OCCUPATIONAL HEALTH STUDY OF THE

ASBESTOS PRODUCTS INDUSTRY IN THE UNITED STATES

Division of Occupational Health

Public Health Service

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Cancer—1964

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Occupational Health Study of the Asbestos Products Industry in the United States*

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Asbestosis has been recognized as an occupational disease since the early 1900's. Information on the prevalence and clinical characteristics of asbestosis has been derived primarily from cross-sectional one-period-in-time studies of actively employed asbestos workers; e.g., Pancoast, Miller and Landis (1917), Merewether (1930), Alwens (1935), Fulton, Dooley, Matthews, and Houtz (1935), Donnelly (1936), McPheeters (1936), Dreessen, DallaValle, Edwards, Miller and Sayers (1938). These have been supplemented by special clinical and autopsy studies, e.g., Cooke (1927), McDonald (1927), Lynch and Smith (1931), Ellman (1933), Egbert (1935). Although these and subsequent studies and case reports have added significantly to the knowledge on asbestosis, many questions remain unanswered concerning the clinical aspects of the disease and its etiology.

Concurrent with the interest in asbestosis as a pneumoconiosis problem, investigators have reported the occurrence of respiratory tract and other malignancies associated with exposure to asbestos. The published data in this respect are based largely on autopsy reports of former employees in the asbestos industries and on mortality statistics; e.g., Lynch and Smith (1935), Gloyne (1935), Egbert and Geiger (1936), Doll (1955), Wagner, Sleggs and Marchand (1960), Mancuso and Coulter (1963), Selikoff, Churg and Hammond (1963). Many of these reports strongly suggest that lung cancer and other malignancies are an occupational hazard of asbestos workers. Other reports do not support this relationship; e.g., Kovnatskii (1940), Jacob and Bohlig (1955), Braun and Truan (1958). Status reports recognize this difference of opinion and the need for further definitive data; e.g., Mayer (1963), Hannon (1964).

Several factors may account for this apparent discrepancy in the technical literature. Diagnostic criteria are seldom defined, making comparisons between different studies difficult, if not impossible. Conclusions are frequently applied to a broad classification

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encompassing asbestos workers in general and are not limited to the group under investigation. Environmental exposure data are often scanty or unavailable, including the magnitude of exposure to specific asbestiform minerals over the period of initial exposure to onset of disease, singly and in combination with other associated exposures capable of producing injury or potentiating synergistic responses. Relevant factors such as community air pollution levels, smoking habits, and family history of disease, characterizing the exposed worker are seldom ascertained or reported. In addition, changes are constantly taking place in industry due to technological advances. A major difficulty in obtaining this information is the long latent period from initial exposure to the onset of disease.

A primary weakness in the knowledge now available on the health effects from exposure to asbestos is the lack of epidemiological information on workers at risk over long periods of employment. Such information may be obtained through the longitudinal study of cohorts during which more precise data is kept on the characteristics of the workers as well as on the nature and intensity of pertinent environmental exposures.

In reviewing the status of knowledge on the health effects of exposure to asbestos, the following questions appear unanswered:

1. What is the prevalence of pneumoconiosis in asbestos workers actively employed in the asbestos products industry in the United States?

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. What are the occupational risks with regard to malignancies of workers in the asbestos-products industry?

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 in this industry that constitute health risks?

To secure more definitive information in these areas, the Division of Occupational Health, U. S. Public Health Service, is undertaking a comprehensive study of the asbestos products manufacturing industry in the United States.

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Scope of Study

The study is designed to obtain information on the effects of exposure to the major types of asbestos used in the United States (chrysotile, crocidolite, and amosite) singly and in combination with other potentially harmful exposures encountered in the manufacture of asbestos products. The following product manufacturing areas will be covered: (1) asbestos textile materials, (2) asbestos cement piping, (3) asbestos insulating materials, (4) asbestos friction materials, and (5) asbestos cement building materials.

Cohorts of workers will be constructed for each of these five product areas on which baseline in-plant environmental exposure data will be obtained along with other personnel data characterizing each individual in the cohort. Prospective data will be added to the cohorts until twenty to thirty years of employment experience has been covered on a significant number in each cohort. Pertinent medical data will be obtained through baseline and routine follow-up examinations on a substantial group within each cohort for clinical evaluation of the worker during the period of the study.

