He has, however, avoided discussing the six cases of melanoma versus one expected, which we consider to be the most important result. As pointed out in the previous study² studies of cancer incidence have advantages compared with studies of mortality, particularly for tumour sites that are successfully cured.

We feel confident that the methodological aspects have been properly considered in our study.¹ Consequently, we are less concerned as to whether the results are "statistically significant" or not. We consider the fact that two cases of melanoma developed in the a priori high risk group selected from the same VCM exposed population before the performance of the previous study² as being of more significance for the interpretation of possible causality than the presence of statistical significance. Development of new cases in a preselected risk group may be of greater significance in a causality discussion than is the presence of "statistically significant" results. As opposed to "statistical significance," a previously selected a priori high risk group cannot be manipulated.

A recent study from Du Pont, USA,³ seems to support our finding, but apparently our results have not attracted the author's attention.^{1,2}

The current lack of adequate animal and in vitro models for studying the development of malignant melanomas makes the study of the possible causal relation between VCM exposure and this tumour complicated. Even so, Maltoni *et al* succeeded in producing malignant melanomas of the skin in Syrian golden hamsters exposed to a wide range of VCM levels,⁴ and they concluded that the tumours were related to the exposure.

References

- 1 Heldaas SS, Andersen A, Langård S. Incidence of cancer among vinyl chloride and polyvinyl chloride workers: a further evidence for an association with malignant melanoma. *Br J Ind Med* 1987;44:278-80.
- 2 Heldaas SS, Langård S, Andersen A. Incidence of cancer among vinyl chloride and polyvinyl chloride workers. *Br J Ind Med* 1984;41:25-30.
- 3 O'Berg MT, Burke CA, Chen JL, Walrath J, Pell S, Gallie CR. Cancer incidence and mortality in the Du Pont Company: an update. *J Occup Med* 1987;29:245-51.
- 4 Maltoni C, Lefemine G, Ciliberti A, Cotti G, Carretti D. Carcinogenicity bioassays of vinyl chloride monomer: a model of risk assessment on an experimental basis. *Environ Health Perspect* 1981;41:3-29.

Pulmonary fibrosis in asbestos insulation workers with lung cancer

SIR—Rudd's letter (1987;44:428-9) points to several interesting questions.

(1) Histopathological pulmonary findings in asbestos insulation workers with long exposure to the dust. I reviewed lung parenchyma sections submitted to me

by pathologists in various institutions in the United States and Canada. As expected, the material was taken from various parts of the lung, often unspecified. It is widely accepted that pulmonary asbestosis is characterised microscopically by diffuse interstitial fibrosis caused by inhaled asbestos fibres. This was sought in my examinations in available parenchyma; Rudd argues that the subpleural areas be excluded, a rather arbitrary preference in view of the absence of data that parenchyma here differs from parenchyma elsewhere; particularly since this part of the lung often has a considerable concentration of asbestos fibres, the result of "pleural drift" of inhaled dust. Parenthetically, lung cancer after asbestos inhalation is not infrequently peripheral in origin.

(2) I reported the presence or absence of microscopically evident diffuse interstitial fibrosis. I also reported that in 130 of 138 one or more asbestos bodies were seen. It is commonplace that in single thin (5 μ) sections, asbestos bodies may be absent. Does this mean that they are not present (sometimes in large numbers) in the lung? Of course not. The likelihood of showing asbestos bodies varies directly with the amount of tissue studied. They are more readily seen in thick (30 μ) sections than thin, more when bulk tissue is digested and filtered than in sections, more when exposure has been to amphiboles than chrysotile, and more when long and thick fibres were inhaled than short and thin. It is thus not enough to say that so many or so many asbestos bodies are seen; one should immediately add comment regarding how much tissue was available for examination and how they were sought. Indeed, in our study, we did not expect to find so many cases (since, occasionally, there was only a single thin section available for review) in which at least one asbestos body was to be seen. My colleagues consider that perhaps this was related to the diligent, prolonged examination to which each slide was subjected.

(3) I was rather surprised to learn from Rudd that in the United Kingdom when there are "too few" asbestos bodies in slides of asbestos workers' lungs the diffuse interstitial fibrosis is not infrequently categorised as cryptogenic fibrosing alveolitis. There must be a great deal of this disease nowadays in the United Kingdom among asbestos workers. And many asbestos workers with diffuse interstitial fibrosis are not eligible for disability compensation.

(4) Asbestos bodies again. I am sure that Rudd is as familiar as we are with the multitude of observations that in lung tissue of asbestos workers with or without lung cancer there tend to be myriads of asbestos fibres uncoated by the iron protein material that allows them to be visible by (relatively insensitive) optical microscopy and thereby seen as asbestos bodies. Generally, the uncoated fibres are demonstrable only by

electron microscopy, after appropriate special preparation of the tissues. It could be—indeed, it is likely—that in the few cases in which we did not observe asbestos bodies, uncoated asbestos fibres would have been seen if we had had an opportunity to examine an adequate tissue sample by electron microscopy. It is perhaps worth noting that we have yet to study an asbestos worker's lung in which we do not find uncoated asbestos fibres (in much larger numbers than in the unexposed general population).

(5) Rudd comments that if our histopathological observations were to be considered evidence of asbestosis in asbestos workers with lung cancer in the United Kingdom many more would be eligible for compensation for lung cancer. Far be it for us to advise how and whether United Kingdom agencies should compensate asbestos workers who suffer lung cancer. We did not proffer such opinions when, until recently, lung cancer was not considered adequate reason for compensation and we will not do it now. Parenthetically, can Rudd tell us what proportion of workers with lung cancer, after important occupational exposure to asbestos, have been denied compensation because a board's histological/asbestos body criteria were not met?

We appreciate Rudd's comments. They reflect important issues in the pathogenesis of lung cancer, not addressed in the bare data reported in our paper but useful as we nowadays grapple with concomitant issues of prevention, compensation, and public health

control. Perhaps the letter reflects these: "I do not intend to suggest that the fibrosis seen in these cases was not caused by asbestos exposure." This acknowledgement goes to the heart of the matter. Besides the theoretical pathogenetic connotations, which can be argued about, there are the practical questions of whether and how we might provide help for those found injured after inadequate protection in the past.

Y SUZUKI

H KIPEN

RUTH LILIS

I J SELIKOFF

*Mount Sinai Medical Center,
1 Gustave L Levy Place,
New York, NY 10029,
USA.*

Notice

The Health and Safety Executive Library and Information Service has indexed all articles relevant to health and safety at work in the *British Journal of Industrial Medicine* from 1944 to date. Approximately 1600 items are available in the HSELINE database, information on which is available on Pergamon Infoline Computer Services, European Space Agency Information Retrieval Services, Datastar, Compact Disc Read Only Memory.