The Interrelationships of Selected Asbestos Exposure Indices

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Based on the assumption that the biological effect of asbestos is related to the concentration of respirable fibers, an index was developed which yields the concentration in numbers of asbestos fibers visible under 430× phase-contrast illumination. Data are presented relating this index to overall dustiness as measured by impinger counts and to absolute fiber concentration and distribution as measured by electron microscopy. The relation between count estimates and gravimetric measures of total dust and chrysotile asbestos deduced from magnesium analyses are given for gross and respirable samples. These relations are developed for use in operations in the manufacture of asbestos textile, friction, cement, and insulation products. The most convenient, practical, and direct index of asbestos fiber exposure proved to be the concentration of fibers longer than 5 microns counted on membrane filters at 430× phase-contrast illumination.

Introduction

AT THE NEW YORK ACADEMY OF SCIENCES Conference on the Biological Effects of Asbestos in 1965, Gilson[1] noted the proliferation of dust sampling methods and appealed for international comparability of dust measurement data to be related to biological data. He also observed that, as dust levels are lowered, it becomes more important to use the index that is biologically most appropriate.

At the present time the goal of international comparability has been partly achieved by the adoption of the concentration in numbers of fibers longer than 5 microns counted on membrane filter samples at 430× magnification with phase-contrast (PC) illumination as the standard method in both Britain and the United States.[2,3] However, information that would permit evaluation of the biological appropriateness of this index is still not complete.

It is rarely possible to make an absolute measurement of that characteristic of an airborne dust which is directly responsible for biological effect. To be practical, measurement for the purpose of assessing hazard and evaluating control must not only be convenient and relevant but also permit the use of statistically adequate sampling strategies. To evaluate indices obtained from varying exposure situations, an examination of the consistency of their relation to other and absolute measures was undertaken.

The large number of methods which might be used to measure exposure to airborne dust containing fibers results from what might be called the "degrees of freedom" of the dust cloud. In measuring the concentration of a gas in air, there is only one attribute to be measured, and one accurate method gives the same result as another. With *granular* dust, however, the attribute could be either number or weight, and with *fibrous* dust, length gives another degree of freedom; further

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