It is planned to include a minimum of 2500 employees in each cohort. Individuals in the five cohorts, insofar as possible, will be followed throughout their life period, including those who may have left the industry, until appreciable periods of exposures as well as latent periods from time of first exposure have been covered. Records of the Bureau of Old Age and Survivors Insurance will show each person in the cohort on whom a death benefit claim is filed along with date and place claim was filed. Death certificates from the respective state departments of health will be obtained and analyzed for causes of death. Evidence confirming cause of death will be studied. From these causes, specific mortality rates will be established on each cohort. These data along with environmental exposure, clinical and other data characterizing individuals in the cohorts will be studied to establish trends and relationships.

Baseline In-plant Data on Cohorts

The entire in-plant employment of each participating plant will be included in one of the five designated cohorts. The following information will be obtained on each individual in the cohorts: (1) identification data, including date and place of birth, sex, places of residency, and social security number, (2) occupational history, (3) job classification and description, and (4) smoking history. Plant managements will provide current information throughout the study in changes on persons in the cohorts.

Environmental data characterizing the nature and extent of in-plant exposures will be obtained on each employee participating in the study. Special consideration will be given to assessing the nature and levels of exposure to asbestos dusts and fibers. This evaluation of the working environment will include determining levels of atmospheric exposure to dust and fiber by counts, particle size distribution of airborne fibers and dusts,

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and certain chemical and physical analysis relating to the exposures. Time weighted exposure values will be determined where possible.

In atmospheric sampling for particulates, impingers and membrane filters will be routinely used. These samplers will be used both with and without size selective pre-samplers such as horizontal plate elutriators. Thermal precipitators and mass samplers such as the conicycle, hexhlet and electrostatic precipitator will also be used. This will permit the comparison of data collected during this study with that of past studies in this country using the impinger method as well as comparison of the data with studies in countries where other methods of sampling are used. Simultaneous sampling using the different procedures will permit the comparison of data obtained by different sampling techniques; e.g., concentration by count can be compared to respirable mass concentration.

Dust and fiber counting of impinger samples will be done using standard light field techniques. Membrane filter and selected impinger samples will be counted using phase contrast microscopy. For comparative purposes, samples will also be counted on a limited basis by other established techniques.

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

Bulk samples of milled asbestos fibers, by type and source, as well as samples of settled dust and rafter dust will be collected from each plant and analyzed for pertinent components such as free silica and polycyclic aromatic compounds.

In addition to assessing the nature and extent of exposure to asbestos dust and fibers, assessment of other associated exposures which may produce injury or potentiate a synergistic response will be undertaken.

Baseline data establishing the nature and extent of pertinent exposure of individuals in the cohorts will be supplemented at periodic intervals to assure reliable data to characterize exposures for the duration of the study. These data will be provided through management programs for routine environmental monitoring of exposures and through separate environmental studies made by state and local official agencies and the Service as needed.

In-plant Medical Studies

The medical studies will include baseline and follow-up examinations at designated intervals of a substantial portion of the personnel in the five cohorts. Where feasible, the medical data on personnel in the cohorts will be obtained through existing plant medical

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departments conducting routine pre-employment and periodic follow-up examinations. These will be supplemented as necessary by examinations conducted by designated official agencies. Criteria and procedures to be used will be developed by the Public Health Service and close surveillance maintained to assure uniformity of data.

The procedures to be used in the clinical evaluation of workers are primarily screening in nature and are not intended within themselves to be used for specific diagnostic purposes. Their major purpose is to establish prevalence of early and progressive abnormalities in the workers; these, in turn, will be correlated with other elements of the study.

A medical history will be taken on every individual in the medical study to obtain information on present and past illnesses which may affect the clinical findings.

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

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

Standardized 14" x 17" full-inspiratory posterior - anterior x-ray films of the chest will be taken. Lateral chest films will be taken where indicated.

Pulmonary function 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.

Data on pathological changes in cohort members will be sought for possible correlation with environmental and medical findings.

Other tests, as may be indicated, may be tried on a pilot basis to determine their usefulness in the study.

Interpretation of chest films for the study will be made by a panel of radiologists. The panel will develop criteria and a system of classification for interpreting films. The films will be interpreted independently and with no knowledge of the clinical and occupational histories. Any differences will be resolved in conference.

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Summary

There is a great need for further definitive information on the health effects from exposure to asbestos dusts and fibers and on safe levels of exposure. Much can be added to the present knowledge in this area by epidemiological information obtainable through the longitudinal study of cohorts, established within the asbestos products manufacturing industry, for which more precise data is kept on the characteristics of the workers as well as on the nature and intensity of pertinent environmental exposures. To this end, the Division of Occupational Health of the U. S. Public Health Service has underway an epidemiologic study of workers in the asbestos products manufacturing industry in the United States. The study will require observations covering twenty to thirty years of exposure experience within the cohorts.

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