

## TECHNICAL SESSION II

## TOXIC SUBSTANCES AND HARMFUL PHYSICAL AGENTS IN MINES

## "NIOSH Mining Related Research"

by

James A. Merchant<sup>1</sup>

---

It is a pleasure to participate in this Tenth Annual Institute on Coal Mining Health, Safety, and Research. A representative from our laboratory has participated in this symposium for the last several years and we look forward to participation in the years to come.

Today I will focus on mining related research currently being conducted by the Division of Respiratory Disease Studies which has principal responsibility within NIOSH and the Public Health Service for occupational respiratory disease research, energy occupational health effects research, and mining (both coal and metal and non-metal) research. Some mining research dealing with inhalation toxicology, ergonomics, radiation, and other physical agents is conducted in NIOSH laboratories located in Cincinnati, Ohio. However, the vast majority of mining related research is conducted out of the Appalachian Laboratory in Morgantown. I will cover only our field based research projects in three areas - coal mining, metal and non-metal mining, and energy.

NIOSH MINING RELATED RESEARCH  
(1979)

- Coal Mining Research
- Metal and Non-Metal Mining Research
- Energy Research

---

<sup>1</sup>Director, Division of Respiratory Disease Studies, Appalachian Laboratory for Occupational Safety and Health, National Institute for Occupational Safety and Health, Morgantown, West Virginia

COAL MINING RESEARCH  
(1979)

- X-ray/Pathology Correlative Studies in Pneumoconiosis
- Morbidity and Industrial Hygiene Study of Diesel Emissions in Coal Mines
- Third Round - National Study of Coal Workers' Pneumoconiosis
- Epidemiological Study of New and Former Coal Miners
- Mortality of Coal Miners in the United States
- Magnetometry/Pathology Correlative Study of C. W. P.
- Pathology Standards for C. W. P.
- Radiographic Reading Trials on Classification of the Pneumoconioses

X-RAY/PATHOLOGY CORRELATIVE STUDIES  
IN PNEUMOCONIOSIS

Objective: Thorough assessment of over 500 cases of C. W. P. for which both pathological (whole lung sections) and chest X-rays (good quality) are available.

Status: Pathological material assessed by two pathologists, X-rays interpreted by three "B" readers. Report expected by September 1980.

MORBIDITY AND INDUSTRIAL HYGIENE STUDY OF  
DIESEL EMISSIONS IN COAL MINES

Objective: Assess whether diesel emission exposure, in addition to coal mine dust exposure, contributes to physiological or radiographic changes or respiratory symptoms among coal miners.

Status: A paper entitled "On Respiratory Health: Coal Miners Exposed to Diesel Exhaust Emissions" by B. Reger and J. Hancock was presented at the SOEH Energy and Mining Conference in April 1979. Further environmental assessments are underway. Final report expected in September 1980.

THIRD ROUND - NATIONAL STUDY OF  
COAL WORKERS' PNEUMOCONIOSIS

Objective: Prospective study of 40 coal mines and over 10,000 miners (began in 1969) to assess radiographic, physiologic and chest symptoms associated with coal mine dust exposures.

Status: Medical data collected in twelve mines. Environmental data to be collected in FY 80. Report expected by September 1981.

EPIDEMIOLOGICAL STUDY OF NEW AND FORMER COAL MINERS

Objective: (1) Assess physiological changes which may occur in new miners within months of employment.

(2) Assess the magnitude of bias introduced through the loss of miners from the cohort of miners studied in the national study of C. W. P.

Status: (1) Environmental, radiographic, symptomatic and physiologic data has been collected on over 100 miners who will be studied at six month intervals for two years. Report expected in September 1982.

(2) A paper entitled "Bias Estimates in a Longitudinal Study of C. W. P." has been submitted for publication.

MORTALITY OF COAL MINERS IN THE UNITED STATES

Objective: Determination of age-standardized death rates of coal miners for all causes - especially pneumoconiosis, airways disease, and malignant neoplasms of the respiratory and digestive systems, and the importance of various risk factors (occupational exposure, tobacco use, etc.).

Status: Three cohorts, previously studied, are under investigation. Report expected in September 1981.

MAGNETOMETRY/PATHOLOGY CORRELATIVE STUDY OF C. W. P.

Objective: To correlate the amount and distribution of coal dust, iron content, histopathology and radiographs of selected freeze-dried lungs and controls with magnetometric measurements.

Status: Data largely collected. Report expected in September 1980.

PATHOLOGY STANDARDS FOR C. W. P.

**Objective:** To develop from available information, standards for the pathological assessment of C. W. P. and related conditions (contract with the College of American Pathologists).

