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TO D. J. Peters

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FROM R. R. Cole

SUBJECT Summary of Asbestos Meeting at NBS on July 18-20, 1977

This comprehensive 3-day Seminar on asbestos and asbestos type materials can basically be broken down into three parts. The first section dealt primarily with the mineralogical facts of asbestos. The second section was the epidemiological aspects of asbestos, and the third section was the analytical techniques and analysis of asbestos.

The mineral aspect was covered by four speakers and dealt primarily with 3 to 1 aspect ratios of length to diameter, and in crystalline structure, tetrahederal arrangement and the various metals present in a specific type of asbestos material. One of the interesting points that came out in this part of the discussions was the fact that fragments would meet the 3 to 1 aspect ratio but would not be an asbestos type material. Basically, asbestos was considered as chrysotile in the serpentine group and in the amphibole group was crocidolite, amosite and anthophyllite asbestos, tremolite asbestos and actinolite asbestos.

It is interesting to note that the anthophyllite, tremolite and actinolite do have a non-asbestos form whereas the chrysotile, crocidolite and amosite in a non-asbestos form is renamed antigorite, riebeckite and cummingtonite, respectively. Aside from the actual chemical structure of the inorganic compound, Dr. Malcolm Ross from the U. S. Geological Survey in Reston, Va. gave a long dissertation on any rock type east of Frederick, Md. would contain some asbestos form material. He did give a direct reference of actual shutting down the earth due to this asbestos problem and spoke very specifically and directly on the Rockville problem. His goal at this meeting was to find out what is the Health Department's stand on asbestos, what do they define as asbestos and what is the toxicity of it. Dr. Ross, after his presentation, went into a general type discussion and was questioned from the floor by Dr. White, who is an assistant under Neil Solomon from the State of Maryland. Dr. White's main concern was the necessity of Maryland's emergency procedures. Dr. Ross maintained that it is no problem and he felt that the State of Maryland was over-reacting. Dr. White appears to be looking for justification of his Department's stand on the proposals that Maryland published.

The epidemiological and pathophysiology had a good cross-section in the Mt. Sinai group: Dr. Nicholson and Dr. Langer (Dr. Silokoff was not there), Dr. Bignon from Paris, France, who were basically anti-industry; Paul Kotin from Johns Mansfield who was pretty strong pro-industry; Dr. Merrill Eaton from the National Cancer Institute made a good neutral presentation as did Clark Cooper who is from Equitable Environmental Health Inc. from Berkley, California.

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Dr. Nicholson from Mt. Sinai started his presentation and basically condemned the two fibers per millimeter standard and referred to it as a no confidence level. The insulation miners are exposed to only six fibers per millimeter and came down very heavily with pneumoncosis, fibrosis and lung cancer. Dr. Langer followed through and claimed that .25 micron diameter particles and very small length could penetrate through the lungs and be filtered out and settle in the lymph nodes and gastro-intestinal areas. The interesting aspect here is that Dr. Silokoff's group, which included Nicholson and Langer, surely must have looked beyond the lung and lung cavity for asbestos. No reports are given directly from Silokoff's group on this and they just referenced Dr. Bignon's work. This came out initially at the NIH hearing which was held in Bethesda, and then again with this NBS hearing.

More rational statements made on the medical aspect were that there should be different parameters for short fibers vs. long fibers for different diameter ~~sight finders~~. There is a difference in toxicity between chrysotile and amosite, etc. Dr. Koten specifically pointed out that the size and shape of the fiber is critical as is co-carcinogens such as smoking. The size beyond determining the biological effect also has something to do with whether the material can become airborne or be ingested. It has to be greater than 3.5 microns in diameter and between 5 and 200 microns in length. Shorter fibers are removed from the lungs the macrophage. Long fibers can be filtered out of the air by the nose may never find their way into the lungs. Dr. Stanton from the National Cancer Institute verified Dr. Koten's remarks by saying the diameter must be less than 2.5 microns in diameter and a length greater than 8 microns. It appears from these gentlemen's remarks that the fineness of the diameter is extremely critical. Dr. Stanton maintains that lung cancer can be caused from polycyclic hydrocarbons or heavy metals, not only asbestos.

