April 19, 1967

PLAINTIFF'S EXHIBIT

CT-172

F. J. Solon

Environmental Health Task Force

1. Dr. A. J. Vorwald - Wayne University, Detroit

Dr. Vorwald reported to me April 11 that the work on the analysis of the dust collected over the Detroit traffic intersection and the analysis of the animal tissue exposed to this dust had been completed and a written report would be submitted within the next four weeks. The report will include the observation that asbestos fibres were identified in the dust samples (though their evaluation techniques do not permit quantification) and that no asbestos fibres or asbestos bodies were found in the animal tissue.

I will submit the report to our Research organization to determine whether there are techniques that could be used to determine the quantity of fibre in relation to the total dust.

2. National Insulations Manufacturers Association

The Association Health and Safety Committee will review at their meeting scheduled on April 21 a proposal submitted by the U. S. Public Health Service for an industry study to evaluate health problems associated with the manufacture of fiber glass products. In general, the proposal is similar to those of the diatomaceous earth and asbestos fibre industry studies in which we have already participated.

3. U. S. Public Health

As a result of our visit on February 28 with Dr. Lewis J. Cralley, we received the attached copy of "Research on Health Effects of Asbestos." This report summarizes the questions, and therefore the areas of needed research, defined through discussions held at the U. S. Public Health Service sponsored meeting held in Cincinnati in 1966.

4. Industrial Hygiene Foundation

Dr. Paul Gross has advised that he has completed the injection experiments with Coalinga fibre and will submit a report on this work. His principal observation is that the reaction to the Coalinga fibre is essentially the same as that resulting from exposure to Canadian chrysotile.

H. M. Jackson

cc: C. B. Burnett
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MT-002729

Research on Health Effects of Asbestos

Asbestos as a curious material was known several centuries B.C., especially for its ability to withstand flame. The physical and chemical properties of asbestos combined with its fibrous structure recommended it as a unique material with a wide range of potential industrial application. It was not until the end of the last century, however, that it gained importance as an industrial resource. The subsequent use of asbestos in a number of technological areas and its contribution to new products made it the precursor of the special science of industrial mineral fiber technology. Asbestos is essential in today's industrial technology including national defense, aerospace, and civilian consumer use.

Asbestos is a general term applied to a group of fibrous crystalline hydrated silicate minerals. Although a number of different types of asbestos minerals exist, only four or five are of commercial importance. Each differs somewhat from the others in chemical composition, physical properties such as ability to withstand heat and chemical erosion, crystalline structure, and in fiber dimension and degree of harshness and brittleness.

The worldwide production of asbestos has greatly expanded since the turn of the century, the overall consumption in this country leveling off for the period 1958-63 at around 750,000 short tons annually. Of this tonnage, approximately 93% was chrysotile, 3.5% crocidolite, 2.5% amosite, and 1% anthophyllite and tremolite.

Even though asbestos has been in industrial use for well over 50 years, much is unknown regarding its health effects and safe levels of exposure.

It was known in the early 1900's that excessive exposure to asbestos gave rise to the disabling pulmonary disease "asbestosis." More recently, evidence has been developed that the incidence of respiratory tract and other malignancies may be excessive in asbestos workers. A major problem in studying the health effects of asbestos is the long latent period of 20 to 25 years and over from initial exposure to the onset of disease. Also in the mid-1930's and earlier, there was little dust control so that the workers were often exposed during this period to massive levels of dust from asbestos and other associated materials in the manufacture of asbestos products. Thus the causative agents of the resultant disease are essentially unknown. Included in these potential sources of causative agents, either alone or in combination, are the one or more types of asbestos fibers themselves, materials associated with the fibers in the ores such as trace minerals and polycyclic aromatic oils, materials which might be added during processing such as metals, tars and pitches, and concomitant external exposures such as smoking or other air pollutants.

A salient point is that in subsequent years when heavy dust exposures were reduced, disease also diminished. This definitely indicates that with sufficient knowledge of the agent(s) responsible for the disease, along with dose-response data, safe levels of exposure can be established.

Studies to elucidate the importance of the asbestos minerals as hazards to health fall into two broad categories: first, those efforts needed to insure answers to urgent questions involving public policy and control efforts; and second, those needed to broaden the long-term base of information on the physical and chemical factors of fibrous materials as related to their interaction with animals and man so that efforts to maintain safe working and living environments can be constantly revaluated and improved. In the first category, for example, come programs aimed at clarifying reports of asbestos bodies being present, to some extent in the lungs of a third or more of our population. Are these truly responses to asbestos fibers or are other fibers also involved? Where do these fibers come from, and what is their potential significance in terms of health? Is there an increasing incidence of mesothelial tumors in our population and is this in any way related to asbestos minerals? Do fibrous minerals play a major or minor role in the causation of lung cancer? Are certain forms of asbestos or other fibers more important in these relationships, and what co-factors are important?

