CORRESPONDENCE

Cancer mortality and exposure to crocidolite

SIR,—De Klerk *et al* (1988;45:5-13, 1989;46:461-7, 529-36) are on rather unsafe ground in relying heavily on a single, relatively short period, occupational hygiene survey of the Wittenoom crocidolite mine and mill¹ in formulating various models relating risk for asbestos diseases and airborne exposure levels.

When he retired in 1984 Major gave me the long running thermal precipitator slides that formed the basis for the estimates of exposure for the few occupational groups he was able to study. I have reassessed some of these using modern light and electron microscopy and the results will be the subject of a future publication but it is clear that the estimates made 20 years ago underestimated the exposure considerably—up to a single order of magnitude.

Major informs me that the large number of non-fibrous compact particles on the LRTP slides degraded the performance of the (early) phase contrast microscope he used which, no doubt, reduced its resolution of the fine crocidolite fibres. At the time he had no established counting rules for guidance and is not surprised that his 27 fpml could become closer to 200 fpml when a microscope satisfying modern resolution criteria and currently agreed counting rules is used. On recounting, the highest light microscopy result indicated exposures of some 300 f/ml greater than 5 μ m in length and in addition some 800 f/ml less than 5 μ m in length. Results from the general area outside the plant produced up to 2 f/ml greater than 5 μ m in length.

For comparison with contemporary fibre counts additional factors such as the collection efficiency of the LRTP relative to that of the modern membrane filter method and static/personal sample differences must be considered; these also would increase the estimate of airborne fibres.

De Klerk *et al* apply Major's published estimates of airborne fibre for a few occupants in one crocidolite mill to 87 job classifications in another mill (discontinued in 1957) believed to have been dustier. The authors ac-

knowledge that this could be a considerable source of error but taken with the underestimates of dust conditions measured in 1966 and my experience in measuring other exposures in the occupational environment, it is my view that the quantitative data in their papers cannot be supported.

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- 1 Major G. Asbestos dust exposure. In: Major G, ed. *Proceedings of the first Australian pneumoconiosis conference in Sydney, 1968*. Sydney: Joint Coal Board, 1968:467-74.

Authors' reply:

We would like to make the following comments on Rogers' letter.

(1) The main emphasis in our dose response level estimates relies on the internal comparisons within the cohort and depends more on the ranking of the different jobs in the two mines and mills than on the absolute dust concentration measurements and more on the duration of exposure than the absolute dust concentrations. We have always recognised that comparisons with other studies would be much less supportable than internal comparisons and we have emphasised this.

(2) The data used in our analyses have been the only estimates available of fibre concentrations in the Wittenoom environment and have been published in refereed journals. Our use of them was discussed with Major before their being used and he helped us with our rankings of the various occupations (along with senior staff who worked in the Wittenoom industry during its period of production).

(3) We are keen to use Rogers' analyses of dust concentrations once they have been published and subjected to adequate peer review.

The thrust of our work has not been to rely on absolute dust concentrations but on relative levels of exposure between occupational groups. We believe that our internal comparisons are as valid as it will ever be possible to make them whereas external comparisons will always be difficult by the changing methodology between different industrial hygienists at different times.

Comparing biological effects of mineral fibres

SIR,—I read Dunnigan's editorial with interest (1989;46:681-2). I support his proposition that it is absolutely necessary in the research concerning mineral fibres to depend on fibre counts instead of gravimetric data. I cannot agree, however, with his implicit statement, based on arbitrary and disputable assumptions about fibre counts, that some manmade mineral fibres (glass wool, rock wool) are at least as dangerous as chrysotile.

Most evidence available points to the opposite conclusion. Most manmade mineral fibres have an amorphous chemical structure whereas chrysotile fibres are crystalline. This has serious implications for their durability. Scholze and Conradt have shown that manmade mineral fibres exhibit relatively poor durability and usually have short life times. By contrast, natural fibres were persistent against the attack of biological fluids. It is generally accepted that the durability of fibres after deposition in the respiratory system is one of the important determinants of the intensity of their biological activity and hence their ability to produce disease. In this respect it must be emphasised that a thorough review of animal inhalation studies with high airborne concentrations of glass and rock wool has not led to the conclusion of a statistically significant increase in the risk of lung cancer or fibrosis, but a strong contrast with chrysotile fibres.

Assumptions about absolute fibre concentrations based on gravimetric data, such as Dunnigan presents in his cumulative dosage table, are inaccurate and not supported by evidence based on exact fibre diameters and length. Dunnigan's observation that exposure levels in the production of rock/glass wool reached 1 f/ml is not supported by occupational hygiene reports, in which it is stated that an attempt to quantify fibre levels during the earlier periods of the industry would, at best, be crude.¹

I agree with Dunnigan that threshold limit values for toxic fibres should be expressed in fibre numbers per unit volume rather than in gravimetric standard. I cannot, however, concur with his conclusion that this must lead to the same threshold limit values for chrysotile and manmade mineral fibres. As I have