**Status:** Final report published in "Archives of Pathology and Laboratory Medicine," July 6, 1979 (Volume 103, Number 8). Available through your local medical library or my office.

RADIOGRAPHIC READING TRIALS ON CLASSIFICATION  
OF THE PNEUMOCONIOSES

**Objective:** Assess the feasibility and reliability of sectional and boundary standard radiographs to supplement the 1971 ILO/UICC Classification.

**Status:** An international workshop and several meetings have been held over the last 18 months (through a contract with the American College of Radiology) to review this and other material. The ILO 1979 classification with new standard radiographs has been approved and will be available to users shortly.

METAL AND NON-METAL MINING RESEARCH  
(1979)

- Morbidity and Industrial Hygiene Study of Fibrous Mineral Workers
- Industrial Hygiene and Mortality Study of Crushed Stone Exposure
- Morbidity, Mortality and Industrial Hygiene Study of Cement Workers
- Mortality Study of Diesel Engine Mechanics
- Pathology Standards for Asbestos Induced Lung Disease
- Mortality Study of Metal and Non-Metal Miners
- NIOSH/MSHA Study of Diesel and Silica Exposure Among Metal and Non-Metal Miners

MORBIDITY AND INDUSTRIAL HYGIENE STUDY  
OF FIBROUS MINERAL WORKERS

Objective: Environmental, radiographic, physiologic and respiratory questionnaire assessment of all U. S. talc facilities and the attapulgite clay industry.

Status: Talc results now under analysis - report expected in September 1979. Attapulgite clay studies scheduled for FY 80.

INDUSTRIAL HYGIENE AND MORTALITY STUDY  
OF CRUSHED STONE WORKERS

Objective: To assess whether workers exposed to serpentine and amphibole fibers indigenous to certain crushed stone results in altered mortality patterns - especially malignant neoplasms.

Status: Industry-wide cohort currently being constructed. Report expected in September 1980.

MORBIDITY, MORTALITY, AND INDUSTRIAL HYGIENE STUDY  
OF CEMENT WORKERS

Objective: Environmental and epidemiological assessment of an industry-wide sample of cement facilities - with an emphasis on airways disease and altered mortality patterns for malignant neoplasms.

Status: Sample defined and field work begun. Report expected in September 1981.

MORTALITY STUDY OF DIESEL ENGINE MECHANICS

Objective: To assess whether a cohort of workers exposed to diesel engine emissions over a significant period (latent period) exhibit altered mortality patterns - especially malignant neoplasms.

Status: Cohort of railroad and other diesel engine mechanics nearly assembled. Report expected in September 1980.

PATHOLOGY STANDARDS FOR ASBESTOS INDUCED LUNG DISEASE

Objective: To review and recommend pathological methods and criteria for the assessment of asbestos induced lung disease - asbestosis, lung cancer and mesothelioma.

Status: Contract under negotiation. Report expected in September 1980.

MORTALITY STUDY OF METAL AND NON-METAL MINERS

Objective: Assessment of mortality patterns of a cohort of over 14,000 miners studied by the U. S. P. H. S. in 1959-61.

Status: Analysis of data complete. Report expected in September 1979.

NIOSH/MSHA STUDY OF DIESEL AND SILICA EXPOSURE  
AMONG METAL AND NON-METAL MINERS

Objective: To assess environmental exposures and respiratory morbidity among over 5,000 miners.

Status: Paper entitled "The Effect of Exposure to Silica and to Diesel Exhaust in Underground Metal and Non-Metal Miners" by M. Attfield, et al. was presented at the ACGIH Symposium on Mining in November 1978. Final report expected in September 1979.

ENERGY RELATED RESEARCH  
(1979)

- Mortality, Morbidity and Industrial Hygiene Study of Oil Shale Workers
- Assessment of Occupational Safety and Health Problems Associated with Energy Industries
- Morbidity and Industrial Hygiene Study of Workers Exposed to Sulfates, Sulfuric Acid, Nitrates and Nitric Acid
- Industrial Hygiene Study of Coal Gasification Plants
- Industrial Hygiene Study of Coal Liquefaction Processes
- Mortality and Industrial Hygiene Study of Workers in Coal Fired Power Plants (TVA)
- Energy Industry Medical Protocol

MORTALITY, MORBIDITY AND INDUSTRIAL HYGIENE STUDY  
OF OIL SHALE WORKERS

Objective: Health effects study of the anvil points oil shale retort and union oil retort cohort employed in 1950's - 1960's. Environmental assessment of current oil shale operations and the U. S. S. R. (Estonia) experience are also included in this project.

