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Scientific Research Staff

Intra Company

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Subject: Visit to Mount Sinai School of Medicine re: Ford Grant for Asbestos Toxicology Research

The Environmental Sciences Laboratory of the Mount Sinai School of Medicine (The City University of New York) received a Ford Motor Company grant of $5,000 for the academic year 1972-1973 in support of their research program on asbestos toxicology. On March 27, 1973, I visited their laboratory to review the status of this work. The discussion was held exclusively with the main investigator, Arthur M. Langer, a Ph.D. in mineralogy.

The work identified as being supported by the Ford grant is the examination and characterization of brake drum dust with respect to the physical and chemical nature of both the fibrous and non-fibrous components. Dr. Langer examined samples of the drum dust from a 1969 Dodge Dart at a mileage of 20,000 miles. While asbestos fiber was not visible by polarized light microscopy, nor was chrysotile identified by X-ray diffraction, an appreciable amount of what appears to be asbestos fiber was observed by transmission electron microscopy at magnifications in the range of 3800-20,000X. I was given some photomicrographs of these samples and observed some directly. A copy of an informal interim report prepared by Dr. Langer is attached.

While no quantitative determination of asbestos content was attempted, the appearance of appreciable amounts of fiber in drum dust is in sharp disagreement with electron microscopic observations previously reported in the literature (J. R. Lynch, "Brake Lining Decomposition Products," Journal of the Air Pollution Control Association, Vol. 18, December 1968, pp. 824-826), and with our own previous observations of drum dust, although some other investigators have reported observing as much as 1 to 3% asbestos in drum dust by optical microscopy or X-ray diffraction. The result is also greatly different from the results of our examination of airborne brake wear dust, in which we found very little asbestos. Since it is desirable to determine the reason

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for these differences, I am sending to Dr. Langer, for comparison in his laboratory, a sample of drum dust in which we had seen little asbestos, and samples of millipore filter from our airborne disc brake wear dust experiment for him to compare airborne dust with drum dust. Samples of these filters had previously been sent to Dr. W. Nicholson at the same laboratory, and he had indicated that the asbestos content was not inconsistent with what he would expect for ordinary urban air samples, although he did not provide any quantitative results.

Dr. Langer plans to examine dust from different kinds of brakes and sizes of vehicles and at different mileages. He plans initially to characterize the fiber components and look for chemical and physical changes in the chrysotile brought about by the braking action. He also intends to characterize the other components in the wear debris.

The Environmental Sciences Laboratory of the Mount Sinai School of Medicine is carrying out a competent and useful study and it is recommended that their grant be renewed for the next academic year.

R. L. Gealer
Chemical Engineering Department

RLG:ao

Att.

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STUDY OF BRAKE-DRUM DECOMPOSITION PRODUCTS - September 1972 - March 1973

Brake-drum dusts were obtained and examined by polarized light microscopy, x-ray diffraction and by transmission electron microscopy. Examination by polarized light microscopy failed to disclose the presence of fibrous components. Few crystalline materials were present as indicated by the lack of birefringence on observed particles. These same materials were subjected to x-ray diffraction analysis. No serpentine peaks were visible (chrysotile). However, some strong quartz lines were observed as well as lines which compared with an iron phase. These dusts were prepared for transmission electron microscopy by sonification in distilled water and pipetted onto formvar coated 200 mesh EM grids. These were carbon coated and examined. Bundles of short chrysotile fibers are the predominant identifiable phase. Many other components are also present, but their identity is presently unknown.

On the basis of preliminary results we observe the following: the fiber present in brake-drum dusts are in the main too small to be resolved by light microscopic methods; most of the additional phases are either non-crystalline, or too small to show characteristic birefringence; X-ray diffraction is too gross a technique to characterize a brake dust for the presence or absence of chrysotile fiber; transmission electron microscopy should be used to determine the presence of fiber. Many fibers and fibrils are present in brake-drum dusts.

Some preliminary selected area electron diffraction studies show the

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presence of some clay phases in the brake dusts. The other phases must be characterized both on a morphological and a micro-chemical basis.

A study of the available literature on the thermal and physical reduction of chrysotile indicates that the brake dusts are likely composed of a mixture of: chrysotile; partially dehydroxylated chrysotile, dehydroxylated chrysotile; forsterite, enstatite, and silica in the form of amorphous silica or a recrystallized phase. The biological activity of brake dusts and their components should be further studied. The nature of the decomposition products should be studied in detail as well.

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