The next medical section was on Oral Ingestion of Asbestos. In samples that were ingested in mice via water, a 50 mg/l solution, 10% of the fibers were greater than 5 microns. A number of fibers were found throughout the body such as the liver and kidneys. 85% of airborne samples were less than 5 microns in diameter.

The next speaker was a gentleman from Connecticut where they do have a mass standard for asbestos fibers of 30 nanograms per cu. meter. They measure through a low volume sampling system which is set up at toll booths along I-95 basically to trap and test the brake linings, clutch linings, etc 2% of the fibers that are airborne are greater than 5 microns. The rest are 5 microns or smaller.

Under the analytical methods section, there were a number of analysis mentioned. Basically, they included the transmission electron microscope, the scanning electron microscope, electron defraction methods, atomic absorption, light microscopy, differential thermal analysis and thermogravimetric analysis. All mining areas of the United States contain asbestos-like material if we apply the 3 to 1 ratio. The concept of cleavage fragment vs. bonafide fibers became an interesting aspect of discussion among the various speakers and really came to the surface in cross-questioning. Health parameters should be considered. These were primarily the level of concentration, the type of fiber, the fiber morphology, the trace metals present, the trace organics present, the surface reactivity of the fiber, and co-carcinogens that are present.

Also mentioned was that most fiber counts would be low because they are obscured, and 98% of the mass was in 10% of the fibers from the Rockville sample. So a mass standard was totally discounted by most of the participants. Two of the speakers in this section came straight out and said that tremolite asbestos is extremely rare in North America and the slides shown in their presentations were from Alaska and Italy. Dr. Krouse from the Colorado School of Mines spoke on the "Misidentification of Asbestos in Talc" and, basically, pointed out that the atomic absorption peaks of tremolite and chlorite are very close to amphibole asbestos, etc. EPA has been sampling asbestos since 1969 and report the results as a mass standard. On a national average, they have recorded 2.6 nanograms per cu.meter. Some interesting points came from ASTM-E4 pointing out inter-laboratory variance. Also ASTM E34 Committee commented that thin fibers are more toxic than thick fibers. An occupational standard, a mining and Milling Standard and an end use standard should be different. Respirators are useful for intermittent use. They refer to an aspect ratio of 5 to 1 and a minimum of 5 microns. The U. S. Steel contingency said that the fragments are distinct from the fibers and can be isolated, and claimed that in the filters very long fibers are lost because they are imbedded. They are presently indexing the X-ray defaction patterns of many different fibers, which they said would be available to anyone who would request them. They pointed out the autopsy of an amosite worker with particles in the lungs exhibiting 20 to 1 and 100 to 1 aspect ratios. e ambient air would normally yield 2 to 5 micron particles. They posed a definition of a fiber which would give an aspect ratio of 10 to 1 of parallel sides and at least 2 microns in length.

During the part of the Workshop that was dedicated to the regulatory agencies, the speakers went with the 2 fibers per millimeter at 3 to 1 aspect ratio, and a minimum of 5 microns in length. MESA also has suggested that any particle or any fiber that meets this parameter shall be considered ~~par~~carcinogenic which drew some adverse remarks from the floor.

Mr. Robert Mehir from CPSC used Mt. Sinai's results in his risk assumptions and is considering requiring manufacturers to repurchase fireplace logs and ashes due to asbestos content. The remainder of the speakers went on expanding on their analysis methods or the justification of parameters that they felt were necessary to protect health. There was one doctor from Fairleigh Dickerson College who could not induce mesothelion in hampsters with short fibers; that is, if they were visible in an optical microscope, he was successful. If he could not see them with the optical microscope, they would not.

Taking the Seminar in its entirety, it was an exhaustive investigation into a problem which no one really knows the answers. The most promising aspect of the whole Seminar is that the questions did surface and those

concerned do have some direction or some idea of where the problems do lie. As far as regulatory agencies and toxicity health aspects, these are the unanswered questions which should be pursued and hopefully resolved. Due to the competitiveness or the polarity of the participants, I think some of the politics are going to have to be ironed out before any significant gains are going to be realized.

Dick