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UNITED STATES RUBBER COMPANY

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December 28, 1966

TO: S. J. Peele, Jr.
TAC, Winnsboro

FROM: J. H. Wolfsie, M.D.
Corporate Medical Director

SUBJECT: The Health Effects of Exposure to Asbestos

Murray C. Brown, M.D., Chief, Division of Occupational Health, Public Health Service, Department of Health, Education, and Welfare, convened a highly selected group to review and discuss the scope and status of on-going research, pointing out areas in need of further research and attention, and to summarize the state of knowledge on the health effects of exposure to asbestos. The meeting was held on December 7 and 8, 1966, at the Occupational Health Research and Training Facility, U. S. Public Health Service, Cincinnati. I attended as the representative of the United States Rubber Company.

Dr. Brown indicated that he would like to go before the Congress by March, 1967, with a projected national program of research, not necessarily governmental, on the biological effects of asbestos, this program to result from the discussions, comments and proposals of the participants of this meeting.

Various mineralogical, environmental, clinical, radiological, physiological, pathological and epidemiological studies were reported, mostly unpublished and in various stages of completion, as summarized below.

Dr. Lewis J. Cralley

The U. S. Public Health Service started an epidemiological study in 1963 to (1) study the effects on health of the three common forms of asbestos (chrysotile, amosite and crocidolite), (2) to establish criteria for safe levels

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of exposure and (3) to establish medical criteria. The study aims to include 10,000 workers, 2,500 in each of asbestos textiles, asbestos insulation, asbestos friction materials, and asbestos cement products. The groups will be followed until they get at least 25 years experience on these workers to include (a) detailed exposure data on fibers, trace metals, silica, radioactivity and polycyclic hydrocarbons; (b) health profile information on each individual; and (c) death certificate and other medical information. It will all be related.

They now have exposure data on over 7,000 workers and expect to start the medical information study by the summer of 1967.

Supportive studies now under way include (1) post-mortem tissue analyses on lung carcinoma cases (for trace metals, etc.), mesotheliomata, asbestosis, and the community (controls); (2) studies on defining the source and identity of respirable fibers, especially in post-mortem tissues; and (3) a record study of people employed in the asbestos industries between 1948 and 1951 on a profile of a group which moved from one exposure to another, as controls were established in industry.

They have found that industry is now different from before 1940 and exposures are now different qualitatively and quantitatively. They will present a paper at the American Industrial Hygiene Association meeting in Chicago next Spring, particularly on the role of trace metals (nickel, cobalt, chromium and manganese) which have been found in quite heavy amounts in association with asbestos fibers and whose role in production of disease cannot be ruled out at this time.

Dr. William S. Lainhart

A panel of radiologists is working out an X ray classification and criteria for asbestosis which may possibly be an extension of the I.L.O. classification for the pneumoconioses. It is not yet agreed upon.

It was remarked that there is a feeling that asbestosis in different countries is not the same.

Dr. Morris Kleinfeld

1. In a study of 220 talc workers (mines and mills) with a minimum of 15 years exposure (1940 to 1965, or prior),

there were 91 deaths. Ten of these deaths (11.0% incidence) were from carcinoma of the lung or pleura (a greater incidence over the expected) and seven deaths were from carcinoma of the gastrointestinal tract or peritoneum (not a greater incidence over the expected). The incidence of deaths from pneumoconioses and complications was 30.7%. Exposures were heavy prior to 1940, after which wet drilling was instituted.

2. A similar study involved 152 asbestos workers in New York (other than N.Y.C.), among which there were 46 deaths. Twelve of these were from carcinoma of the lung or pleura (a greater incidence over the expected) and seven deaths were from carcinoma of the gastrointestinal tract or peritoneum (a greater incidence over the expected).