Concurrent with answers to these pressing questions, there is a need for a strongly supported program aimed at answers over the longer term regarding the pathogenesis of asbestosis and the other effects that appear associated with the inhalation of asbestos dust. Better information on the physical and chemical characteristics of the asbestos minerals which lead to their being inhaled and retained in the body, in their carrying with them other chemicals, in their migration, may open up unsuspected avenues of biological research.

Answers are needed to the following questions in safeguarding the workers' health, yet permitting the benefit of asbestos in today's industrial technology. The information gained will also have direct application toward the safe use of the many new synthetic fibers being introduced into industry in the rapidly expanding science of industrial fiber technology.

1. What is the nature and pattern of disease in workers exposed to the different forms of asbestos fibers and how do they relate to the magnitude and duration of exposure?

The answer to the above is basic to understanding related health problems and setting up research on a rational basis for their solution. It will provide evidence bearing on the etiologic factors involved and their inter-relationship, give information on the dose-response relationship of the agent(s) to the disease, provide criteria for setting up safe levels of exposure and give the basis for establishing medical and environmental surveillance procedures where asbestos is encountered and handled. It will also provide useful information for evaluating possible risks from inhaled fibers in those not occupationally exposed.

2. How are the diseases and other manifestations observed in workers exposed to asbestiform fibers characterized clinically and pathologically, and do they differ when exposure involves one form of asbestos or another?

Far more information is needed on the pathogenesis of asbestosis and on other responses to asbestos fibers in man, based on careful serial studies and correlations of clinical, physiologic, radiographic and histological changes. Results of these studies would relate to the prevention of asbestos-related disease as well as give useful information on the biological response to other respirable fibers. The findings would supplement current criteria for diagnosis, prognosis and management of disease, continued employability, fair adjudication of compensation claims and effective rehabilitation. They would also provide information important in establishing surveillance programs for asbestos workers and in effecting control measures.

3. What are the factors involved in the pathogenesis of the diseases associated with the inhalation of asbestos minerals and what are the primary etiologic factors involved?

With few exceptions, asbestos is generally formulated with other materials in the preparation of asbestos products, though in many instances the asbestos may be a predominant ingredient. Even in the mining and milling of asbestos, recent studies have shown that these operations are associated with exposures to potentially injurious agents such as trace minerals of nickel, cobalt, manganese, zirconium, titanium, etc., as well as polycyclic aromatic compounds in some ores, and potentially from metals abraded from processing equipment due to the harshness of the fibers. These same contaminants may be carried in degrees in the milled fiber and subsequently added to as processing of the fiber continues. Thus the etiologic agents resulting in the diseases observed in past studies are generally unknown. They may have been one or more of the fibrous forms of asbestos, trace minerals in the ore, polycyclic aromatic compounds associated with the ore, additives in processing, such as metals, coal tars and pitch, etc., smoking, other air pollutants, or some combination of these factors. Studies in the past have generally related resulting disease to fiber exposure only. This requires a further look into both the clinical and animal research of the past, as well as current research, to further define related agents in light of this more recent information.

The above information will also be most useful in pinpointing preventive measures, not only in terms of inhaled fibers, but in terms of other associated co-factors.

4. What chemical and physical characteristics of asbestos fibers relate to their respirability, mobility, clearance and immobilization in the body and how do the types of asbestos differ in these respects?

Most of the research relating to the respirability and retention, mobility, and clearance of materials from the lungs has been done on particulates that have random movements since they are generally spherical. Fibers, however, having a much greater length-to-diameter ratio, have direction and orientation in their movement and may behave quite differently than particulates. Fibers that are harsh and rigid may have tissue penetration potential. Through this mechanism they may, as carriers, transport toxic agents from the lungs to other organ sites and thus have a causal relationship heretofore not understood. It is important to have an understanding of the behaviour of fibers in lungs and other tissues and to relate this to the respective physical and chemical characteristics of fibers so that patterns of response can be understood and predicted.

5. How can asbestos fibers in vivo and vitro be differentiated as to type and how can they be distinguished from non-asbestos fibers?

Respirable fibers are ubiquitous. They may be either natural or synthetic and from animal, vegetable or mineral origin. Modern technology is introducing increasing numbers of synthetic fibers into industrial use. It has been known for some time that asbestos fibers in the lungs give rise to asbestos bodies. The findings of similar-type bodies in the lungs of a large percentage of individuals coming to autopsy in general urban hospitals, even though the number in any individual may be relatively small, has given concern as to their meaning as well as to the indentification of the associated fibers and their environmental source. Methods must be developed for isolating, indentifying, and quantitating fibrous materials in the lungs and other tissues and in the associated ferrunginous bodies.

6. What levels of exposure to the etiologic agents associated with asbestos-related diseases can be regarded as safe?

This is a prime objective of the research. When information on safe levels becomes available, environmental and other controls can be devised to keep exposures within the recommended limits.

