

for other workers in the control group (De Klerk *et al.*, 1989). These estimates have also been incorporated into other studies, which are quoted by Hodgson and Darnton.

As occupational hygienists experienced in the investigation of occupational exposures in epidemiological investigations for mesothelioma, we have attempted without success to assemble exposure data and dose estimates for the Wittenoom cohort because of the 'quality of the quantitative exposure data' (Dupre *et al.*, 1984).

We have made inquiries of some of the original miners, millers and mines inspectors regarding exposure conditions and knowledge of how this changed over the 23 years of various operations, and are of the opinion that there is insufficient exposure information to calculate the asbestos fibre dose in a scientific manner. The basic information simply does not exist. At best, the exposure values reported in the literature and used by Hodgson and Darnton should be recognized as 'guesstimates', made by people who have not been trained in occupational hygiene and who have no experience in asbestos dust monitoring.

Further, we deny the statements by De Klerk *et al.* (1989), that the ranking and exposure estimates used in the original epidemiological studies 'have been verified by the industrial hygienist who conducted the original survey'. In response to this suggestion we have objected to the misuse and improper representation of the raw data whenever it has been presented at conferences, such as the 1987 International Conference on Occupational Health held in Sydney and the 1996 BOHS Inhaled Particles VII held in Cambridge.

We agree with the comments of Hodgson and Darnton that the risk slope is very sensitive to the exposure levels chosen. However, the use of poor exposure estimates produces only inaccurate risk analysis and assists in the promotion of bad science.

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REFERENCES

- De Klerk N, Armstrong B, Musk A, Hobbs M. (1989) Cancer mortality in relation to measures of exposure to crocidolite at Wittenoom Gorge in Western Australia. *Br J Ind Med*; 46: 529–36.
- Dupre JS, Mustard JF, Uffen RJ. (1984) Report of the Royal Commission on Matters of Health and Safety from the Use of Asbestos in Ontario, vol. 1. Ontario Ministry of Government Services Publications Services Branch.
- Hodgson J, Darnton A. (2000) Quantitative risks of mesothelioma and lung cancer in relation to asbestos exposure. *Ann Occup Hyg*; 44: 565–601.
- Major G. (1968) Asbestos dust exposure. In Proceedings of the First Australian Pneumoconiosis Conference. Sydney: Joint Coal Board. p. 467–74.
- Rogers A, Nevill M. (1995) Occupational and environmental mesotheliomas due to crocidolite mining activities in Wittenoom, Western Australia. *Scand J Work Environ Health*; 21: 259–64.
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Reply

Mr Rogers is correct in pointing out the difficulties encountered in understanding the exposure histories of the members of the Wittenoom cohorts and the inadequacy of the dust monitoring data resulting from the sampling strategies and instruments that were used. Unfortunately this is a common experience when endeavouring to use exposure data collected for compliance with various standards for epidemiological purposes.

In trying to understand the health effects of crocidolite, it has been disappointing that despite the expertise of the industrial hygienist who conducted the 1966 survey and the logistics of going to such a remote town in the Pilbara region of Western Australia, only 38 'static' samples were collected during the visit, and that the only reporting or documentation of the results occurred in a conference in 1968. The Wittenoom workers and township residents are unique in that they were exposed exclusively to crocidolite, and their employment histories have been well documented. Follow-up of the cohorts has been undertaken over the past 25 years throughout Australia and also in Italy. In Australia, assessment

of mesothelioma incidence has been complete as a result of mesothelioma registries, cancer registries and pathology records, as well as mortality records accessed in all states since the 1940s. Vital status, cancer incidence and certified causes of death are therefore well established for the cohorts.

In 1983 we endeavoured to make the best use that we could of the available dust measurements in order, at least, to look at internal dose–response relationships, in addition to documenting disease incidences and mortality ratios for the workforce as a whole. In 1991 we carried out similar work on a cohort of residents of the township of Wittenoom who were known not to have worked for the Australian Blue Asbestos Company. Mr Major was of great assistance in helping us understand the relative exposures of the various job categories in relation to those job categories for which sampling had been carried out by him in 1966. We never stated that Mr Major agreed with exposure estimates, as reading of the cited paper clearly indicates (De Klerk *et al.*, 1989). We also engaged the assistance of the mine and mill supervisors, the company management and govern-

ment mines inspectors to assist in interpolating and extrapolating between jobs, and, with the help of the much-criticized results of the earlier konimeter surveys, to estimate historical exposures. This exercise permitted us to attribute fibre/ml exposures to the various job categories.

We have published a validation of our estimates that shows clear agreement with lung fibre burdens (De Klerk *et al.*, 1996) and, based on the 'guesstimates', we have also shown clear dose-response relationships between exposure and all asbestos-related diseases in this cohort. Indeed, during this same period, Mr Rogers used risk estimates based on these exposure estimates in at least two publications (Nevill and Rogers, 1992; Rogers and Nevill, 1995) without questioning their validity.

It is most disappointing that the material collected by Mr Major was apparently available for recounting and reanalysis by him and Mr Rogers until the recent past and then unaccountably disappeared from the National Occupational Health and Safety Commission when Mr Rogers left the Commission, although he had previously stated at the Inhaled Particles Meeting in Cambridge in 1996 that he was in possession of the material.

If the exposure estimates are underestimates, then Mr Major and Mr Rogers have missed the opportunity to rectify the problem and contribute to science.

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REFERENCES

- De Klerk NH, Armstrong BK, Musk AW, Hobbs MST. (1989) Cancer mortality in relation to measures of exposure to crocidolite at Wittenoom Gorge in Western Australia. *Br J Ind Med*; 46: 529-36.
- De Klerk NH, Musk AW, Williams VM, Filion PR, Whitaker D, Shilkin KB. (1996) Comparison of measures of exposure to asbestos in former crocidolite workers from Wittenoom Gorge, W. Australia. *Am J Ind Med*; 30: 579-87.
- Nevill M, Rogers A. (1992) Inquiry into asbestos issues at Wittenoom, Perth.
- Rogers A, Nevill M. (1995) Occupational and environmental mesotheliomas due to crocidolite mining activities in Wittenoom, Western Australia. *Scand J Work Environ Health*; 21: 259-64.

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Editorial Note

Drs Musk and de Klerk's letter was shown to Mr Rogers, who made the following points.

1. Mr Major states that he did not discuss the relative exposures between the work groups, only the difficulty of extrapolating from his measurements.
2. A 'clear dose-response relationship' does not validate the actual exposure values used, but the decision about exposure values of course determines the slope of the relationship, which influences the apparent relative potencies of different fibre types. Browne (2001) raised similar issues on the use of the South African data.

3. Rogers and Nevill quoted the results as an upper estimate of risk, reflecting their belief that the exposure estimates were too low.
4. The Wittenoom samples seem to have been destroyed with many others during the reorganization of the National Occupational Health and Safety Commission in about 1996.

Dr Hodgson was invited to comment on the Rogers and Major letter, but decided not to do so.

REFERENCE

- Browne K. (2001) Correspondence. *Ann Occup Hyg*; 45: 327-9.

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