Dr. Jan Lieben

An epidemiological study of mesotheliomas was conducted by examining the records in 152 hospitals in southeastern Pennsylvania, covering a population of over six million. Forty-two were found: ten in asbestos workers; eight in people who lived or worked within two miles of an asbestos factory; three in family contacts of asbestos workers; and eleven with no exposure data; and ten in individuals with a rather vague history of asbestos exposure. They were mostly pleural, also peritoneal, and some in both areas. All have died except two. This study will appear in the March 1967, issue of the Archives of Environmental Health.

Dr. Irving J. Selikoff

In 1963, his group began a study of insulation workers (Asbestos Workers Union; over 1,500 members; 95% examined) and they found an increased incidence of cancer of the lung in heavily exposed factory workers.

In an early study of 255 deaths in this group, which was greater than the expected number of deaths, there were 45 cases of cancer of the lung or pleura, 29 cases of cancer of the stomach, colon and rectum, and 12 cases of asbestosis.

There were 335 deaths as of August 1, 1966. Forty-two percent were from cancer, 7.2% from asbestosis, and 50.7% from all other causes. Eighteen and one-half percent died from bronchogenic carcinoma, 4.2% from mesothelioma,

11.0% from gastrointestinal carcinoma, 1.8% from upper respiratory carcinoma, 1.2% from bladder carcinoma, and 2.4% from generalized carcinomatosis.

They are doing physiological studies to try to find the earliest evidence of disease.

In a factory which closed in 1954, there were 1,000 men who had chest X rays. They are studying what happens after exposure stops, in this group. They are finding the same incidence of "asbestos bodies" in post-mortem lung examinations as Paul Gross did in Pittsburgh. However, he admits that he cannot say that it is asbestos. This is being done in three hospitals in New York City in which autopsy specimens from the pleura and lungs are obtained on all deaths, and they are looking for "asbestos bodies" and/or mineral fibers of any kind on ashed material, which they are attempting to correlate with the pathologic findings.

Indirect occupational exposures are being studied in two trades in the building industry, who are working with insulation workers.

They will study all people living within ½ mile of an asbestos plant.

In Dr. William E. Smith's laboratory, animal studies are being done on pathogenesis.

They are also studying trace elements (nickel, iron, chromium and cobalt) in the lungs of all deaths among asbestos workers.

Also, they are checking the relationship with cigarette smoking.

Dr. Thomas H. Milby (reported by Dr. I. R. Tabershaw)

A survey has been going on the past six months, involving five asbestos mines and mills in California (all chrysotile) which began operations within the past five years and which employ 200 people (½ in 1 plant). They found dust concentrations well over the threshold limit values in some, ten times in some instances, although one or two were alright. There have been no cases of asbestosis to date. There was a lack of interest by management in most of them, medical programs were poor generally, and the plants were not designed for dust control.

Dr. Irving R. Tabershaw

He and Dr. W. Clark Cooper, for about the past one year, have been conducting a clinical and environmental evaluation of asbestos insulation workers, via their union, in the San Francisco Bay area. There are 600 men in the local union (2,000 in West). Have had yearly chest X rays since 1958, on a voluntary basis, with 85% response. They have a group of 3,000 who had an intense exposure during the War and none since. Exposures are mostly to amosite, with some crocidolite. They are also exposed to fibrous glass and other materials. The use of asbestos is increasing.

They find that X ray findings and symptoms are correlated with length in the trade. About 25% show some changes in the lung or pleura on X ray, which are consistent with the length of exposure. Many with long exposures have no findings.

Exposures are heavy in prefabrication, in tearing out old insulation and in mudding.

Impinger counts show that threshold limit values generally have not been exceeded in most cases. However, on millipore counts they find greater exposure, and most fibers are less than three microns in diameter and therefore respirable.

In pathologic studies involving lung smears of consecutive autopsies, they find the same incidence of "asbestos bodies" on the West Coast as others find elsewhere.

In sputa studies in asbestos workers, close to 40% show "asbestos bodies".

Mesotheliomas are being studied.

Dr. E. Cuyler Hammond

An increased incidence of gastrointestinal cancer, mostly in the rectum and colon and a sclerosing adenocarcinoma, was found in their (Dr. Selikoff's group) study and in other studies.

