PLAINTIFF'S EXHIBIT

ASA-651

ASARCO

MOV
RDP
DAR
LDW
SGC
SDB
RCM
DLW
WCF

Department of Environmental Sciences

M. O. Varner
Manager

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Asbestos - Gen'l.

Mr. K. W. Nelson
New York Office

The following is a discussion on asbestos that you requested. The majority of the information was obtained from: the NIOSH Criteria Document on Asbestos (1972); the NIOSH Revised Recommended Asbestos Standard (1976); and the NAS Biologic Effects of Atmospheric Pollutants - Asbestos (1971).

I. SHORT HISTORY OF ASBESTOS TOXICITY STUDIES

The widespread industrial use of asbestos started about 1880. The first recorded case of asbestosis was reported by Murray (1906) in England. Mills (1930) reported the first case of asbestosis found in the United States. Cooke and McDonald (1927) gave the first complete description of asbestosis.

The first suspicion that asbestos exposure may be associated with lung cancer was made by Lynch and Smith (1935) who reported on a textile worker with asbestosis and lung cancer. Merewether (1947) reported on an increased incidence of lung cancer associated with persons who had died of asbestosis as compared with those who died from silicosis. Doll (1955) presented epidemiologic evidence that asbestos textile workers had an increased risk of lung cancer.

Table III-1 and III-2 from the NIOSH Criteria Document (1976) showing lists of human population studies are attached for your information.

II. HISTORY OF THE DEVELOPMENT OF ASBESTOS STANDARDS

The first standard for airborne levels of asbestos was proposed by Dreessen in 1938. This standard called for a dust concentration of 5 mppcf as determined by the impinger technique. The ACGIH adopted 5 mppcf as the TLV for asbestos in 1946 and this limit remained in effect until 1970. In 1968 and 1969 the ACGIH announced intentions to lower the standard to 2 mppcf or 12 fibers/cc >5μ in length. In 1970 and 1971, the ACGIH proposed a lower limit of 5 fibers/cc >5μ in length and this was adopted in 1974.

Meanwhile, the OSHAct became effective in April 1971 and the ACGIH TLV of 2 mppcf or 12 fibers/cc was adopted as the interim OSHA standard. In December 1971, a temporary emergency standard for asbestos was adopted by OSHA as the result of an AFL-CIO petition. This was the first comprehensive health standard issued by OSHA and in addition to air limits of 5 fibers/cc >5μ in length (8-hour TWA) and 10 fibers/cc >5μ in length (15 minute ceiling), methods of compliance, employee monitoring, medical examinations, employee training and recordkeeping requirements were also instituted.

In June 1972, OSHA promulgated their final asbestos standard which is still currently in effect. In addition to the aforementioned work practice requirements, the emergency standard air limits of 5 fibers/cc--TWA and 10 fibers/cc--ceiling remained in effect until July 1, 1976 when they were automatically lowered to 2 fibers/cc--TWA and 10 fibers/cc--ceiling.

In October 1975, OSHA proposed a new asbestos standard with air limits of 0.5 fibers/cc--TWA and 5 fibers/cc--ceiling. Not to be outdone, NIOSH, in December 1976 proposed air limits of 0.1 fibers/cc--TWA and 0.5 fibers/cc--ceiling. Neither of these proposed limits have been promulgated as yet.

Appendix B from "Asbestos, An Information Resource," which summarizes the requirements of OSHA's promulgated and proposed standards is attached.

III. SAMPLING AND ANALYTICAL METHODS

The current OSHA standard specifies the sampling and analytical method to be used for airborne asbestos samples. Basically the method consists of the following steps:

1. Drawing the workroom air through a membrane filter (open-faced) at approximately 2 liters/min. for a specified time period (15 minutes to 8 hours).

2. Cutting a wedge-shaped piece from the filter, mounting it on a microscope slide and rendering the filter transparent.

3. Determine the average number of fibers (>5μ long) in a specified area using phase contrast microscopy (400-450X). The standard method specifies that at least 100 fibers total should be counted, however, a minimum of 20 microscope fields will be counted even if the 100 fiber count is reached before 20 fields are counted. Also, a maximum of 100 fields will be counted, even if the 100 fiber count is not reached. This method also indicates that all particles that are longer than

> 5 microns are to be counted, as long as they are over 3 times as long as they are wide. This method cannot differentiate asbestos fibers from other fibers that may be present on the same sample nor can it positively differentiate true fibers from long narrow particles.

Although transmission electron microscopy (TEM), selected area electron diffraction (SAED) and energy-dispersive X-ray (EDX) are useful techniques for mineralogical identification of fibers, they are not absolute identifying methods as shown by the following quote from the 1976 U.S. Bureau of Mines publication "Asbestos Minerals and Their Nonasbestos Analogs."

> There presently is no absolute way to distinguish between asbestos minerals and their nonasbestos counterparts in the micrometer-size ranges when their morphological differences are absent. Their average crystal structures, chemical composition, and individual fragments, either by cleaving or naturally occurring single crystals, are essentially similar. Although minor variations occur in their structural and chemical makeup, they cannot be differentiated by either TEM, SAED, or EDX techniques alone. Discrimination of naturally occurring asbestos from the nonasbestos counterparts can only be made by megascopic and light optical microscopic examination of the ores. It cannot be easily done by electron microscopy.

The theoretical minimum asbestos fiber concentration as determined by the standard phase contrast optical microscope method is 0.04 fibers/cc for a 15 minute sample and 0.001 fibers/cc for a 480 minute sample. These figures are calculated using the following assumptions: one fiber found in 100 fields; a sampling rate of 2 liters/minute; and a microscope counting field of 0.007 mm^2. However, in the NIOSH revised criteria document (1976), there is a discussion that indicates that in order to maintain an acceptable coefficient of variation (CV) (below 20%) a minimum of 25 fibers must be counted. Using the same assumptions as for the theoretical calculation, this would give a minimum detection limit of 1.02 fibers/cc for a 15 minute sample and 0.03 fibers/cc for a 480 minute sample. Assuming that the NIOSH recommended minimum of 25 fibers is correct, the detection limit for an eight hour sample is acceptable for the NIOSH proposed 8-hour TWA limit of 0.1 fibers/cc, however, it is not acceptable for the 0.5 fibers/cc ceiling limit (15 minutes).

Actually the CV of 20% mentioned in the Asbestos criteria document appears to be wishful thinking because another NIOSH publication, "Occupational Exposure Sampling Strategy Manual," (1977) lists the CV for asbestos as 24-38%. This range of CV's agrees relatively well with the CV's determined from Proficiency Analytical Testing (PAT) samples (see attached Table 5). When one considers that this range of CV's means an expected accuracy of approximately ±48-76%, one can see how inaccurate air measurements in the range of the proposed standards are.

IV. ASBESTOS REGULATIONS OF OTHER AGENCIES

In addition to the occupational health regulations of OSHA and MSHA, asbestos is regulated by the EPA under the Clean Air Act, Clean Water Act and TSCA; the Consumer Product Safety Commission; the DOT and the FDA. A list of these agencies citations is attached.

In summary, asbestos is probably the most regulated material there is. It is the industrial hygienists's job to see that asbestos and asbestos-containing products are handled in an enclosed manner as much as possible and that housekeeping and waste disposal procedures are rigidly adhered to. It is also his job to convey factual scientific information on the toxicity of asbestos to consumers of asbestos products and the public in an attempt to remove the stigma attached to this material by the regulatory agencies and the media.

I hope that this discussion satisfies your request.

Stanley G. Cothrin

Stanley G. Cothrin
Senior Environmental Scientist

SGC/cah

cc: ✓ MOVarner