JOHNS-MANVILLE RESEARCH AND ENGINEERING CENTER

Date November 14, 1967

File 259

MINUTES: ASBESTOS ENVIRONMENTAL PROGRAM

Meeting with Dr. Arthur Vorwald and Associates
Wayne State University - November 1, 1967

General:

The meeting was arranged by H. M. Jackson for an efficient interchange of information between Johns-Manville and Dr. Vorwald. Attending from Wayne State University were:

Dr. Arthur Vorwald	-	Head, Environmental Medicine Laboratory
Dr. Ralph Smith	-	In charge of chemical and physical techniques for the laboratory
Mr. Ken Mikel	-	Performs all petrographic and electron microscope work

Attending from J-M were:

H. M. Jackson	C. L. Scheckler
F. L. Pundsack	D. Bailey
S. Speil	G. Reimschussel
W. C. Streib	T. Weeks
E. M. Fenner	

The agenda, attached, was followed, except for omission of the facilities tour.

The subject matter presented by J-M personnel was, in general, the same as that presented at the meeting with Drs. Cralley, Keenan, and Gross on July 6, 1967 (see Minutes of July 13, 1967).

Summary:

This meeting fulfilled its main objective of acquainting J-M personnel with the work at Wayne State University and vice versa. It gave J-M people a much more vivid understanding of carcinomas; it gave Wayne State personnel a much better understanding of the differences between different types of asbestos, as well as different types of chrysotile. It was agreed that W. C. Streib would send approximately 1 lb of clean, crude fiber to Dr. Vorwald for use in some of his injection studies. It was suggested that a program should be initiated to observe the chemical behavior of various asbestos fibers in blood serum at room temperature, as well as in pleural fluids and saline solution.

Presentation - General Details:

W. C. Streib - Discussed the types of fiber and major sub-divisions of chrysotile, and reviewed physical properties. He discussed differences in associated impurities of Canadian, Rhodesian, and Arizona fibers, and reviewed the significance of harshness, describing its effect on various processing parameters and uses.

F. L. Pundsack - Reviewed the general formation and geological occurrence of Canadian chrysotile in the serpentine belt.

G. Reimschussel - Reviewed chemical and physical characteristics of chrysotile and described the structure of chrysotile and amphiboles. He also elaborated on the modes of occurrence and contents of nickel, iron and other trace elements. Later in the afternoon, he described the program on identification and determination of benzo(a)pyrene in chrysotile and other asbestos materials.

T. Weeks - Reviewed his study of adsorption of various organic species on chrysotile, both from the liquid and vapor phase.

D. Bailey - Presented and described a series of photomicrographs and electron micrographs of several forms of asbestos, reviewing the differences involved. He described the decomposition of chrysotile in the Spex Mill, and compared the observed results with the dust obtained from brake lining decomposition studies.

Dr. Vorwald was the spokesman for the Wayne State personnel. He gave a lucid explanation of the detection and formation of lung carcinoma, and of pleural mesothelioma. For most of the J-M attendees, the color pictures which he presented enhanced considerably our understanding of the phenomena which we had not fully grasped from verbal and pictorial representations heretofore.

Vorwald started his discussion by pointing out that the ferruginous coating on "asbestos bodies" constituted a protective attempt by the body. He noted that in some cases decomposed tissue or even corpuscles might resemble a so-called body.

He noted the possibility of geographical or other environmental factors having a significant effect on the frequency of carcinoma incidence, e.g., the relatively low incidence in the asbestos area in Quebec.

He then proceeded to show a series of chest X-rays of a case which was diagnosed as carcinoma, clearly pointing out the light spots in the film which were evidence of cancerous growth and showing how sometimes carcinoma could be improperly diagnosed as an abscess. This was followed by a picture of the total cancer and with a series of microscopic sections taken at different magnifications, and finally a section with excellent examples of ferruginous bodies, both dumb bell and segmental. He then showed the structure of the lungs, indicating how the cancer had penetrated, and further explained the diagnosis of emphysema as a fibrotic condition where the alveola walls had become extremely thin or ruptured. He questioned the proof that there is necessarily a causal relationship between the presence of "asbestos bodies" and carcinoma.

Vorwald then showed a second series of pictures describing pleural mesothelioma. In the case of pleural mesothelioma, the pleural cavity around the lung is more or less completely filled with a tumor whose growth may finally be fatal. Usually there are few, if any, fibers found in this area. One of the problems is to explain how fibers in the lung can cause the tumor without contact. Is it possible that extremely fine fibers can find their way through the lining, or that eluted material or ions can penetrate?

Vorwald indicated that there has been no known relation between silicosis or either mesothelioma or carcinoma. He wondered whether the presence of minute amounts of silica with the asbestos might be synergistic in some unknown manner.

Vorwald then went into a detailed explanation and series of pictures describing his laboratory facilities for studying animals by inspiration of fiber or other dust materials. He described the set up wherein for a period of years approximately 14,000 cu ft/minute had been aspirated into a large duct system over the heavily traveled road at St. Antoine Street in Detroit. This air had been ducted into a series of cages in which various animals had been exposed. Despite the dirtiness of the air, both from particulates and fumes, there had been no statistically significant effect on the animals involved.