He is not certain that there is a relationship to asbestos exposure but emphasizes that it should be pursued.

In Dr. William E. Smith's laboratory, hamsters were fed asbestos but did not develope gastrointestinal cancer.

Dr. Kenneth W. Smith

Different types of asbestos cause different types of disease in humans. He emphasized that we should define our terms strictly with regard to the type of fiber or fibers being used.

In insulation, amosite fiber is mostly used, although Canadian chrysotile is coming in.

They are doing a study of lung sections, trying to identify the type of fiber (s) causing disease in humans. Upon completion, results will published.

They have an active program with brake lining dust to see if it is possible for it to become air-borne.

He indicated they have over 20,000 people who are available for study.

Dr. J. H. Wolfsie

The nature of our epidemiological and clinical study at Hogansville was beiefly described. No findings were given, but the group was told that the collected data will be analyzed and it is expected that the results of this study will be published.

Dr. C. C. Blackwell, Jr.

He represents a manufacturer of friction materials. They have a complete medical program for workers, including X rays, and he maintained they had no health problems related to asbestos.

Dr. George W. Wright

The asbestos producers in Quebec, who produce most of the asbestos fiber in the free world, have formed an Institute of Occupational and Environmental Health in Montreal. Dr. Wright is chairman of its Scientific Committee.

They will get together in a filing system information on asbestos and related fibers and health. They will engender research, encourage the development of new knowledge, review research proposals and attempt to get money for same.

Dr. McDonald

On a grant from the Institute of Occupational and Environmental Health, Montreal, an Asbestos Research Unit was established at McGill University to study the role of chrysotile fiber on health. Twenty-seven thousand workers will be traced (2,000 with at least 25 years exposure to chrysotile at Thetford) to find what happened to their health. Six thousand to seven thousand of these are currently employed.

X rays will be classified (annual for minimum of 20 years) and related to exposure and fairly extensive pulmonary function surveys will be done. This will take three years.

Dr. P. Cartier stated that in Thetford there is 2 to 5% free silica in the ore underground and less than 1% in the mill. Dr. K. Smith stated that at the Johns-Manville mine 65 miles away, there is less than 0.1% free silica in the ore.

Dr. J. Churg

In the pathological recognition of mesotheliomata, criteria include (1) spread on the mesothelial surface of the pleura or peritoneum; (2) no other primary site; and (3) a characteristic histological pattern. It is in the third criterion that there is no good agreement.

These growths vary in their ability to produce mucopolysaccharides which are removed by hyaluronidase.

There is a panel working on the pathological classification of asbestosis.

Dr. Paul Gross

Using chrysotile asbestos dust in inhalation chambers, a three year study on three species is being completed at the Industrial Hygiene Foundation. Primary lung cancer was found in 14% of rats that survived 15 months or longer. (No cancer was found in hamsters or guinea pigs). This is the first time that this is reported for chrysotile, with one exception, mesothelioma found in an animal heavily exposed to chrysotile. Of the 18 cancers (this 14%), there were ten adenocarcinomas, two squamous cell carcinomas (one also had an adenocarcinoma), two alveolar cell carcinomas, one mesothelioma and four reticulum cell sarcomas which originated in the alveolar wall.

Since cancer was not found by other investigations in similar studies, it was wondered why it occurred in the above study. The chrysotile dust for this study was produced by a hammer mill, and it was thought that perhaps the asbestos dust contained added trace metals from the steel alloy of the hammer mill. On analysis by the Public Health Service, considerable amounts of nickel were found in the above dust. This raises the possibility that the carcinogenicity may be related to an adventitious material rather than to the chrysotile dust.

There is a feeling that the "asbestos body" in the lung is probably a non-specific effect. The term "ferruginous body" is proposed in its place because it is an iron-containing body. In testing other fibrous materials in animals, so far they found in the lung bodies with a beautiful iron reaction and club-shaped ends following exposure to aluminum silicate and glass. Silicon carbide gave a segmented body, but there was no coating giving a positive staining for iron. Studies with additional fibrous materials are in progress.

