and simplicity. The design is to be based upon data previously obtained by Dr. Schowengerdt from NIOSH sponsored grant support on nucleation and water droplet growth on coal dust.

APPENDIX B

Members of the Mine Health Research Advisory Committee

Charles R. Carrington, M.D. (Chairperson)
Associate Professor of Pathology
Department of Pathology
School of Medicine
Stanford University
Stanford, California 94305
(415) 497-5258

Charles E. Andrews, M.D.
Vice President for Health Sciences
West Virginia University Medical Center
Morgantown, West Virginia 26506
(304) 293-2321

Hubert A. Farbes, Jr.
Attorney
Conover, McClearn, Heppenstall & Kearns, P.C.
700 Denver Club Building
518 17th Street
Denver, Colorado 80202
(303) 232-9450

Manuel R. Gomez, M.D.
Hunter College School of Health Sciences
440 East 26th Street
Box 611
New York, New York 10010
(212) 481-5120

Reginald Greene, M.D.
Radiologist
Department of Radiology
Massachusetts General Hospital
Fruit Street
Boston, Massachusetts 02114
(617) 726-8391

John H. Johnson, Ph.D.
Professor of Mechanical Engineering
906 MEEM
Michigan Technological University
Houghton, Michigan 49931
(906) 487-2576

Lorin E. Kerr, M.D.
Director
Department of Occupational Health
United Mine Workers of America
900 15th Street, N.W.

Washington, D.C. 20005
(202) 638-2753

John B. Moran, M.S.
Director, Industrial Hygiene
and Professional Services
Safety Products Division
American Optical Corporation
14 Mechanic Street
Southbridge, Massachusetts 01550
(617) 764-4402

L. Christine Oliver, M.D.
Medical Consultant
Oil, Chemical and Atomic Workers
International Union
114 Saint Botolph Street, Apt. 3
Boston, Massachusetts 02115
(617) 783-3110

Mary E. Rahjes, M.P.H.
Director, Division Community Health Services
Colorado Department of Health
4210 East 11th Avenue
Denver, Colorado 80220
(303) 3200-6137

Donald L. Rasmussen, M.D.
Director, Appalachian
Pulmonary Laboratory
306 1/2 Stanaford Road
Beckley, West Virginia 25801
(304) 255-0031

Patrick R. Robins, M.D.
Professional Village South
700 West Kent
Missoula, Montana 59801
(406) 542-2169

Donald L. Werner, M.D.
Health, Department of Occupational Medicine
East Range Clinics, Ltd.
Box 847
Hoyt Lakes, Minnesota 55750
(218) 225-4244

EX OFFICIO PRIMARY

John A. Breslin, Ph.D.
Acting Chief, Branch of Health Research
Division of Minerals Health, Safety and
Technology
Bureau of Mines

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ROBERT A. TAFT LABORATORIES
4676 COLUMBIA PARKWAY, CINCINNATI, OHIO 45226

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE. \$300

Third Class Mail



POSTAGE AND FEES PAID
U.S. DEPARTMENT OF HHS
HHS 396