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ENVIRONMENTAL AND MEDICAL IN-PLANT OCCUPATIONAL HEALTH STUDY OF THE ASBESTOS PRODUCTS INDUSTRY

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Division of Occupational Health

Public Health Service

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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Environmental and Medical In-Plant
Occupational Health Study of the Asbestos Products Industry

Although numerous studies and review articles have been published since the 1920's on the subject of asbestos and its effects on exposed workers, many questions remain unanswered concerning the etiology and clinical aspects of injury arising from excessive exposures. One reason for this is the long latent period that may exist between periods of significant exposure and injury to health demonstrable through chest roentgenograms, function tests and symptoms. Despite the large amount of accumulated knowledge, the following questions remain largely unanswered:

1. What is the prevalence of pneumoconiosis in workers actively employed in the asbestos products industry?
2. What is the significance of exposure to different sources and forms of asbestos and to other materials commonly employed in this industry in the development of pneumoconiosis?
3. What is the role of non-occupational respiratory disease in the development of the pneumoconiosis?
4. Are malignancies occupational risks of the worker in the asbestos products industry? If so, what are the important etiological factors?
5. What other diseases, if any, may be associated with exposure to asbestos or other materials commonly used in the asbestos products industry?
6. What are safe levels of exposures to the various materials that constitute health risks in this industry?

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To secure information in these areas, the Division of Occupational Health is conducting a comprehensive study of the asbestos products industry in the United States. The objectives of the study are:

1. To determine the health status of workers in this industry with special attention to diseases of the respiratory tract.
2. To determine which environmental factors have an adverse effect upon the health of workers in the asbestos products industry.
3. To determine the relationship between occupational exposure and cause of death of asbestos workers.
4. To develop medical and environmental criteria and procedures for the control of health risks identified by the studies.

One necessary approach in obtaining information on the above is the conduct of coordinated in-plant environmental and medical occupational health studies in the asbestos products industry. The environmental studies will define the various working environments with special emphasis on levels and types of exposure to asbestos fibers and dust. The medical studies will obtain information on the health status of workers in these environments with special attention directed toward effects from exposure to asbestos dust. The environmental and medical data will then be studied to establish inter-relationships.

The difficulty of establishing relationships between environmental exposures and degrees of injury to health is fully realized because of the long latent period that may exist between periods of significant exposure and the onset

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of demonstrable injury to health. Consequently, any prevalence in a work population of abnormality or injury to health relating to pneumoconiotic or anaplastic changes would likely be the result of environmental exposures that occurred in past years. Due to the constant change and improvement in industrial technology in the processing and use of asbestos fibers as an industrial material over the past decades, and the increased attention that has been given to controlling environmental exposures to asbestos fibers and dusts, prevalence data would reflect significant exposures in the past and would not necessarily relate to the current levels of environmental exposures.

Medical and environmental data obtained during the current study have the additional value of establishing a baseline from which longitudinal observations will be made until the objectives of the study have been achieved.

Selection of Plants

Plants in the asbestos products industry will be selected in a way to minimize biases. A sufficient number of plants, in terms of number of workers employed as well as types of operations, exposures and products, will be studied to permit the development of data to meet the objectives of the study.

History of Plant Operations. Brief chronological histories will be obtained of the plants participating in the study, giving special attention to engineering and other steps which have been taken to control dust and improve plant conditions.

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Description of Plant Operations. Description of plant operations and processes including job classifications and duties will be obtained on each plant participating in the study. This will permit a better understanding of the relationship between an employee's job and environmental exposures. It will also be useful in the establishment of time weighted exposure values.

In-Plant Environmental Studies

Investigation of in-plant environmental conditions will be designed to delineate, as far as feasible, primary exposures in the working environment in each plant studied by department and operation. Special consideration will be given to the assessment of the nature and levels of exposure to asbestos dusts and fibers, and in addition, investigations of corollary exposures to other environmental hazards will be made, including an evaluation of primary exposures to fumes, mists, vapors, gases and other mineral dusts.

This evaluation of the working environment will include dust counting, particle size distribution of airborne fibers and dusts, and the determination of certain chemical and physical properties of asbestos.

Time weighted exposure values will be determined for each job classification.

For further evaluation of the total environment, air flow, temperature, humidity and other measurements will be determined, as required, to assess the exposures to other environmental factors.

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The effect of seasonal and processing variations on exposure will be considered in the conduct of in-plant environmental studies.

Atmospheric Sampling Techniques. The standard and midget impinger, thermal precipitator, and membrane filter will be used to collect environmental samples for dust counting. This will permit the comparison of data collected during this study with that of past studies, as well as the comparison of data by different collecting techniques. The selection and development of other collection methods will be based upon the aerodynamic and physical characteristics of asbestos fibers and upon the collection characteristics of the instrumentation to be utilized.