In animal studies to determine whether the shape of the particle (a fiber is considered a particle which is at least three times as long as it is wide) is related to fibrogenicity and carcinogenicity, filamentous materials other than asbestos are being used. So far there is an inert response (no collagen formation).

To test the hypothesis that fibrogenicity and carcinogenicity in chrysotile is not in the magnesium silicate fiber per se, synthetic chrysotile was injected intratracheally with a completely inert reaction. There was no fibrosis in the animal such as is found from natural chrysotile.

In using natural chrysotile rid of benzopyrene and hydrocarbons by heat and rid of trace metals by a chelating agent or by aqua regia, so far the studies indicate that it is still fibrogenic, although this is only preliminary.

Nickel, chromium, cobalt and manganese will be added alone and in combination to synthetic chrysotile and will be injected intratracheally into animals. As controls, benzopyrene will be added.

Specially prepared glass dust (the industrially produced material by and large is not respirable) alone and with binders (phenol-formaldehyde resin and starch binder) will be injected intratracheally.

The above chrysotile studies will also be done with amosite and crocidolite.

An investigation of the nature of the ferruginous body will be done by (a) electronmicroscopy of the development of the body in hamsters, in which it is produced very readily, by sampling animals at intervals and by (b) isolation of the bodies from lungs in the general population from autopsy material, concentrating them, and subjecting them to microprobe analysis to analyze for the central filament.

Dr. Spiel

In Johns-Manville studies, so far no benzopyrene has been found in Canadian chrysotile.

Studies will be done on the physics and chemistry of different forms of asbestos.

Dr. William E. Smith

Tumors produced from asbestos in animals have been transplanted into leg muscles. They metastasize to lungs.

Dr. Forde A. McIver

In inhalational chrysotile asbestos studies over many years and involving several species of animals, no cancer was found except one carcinoma of the lung in a dog. They used 150 m.p.p.c.f. in all studies. They will also study amosite and crocidolite.

Dr. Paul Cartier

Medical data has been collected for the past 21 years at the Thetford Clinic.

Pulmonary tuberculosis, which was considered a problem from 1940 to 1948, is no longer a problem in the Thetford Mines. He considers that this was a socioeconomic problem and was not related to exposure to asbestos.

Dr. Benjamin G. Ferris

In a study of laggers in shipyards, it was found that 40 to 60% of those working over 20 to 30 years have asbestosis. No cancer was found. Exposure was to amosite. It is Dr. Ferris' opinion that asbestosis occurred after

exposure to 50-60 m.p.p.c.f. years, which is the same observation that was made by Dr. John G. Wells of Newnan, Georgia, who has been conducting the studies on our Asbeston employees in Hogansville.

Dr. Arthur J. Vorwald

Of air collected and monitored from a city street in Detroit over the past six years, collected particulates are being studied. As yet, no fibers were found under light microscopy. They will do electron microscopy.

In this same study, rats, guinea pigs and rabbits exposed for three to six years to this same "street" air, are being studied for the presence of ferruginous bodies and fibrous materials in the lungs. In the white rat, so far they have not found ferruginous or asbestos bodies.

Using injection and inhalation techniques, hamsters, rats, guinea pigs and rabbits will be exposed to chrysotile, amosite and crocidolite obtained from Johns-Manville. They are doing physical and chemical analysis of them. The materials will be injected intrapleurally, intraperitoneally, intratesticularly and subcutaneously in the four different species. In inhalation studies, the same four species will be exposed to atmospheric concentrations of the fibers in large rooms, one room for each of the three fibers.

Dr. Ben Felson

The tentative radiological classification for asbestosis used in the USPHS asbestos chest studies was described.

It was shown that the ILO classification for pneumoconioses will not work for asbestosis. Additional items were added (for asbestosis) to the USPHS modification of the ILO classification.

J. H. Wolfsie, M.D.

/dcw

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