U.S. DEPARTMENT OF LABOR
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
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Kelly F. Bailey
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P.O.Box 7497
Birmingham, Alabama 35253-0497

Dear Kelly,

I received your letter of April 10 requesting information regarding analysis of non-asbestiform fibers especially as refers to actinolite. As you indicated, the general procedure for actinolite, tremolite and anthophyllite is the same.

As you know, OSHA standards require that fiber counts be based on phase contrast light microscopy (PCM). When appropriately used, PCM can be a very powerful tool in analysis. OSHA allows the use of "differential counting" which is the exclusion from PCM counts of certain fibers meeting the size and shape criteria for fibers (longer than or equal to 5 um, and aspect ratio greater than or equal to 3:1). This exclusion is normally used for obvious contaminants such as fiberglass, gypsum, natural and synthetic organic fibers and the like. In practice, all available information is evaluated by an analyst while making his decisions.

The information assessed by the analyst may include the operation involved in the sampling, the industry type, any known interferences, polarized light microscopy (PLM), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) as well as any other information supplied by the sampler or company. But, most important is the analyst's personal experience as a microscopist. This provides a mental catalog of appropriate fiber morphologies and responses to PLM, SEM, TEM etc. An analyst is trained by exposure to known fiber types and different analytical problems. In this way, much of the limitation of PCM can be overcome.

Morphological identification is the technique generally applied to the problem of determining the difference between asbestiform fibers and other OSHA fibers such as cleavage fragments. When crushed, ground or otherwise processed, fibers from asbestos ore show curvature indicating high tensile strength. They show frayed or tinely divided ends, they show branching and very high aspect ratios. They may show striations internally. Cleavage fragments, on the other hand tend to be prismatic, lathlike or acicular in morphology. They do not show curvature and do not show branching or frayed ends. The internal structure tends to be uniform. The ends of the fibers look stepped rather than the asbestos "broom" ends.

As the fiber diameter decreases, our ability to distinguish these features decreases as well. For thin fibers, the identification may be made by

association. If a sample contains true asbestos fibers, there will be longer, identifiable fibers elsewhere on the filter or in the bulk sample of material that we request with each set of samples submitted to our laboratory. If these appear, or if they show patent non-asbestos morphology this information will aid in our analysis.

For the larger fibers, we generally do not have much trouble. However, as the size of the fiber decreases, the analysis is more likely to include all fibers unless they are specifically ruled out by prior SEM or TEM analysis which would look for the same sorts of morphological evidence as well as a definite identification of the minerals by chemistry and crystal structure.

As you can see, we apply and encourage to be applied a broad range of technique to the problem of fiber analysis under the OSHA standards. Should you have any further questions, do not hesitate to contact us.

Sincerely,

Daniel T. Crane
Supervisory Physical Scientist