7. How can exposures be prevented?

The aerodynamic properties of fibers will differ somewhat depending upon the specific physical and chemical properties of the fibers. Their behavior in air is much less understood than that of particulates spherical in shape. Information is needed on the behavior of fibers for the design of ventilation control equipment and the design of process equipment to minimize the dispersion of fibers into the air.

8. What environmental and medical surveillance procedures are recommended where asbestos fibers are encountered or handled?

Surveillance of the working population at risk is an essential part of any occupational health program in industry to detect early changes before damages to health have occurred. Environmental monitoring of exposure levels as well as continuing information on the health status of the working force are important segments of a surveillance program. The development and application of surveillance procedures will assure the use of asbestos with minimum risk to health.

The answers to the above questions can come only from widely-based interrelated research directed to the health response of the worker and his specific environment. The research, although directed rather specifically to the asbestos worker and his environment, has application in the understanding of a wide range of allied occupational diseases, especially those relating to fiber exposures. This research should encompass:

Epidemiologic

(a) Longitudinal studies of groups of workers in different employment categories with contrasting exposures to different types of asbestos fibers by magnitude and duration, singly and in combination with other associated materials capable of producing injury or eliciting a synergistic response to establish inter-relationships between health patterns of the workers and environmental exposures.

(b) Studies of the relation between exposure to asbestos minerals and clinical symptoms, pulmonary changes demonstrable by pulmonary function and work tests, and chest roentgenographic shadows suggestive of asbestosis.

(c) Records studies of morbidity and mortality patterns and trends in groups of workers with contrasting exposures to asbestos and other associated materials; also a search for common genetic or hereditary patterns relating to the disease.

(d) Analysis of selected post-mortem tissues of workers with work histories in industries having contrasting exposures to different forms of asbestos and other associated materials during and after periods of massive dust exposure. Also, studies must be conducted on workers in these categories who died from an exposure associated disease as well as those who showed no obvious indication of associated disease.

(e) Sputum study of asbestos workers to correlate and quantitate magnitude and duration of exposures with the occurrence of asbestos bodies.

(f) Study of contrasting population groups with respect to geographical areas, air pollution, employment patterns, etc., for presence of pulmonary ferruginous bodies; determine if these correlate with disease patterns observed.

(g) Study of ecological factors that may have a bearing on either the disease or be inter-related with causative agents, including community exposures.

Clinical and human pathology

(a) Comprehensive study of selected individuals with different patterns and progression of disease with respect to: (1) impaired pulmonary vascular circulation, both by tests of function and by angiography, (2) pleural thickening in reducing function, producing physical signs, altering roentgenographic patterns, and being a precursor of pleural tumors, (3) impact of viral infections on persons with asbestos exposures, (4) sites of pulmonary fiber depositions and injury, (5) immunochemical changes, (6) the nature of emphysema so often associated with asbestosis, . (7) the role of chronic bronchitis and other causes, and of pulmonary obstructive disease in altering the prognosis of asbestosis, (8) correlation between roentgenographic evidence of disease and the capacity of the cardiopulmonary system to fulfill its required function.

(b) Establishment of a mesothelioma case registery including uniform criteria for diagnosis; epidemiologic follow up of reported cases.

(c) Development of a uniform classification for reading chest roentgenograms of persons exposed to asbestos and other fibers; correlate roentgenologic patterns with clinical, physiologic and histological changes.

(d) Study to detect individuals who may be hypersusceptible, either on an acquired or a genetic basis.

Animal and tissue culture

(a) Determination of respirability, sites of retention, mobility, penetration and migration to other tissue, and clearance of pulmonary fibers in relation to their chemical and physical properties.

(b) Study of mechanism of formation and meaning of ferruginous bodies arising from respired pulmonary fibers from different sources.

(c) Study of the chemical and physical characteristics of various types of asbestos fibers, singly and in combination with other associated injurious materials and their capacity to give rise to different forms of cancer; evaluate additive,enchancing, or inhibiting action of fibers and carcinogens from cigarette smoke and other sources.

(d) Study of potential of pulmonary fibers as carriers of carcinogenic and other agents from lungs to other tissue sites.

(e) Development of dose-response data as an aid to developing safe exposure levels.

(f) Investigation into the effects of asbestos and other fibers, and of associated injurious materials, on cellular physiology, enzyme suppression, and genetic pattern.

(g) Study of immunochemical changes, biochemical tests, etc., that may further characterize the exposure-response pattern and serve as predicitive tests.

Chemical and physical

(a) Study of the positive identification of individual fibers, both in vivo and vitro; the nature and quantity of other contaminants such as minerals, metals, and oils associated with the fibers including mechamism of association.

(b) Study of solubility of fibers and associated contaminants in tissue fluids; relate to blood and urine levels of associated materials.

(c) Study of sources and indentification of respirable fibers responsible for ferruginous bodies seen in lungs and general population of non-asbestos workers.

DRAFT:
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