

- 360 THE CHARACTERIZATION OF ASBESTOS FIBER DISTRIBUTION ON MEMBRANE FILTERS AMONG DIFFERENT SAMPLING CASSETTES. Hunsaker, H. A. and R. M. Buchan, Occupational Health & Safety Section, Colorado State University, Fort Collins, CO 80523

The usual assessment of occupational exposure to airborne asbestos fibers is made by the membrane filter, optical microscopy (MF/OM) method. Even with standardized sampling and counting procedures which are periodically improved, the analytical precision of the MF/OM method is relatively poor as a consequence of several random and systematic sources of variation. One such source of variation is the distribution of fibers on the membrane filter. The NIOSH 7400 method assumes that the effect of a non-random distribution, if it occurs, is negligible. However, work by other investigators has indicated that fiber distribution may be non-random as a result of factors such as cassette design and electrostatic phenomena. A laboratory investigation was conducted to thoroughly characterize and compare the distribution of asbestos fibers on membrane filters among different sampling cassettes. The cassette types compared in the study were: 25 mm conductive cowl cassettes with and without airflow distribution trenches in the cassette bottom; a 37 mm open-face cassette with airflow distribution trenches in the cassette bottom; and a 37 mm, circumferential orifice cassette. Chrysotile fibers were generated and sampled within a 1 m³ box. Prior to and during sampling, a relative humidity of 70% was maintained to minimize electrostatic effects. Sampling variables were adjusted to obtain a fiber density which was both statistically valid for counting purposes and approximately equivalent among filters of differently sized sampling cassettes. Permanent mounts of whole filters were obtained with a DMF/acetic acid clearing solution and a Euparal mountant. Filters were positioned onto slides in such a way that their orientation within the sampling cassette was known. Along each of six (60°) radial sectors, 9 counting fields in the 25 mm filters and 20 counting fields in the 37 mm filters were selected such that counting fields were located in the middle of rings of equivalent area. This sampling regimen ensured that no region of the filter, on a per unit area basis, was under- or over-sampled relative to another region. No differences in fiber density existed between on- and off-trench positions in the 25 mm cassettes with airflow trenches in the base. In all cassette types examined, a trend of decreasing fiber density was observed from the middle to the outer regions of the filters. The decreasing trend in fiber density was especially prominent in the approximately outer one-third, by distance, of the 25 mm filters. The observed intrawedge trend in fiber density may be a significant factor in the overall precision of the MF/OM method for airborne asbestos fibers since neither NIOSH nor OSHA specify the location or orientation of counting lines within a mounted whole filter or wedge.

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Asbestos fiber deposition upon a filter can be statistically described by a poisson frequency distribution. Poisson distributions can be developed to model gross, net and blank fiber depositions. A statistical approach is developed to calculate the analytical limit of detection (ALOD) expressed as fibers/mm².

The ALOD represents the total sample fiber surface density that can be differentiated from a "blank" filter at a 95% statistical confidence level. Based upon the ALOD concept, an environmental limit of detection (ELOD) is presented that defines the airborne fiber concentrations that are statistically discernable above background

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