The laboratory now contained one generating room, and three exposure rooms, each approximately 10 x 13 ft. The generating room was used to feed fibers, as desired, into individual duct systems for each of the three rooms. In a current series of tests, crocidolite, chrysotile, and amosite, respectively, were fed into each of the rooms. In the rooms the air entered from one side wall through a diffusion panel with large holes and exited on the other side. Cages were moved at frequent intervals to insure uniformity of exposure for rabbits, hamsters, rats, and guinea pigs. In addition to the exposure rooms, the laboratory was equipped with a variety of stainless steel exposure chambers. One type of exposure chamber, costing $6,000 each, was used for larger animals, such as monkeys. Another type, less expensive, was rectangular with glove ports and used primarily for exposure to vapors. In many cases, a nose injection system was used to expose a large number of animals. This was preferred to intratracheal injection. Monkeys had been trained to smoke. Dr. Vorwald described a Faraday Cage System for electronic evaluation of breathing at various stages of the exposure using a multi-channel recorder.

The study of exposure to asbestos, sponsored by the U. S. Public Health Service, was furnished fiber by J-M through Hugh Jackson. The fibers included a 3-grade chrysotile, amosite, and crocidolite. These fibers were prepared by Ken Mikel in a variety of ways for different studies. For injection studies, small quantities of fiber were mixed in a Waring Blender in a thick slurry from 1 to 15 minutes. The fiber length of the chrysotile was 20 microns; the other fibers were usually smaller. The materials were then dried at 50C and ground by hand in an agate mortar and pestle for 15 minutes. In interperitonal and interpleural injections, the first experiments utilized 50 mg/cc, later reduced to 20 mg/cc. Intratracheal injections utilized 10 and then finally 5 mg/cc.

In these animals, fibrosis has been noted in many cases after one year (intratracheal and 8 months (inhalation) studies. No readily identifiable carcinoma has yet been identified from the chrysotile samples. In the case of the rats injected with amosite, there is a single carcinoma evident after one year.

A rather unusual system was devised for preparing fiber for aspiration studies. At first, the material was fed through a hammer mill directly into air lines to the exposure rooms. However, for some reason (unknown to us) the mill lost hammers and, therefore, this method was discontinued. It is our understanding that this method has been, and is now, used by Dr. Gross.

Mr. Mikel then set up a 55-gal steel drum with steel brushes placed inside axially, but not touching the circumference of the drum. Fiber was placed in the drum and the drum was rotated breaking down the fiber. This material was then fed by a small extrusion feeder into a vertical plastic pipe, conveyed upward by compressed air introduced at the bottom of the pipe, and over into the individual exposure rooms. The compressed air came from an oil-free unit. Apparently the vertical pipe acted as a type of air separator, because the coarse material dropped to the bottom of the system and was removed periodically. The average of the material entering the exposure room was as follows.

	Chrysotile	Amosite	Crocidolite
Diameter, microns	0.1	0.3	0.3
Length, microns	8 - 12	3	4

No analytical work has yet been performed on these fibers. We would anticipate considerable pickup of trace metals, and this is surprising since at several points during the discussion Dr. Vorwald had pointed out the possible importance of trace metallic constituents. Within a short period, analytical work will be started on the original fibrous material, the fibrous material in the room, and also on lung sections.

The concentration of fiber in the exposure rooms was 48 to 55 mg/cu meter for an exposure period of 4 hr/day and 4 days/week. This is a very high concentration and leads to questions concerning the concentration effect vs the time effect.

Dr. Vorwald summarized his talk by a series of rhetorical questions indicating the lack of fundamental information on many aspects of the asbestos environment problem.

1. What is the effect of sizes and of concentration of fibers?

2. Do the fibers adsorb some contaminating factor from the air?

3. Once the fiber enters the body, how is it effected by tissue fluids or pleural fluids?

4. Should we perform experimental studies of the leaching effect on fibers by pleural fluids, by distilled water, by saline solution, or blood serum?

5. Should we start tissue culture studies to determine (outside of the body) effects of fiber on tissue?

6. What size fiber can be enclosed by a phagocyte for effective removal?

7. What changes occur in the fiber over a period of time?

8. What is the effect of the type of fiber involved; of the mineralogical species; of sub-species?

9. How does the size of the fiber really control the travel of a fiber as it enters the body?

10. Finally, how can we more exactly identify fibers and particles which are found in the lung and its surroundings?

Although Mr. Mikel had made a vast number of electron micrograph and microscopic observations on the dust and dirt obtained through the outside duct system, it was obvious from our discussion that his understanding of fiber morphology left much to be desired.

I discussed privately with Dr. Vorwald what phase of the J-M information at this meeting was of most value to him, and would be of most benefit to medical people involved in this type of work. He indicated that the discussion of physical and chemical properties of the fiber at ambient temperatures was exceedingly interesting; he was particularly impressed with the explanation of differences of amphiboles and chrysotile, and between different forms of chrysotile from a variety of location as well as from adjacent locations. He felt that most medical people did not realiz that these differences existed and tended to categorize asbestos minerals as a singl group with even many sophisticated experimenters not realizing the physical differences between chrysotile fibers from different areas.

SSpeil

S. Speil

SS/rs

Attachment

cc: Dr. George Wright

H. M. Jackson, DH
K. V. Lindell, Asb
A. C. Smith
F. L. Pundsack
W. C. Streib
E. M. Fenner
J. P. Leineweber