The thermal precipitator, molecular filter, cascade impactor, high volume air sampler and electrostatic precipitator and any other technique which may appear applicable will be utilized as a method of collection for determining size distribution of asbestos fibers and other dust in the environment, or as means of collection for analytical, petrographic and other phases of the investigation.

Generally accepted techniques will be utilized for collection and analysis of exposures to other environmental agents, such as mineral dusts, fumes, vapors, and gases.

Examination, Counting, and Characterization. Dust and fiber counting of airborne samples will be done using standard light field techniques.

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In addition, samples will be counted by phase contrast microscopic techniques. Sufficient numbers of samples to be of statistical significance will be counted by other procedures as may be developed. The dust counting will be done in the field where possible.

Particle size determinations will be made on representative air samples taken at various operations. These will include separate distribution for asbestos fibers and total dust. The various techniques to be employed will include electron microscopy, dispersion staining, and phase contrast microscopy.

Prior to the start of the environmental field sampling program, statistical assessment will be made to assure that sufficient samples will be obtained. Statistical analysis of results will also be done to differentiate characteristics of collection, counting, sizing and other parameters.

Analytical Techniques. X-ray diffraction, differential thermal analysis, thermal gravimetric analysis, separation procedures and other physical methods of analysis, including petrologic techniques will be accomplished on environmental samples collected by the various methods. These procedures will give identification of the asbestos fibers and associated mineral dusts.

Evaluation of Settled Dust and Other Bulk Material. Settled dust, rafter samples, raw material and the relationship of its composition and the

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composition of the respirable fraction will be studied in conjunction with studies of the aerodynamic and physical characteristics of asbestos fibers (such as settling velocities, size, shape, chemical composition and density). These will include elutriation, and photometric methods or any other method which may be developed.

Environmental Sample Bank. Additional samples of airborne particulates, settled dust, rafter dust, raw materials, intermediate products, and parent material will be collected and held in a bank for subsequent study in case the need arises.

In-Plant Medical Studies

Examination of workers will be made in Public Health Service mobile equipment located at plant sites. The procedures to be used in the clinical evaluation of workers are, primarily, screening procedures and are not intended within themselves to be used for specific diagnostic purposes. Their major purpose is to establish prevalence of abnormality in the workers; this, in turn, will be correlated with other elements of the study.

Occupational History. Information will be obtained on present and past employment of workers. It is important to gain information on other significant environmental exposures that may have produced pneumoconiosis or otherwise contributed to the present physical condition.

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Medical History. Information will be obtained on each worker concerning present symptoms as well as past illnesses which may have affected present findings. Special attention will be given to the smoking history.

Physical Examination. This will include ascertaining the pulse rate, blood pressure values, and respiratory rate, and an examination of the heart and lungs, and the skin of hands and forearms.

Sputum Examination. Sputum samples will be collected for an initial period and examined for asbestos bodies and cellular dyscrasia.

Chest Roentgenogram. Standardized 14" x 17" full-inspiratory PA x-ray films of the chest will be taken of the workers. Lateral chest films will be made where indicated.

Pulmonary Function Tests. These tests will include: (1) single breath nitrogen analysis for evaluation of homogeneity of gas mixing in the lungs, (2) timed forced expiratory volume, maximum expiratory flow rate, and forced vital capacity for evaluation of airway resistance, (3) diffusion capacity for carbon monoxide (DCO) and oxygen consumption during exercise for evaluation of gas transfer across alveolar-capillary boundaries.

Other tests, such as evaluation of ventilation perfusion relationship through measurement of urinary PN_2, may be tried on a pilot basis to determine their usefulness in the study.

Interpretation of Chest Films. Interpretation of chest films for the study will be made by a panel of radiologists who will interpret the films independently and then resolve any differences in conference.

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Films and medical records will be kept by the Occupational Health Research and Technical Services Branch, Division of Occupational Health, and will remain the permanent property of the U. S. Public Health Service.

Release of Medical Information

Medical data will be released to the physician designated by the worker whenever, in the judgment of the Public Health Service physicians, withholding it might lead to impairment of health. Thus, any abnormality or suspected abnormality which warrants prompt treatment or further diagnostic study will be reported immediately by the examining physician in the field, and followed up by written report to the private physician from the Chief Medical Officer. This will include cases with suspected tumors, suspected active tuberculosis, or evidence of cardiac disease. No other findings, however, will be reported unless the individual requires prompt medical attention in the opinion of the Chief Medical Officer.

Confidentiality of Findings

Records of the medical study will remain the property of the Public Health Service and will be kept in confidence in accordance with prevailing Public Health Service policy. Records and reports in which individual workers or companies are identifiable will not be made available to companies, unions, or official agencies. All reports will be written in such a manner that individuals and companies cannot be identified.

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Reports

No reports will be issued by the Public Health Service on the study until sufficient information has been collected to permit drawing valid conclusions. Such reports will be public documents and copies will be available to all interested groups and associations.

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