Status: Health effects data, morbidity (UBTL Contract) and mortality (NIOSH) are collected and analyzed. Report expected in September 1979.

ASSESSMENT OF OCCUPATIONAL SAFETY AND HEALTH PROBLEMS  
ASSOCIATED WITH ENERGY INDUSTRIES

Objective: In-House and task order contract (SRI) to conduct state-of-the-art reviews of various energy technologies - magnetohydrodynamics, solar, geothermal, etc.

Status: Several reviews complete - some have lead to full research projects. Final reports expected in September 1979.

MORBIDITY AND INDUSTRIAL HYGIENE STUDY OF WORKERS EXPOSED  
TO SULFATES, SULFURIC ACID, NITRATES, AND NITRIC ACID

Objective: Epidemiological and environmental assessment of these exposures on lung function and respiratory symptoms.

Status: Papers entitled "Acute Changes in Pulmonary Function in Salt Miners" and "Epidemiological/Environmental Studies of Salt Miners" have been presented by J. Gamble at the ACGIH Mining Symposium in November 1978 and at the ACCP Conference on Occupational Lung Disease in February 1979. Diesel mechanics are currently under study. Final report expected in September 1980.

INDUSTRIAL HYGIENE STUDY OF COAL GASIFICATION PLANTS

Objective: In-depth environmental characterization of the worker's environment in two coal gasification facilities - one high-BTU and one low-BTU (Contract Enviro Control).

Status: Report on first plant expected in September 1979. Final report in September 1980.

INDUSTRIAL HYGIENE STUDY OF COAL LIQUEFACTION PROCESSES

Objective: In-depth environmental characterization of four coal liquefaction facilities to address coal liquefaction products, processes, material containment methods, and worker exposures.

Status: One plant study completed. Final report expected in September 1980.

MORTALITY AND INDUSTRIAL HYGIENE STUDY  
OF WORKERS IN COAL FIRED POWER PLANTS (TVA)

Objective: Assessment of environmental exposures and mortality patterns of ten high risk jobs.

Status: Environmental assessments completed. Cohorts under construction. Final report expected September 1981.

ENERGY INDUSTRY MEDICAL PROTOCOL

Objective: To develop a thorough and feasible medical examination protocol for use in the emerging energy industries.

Status: Review completed - final report expected in September 1979.

DPSE MINING RESEARCH

- Analytical Support to Health Hazard Evaluations
- Analytical Support to Energy Projects
- Organic Methods Development
- Diesel Emissions Methods Development
- Development of Certification Procedures for Mine Dust Samples

DSHEFS MINING RESEARCH

- Uranium Mining and Milling Study
- Medical and Industrial Hygiene Study of Workers Exposed to Manganese
- Mortality and Industrial Hygiene Study of Workers Exposed to Selenium
- Mortality and Industrial Hygiene Study of Phosphate Workers
- Disability Conditions in the Work Place: Phase III

DRDS LABORATORY BASED RELATED MINING RESEARCH

1. In Vivo Effects of Metals (SE, CD, HG, ZN) on Lipid Peroxidation in the Lung
2. Image Analysis of Chest X-rays
3. Effects of Added Resistance to Breathing

4. Toxicity of Selected Particulates to Alveolar Macrophages
5. Macrophage Induction of Fibrogenic Activity
6. Metal Induced Lipid Peroxidation in Cell Membranes
7. Fibrogenic Potential of Aluminum and Its Compounds
8. Diesel and Metal Particulates on Interferon Synthesis
9. Aluminum, Chromium, and Iron Toxicity to Lung Cells

#### DBBS MINING RESEARCH

- Diesel Exhaust/Coal Dust Animal Exposure Studies
- Patho-Physiological Studies of the Pulmonary System
- Pulmonary Hypersensitivity - Group VIII Metals

#### CONCLUSIONS

- (1) Although a good deal of research is underway, much more needs to be completed to adequately assess mining and energy industry health hazards.
- (2) The following areas will receive priority in NIOSH mining related research:
  - A) Assessment of airways diseases rather than the pneumoconioses
  - B) Definition and quantitation of risk factors and their interactions in dose-response studies.
  - C) Assessment of carcinogens (and mutagens) in the mining environment.
- (3) Ongoing and future field research will be materially strengthened by the emerging health hazard evaluation and mining surveillance programs.

---

Editor's Note: The Question/Answer Period following Dr. Merchant's presentation was not recorded.

AUGUST 28, 29 and 30, 1979  
BLACKSBURG, VIRGINIA

TENTH ANNUAL INSTITUTE  
ON  
COAL MINING HEALTH  
SAFETY AND RESEARCH

**PROCEEDINGS 1979**

