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LETTERS TO THE EDITOR

Asbestos hazard from protective clothing

Sir,

Investigations (being reported elsewhere) have been carried out at the Springfields Works of the United Kingdom Atomic Energy Authority to examine the redispersion of radioactive dust from contaminated coveralls into the atmosphere. A significant relationship was found to exist between the degree of contamination of the coveralls and the concentration of radioactive dust in the breathing zones of the wearers.

It was considered that the wearing of protective clothing made from fibrous asbestos materials might give rise to an airborne asbestos hazard in a similar mode and this hypothesis is supported by the investigations we now describe.

The tests were carried out by an experimentalist wearing a normal industrial type asbestos apron and asbestos gauntlets whilst undertaking a standard pattern of work. During this work period the concentration of asbestos fibres near the wearer's breathing zone and in his vicinity was determined. The tests were carried out under laboratory conditions and no asbestos in any form was present in the laboratory during the experiments other than the protective clothing under test. The laboratory itself had a volume of about 70 m^3 and was air-extracted at ceiling level at a rate of about 13 m^3/min.

The work pattern was designed to combine movements typical of those found in industrial plant environments, and basically consisted of carrying objects about the laboratory, walking, and bench work. During each standard work routine, dust samples were collected on Casella personal air samplers (PAS), originally developed by SHERWOOD and GREENHALGH (1960). The experimentalist carried a PAS on a helmet and another on his chest, whilst a third PAS was set up in a fixed position in the centre of the laboratory at an average distance of about 6 ft from the working zone of the experimentalist. All three samplers were operated simultaneously during each test run.

During each test the floor area was covered by Polythene sheets and after completion of a test run a settling time of at least 24 hr was allowed, after which the sheets were changed and the laboratory area cleaned to minimise accumulation of asbestos fibres. Before commencement of the next test, a 2 hr duration PAS sample was obtained from the centre of the laboratory for control purposes. As a precaution, the experimentalist wore a dust respirator during each test.

All samples were obtained on Millipore HA filter-papers at a sampling rate of 400 cm^3/min and these were counted by a method similar to that described by HOLMES (1965). Briefly, this consists of fixing the sample by drawing a chloroform solution of 'Perspex' through the filter, and then clearing by means of glycerol triacetate. The transparent sample was examined microscopically, and all fibres within the range of

lengths 5 μm to 100 μm, and with a length to breadth ratio of at least 3, were counted using a Porton graticule and projection microscope at a magnification of ×1000. Fifty randomly chosen graticule areas of apparent size 88 μm by 44 μm were examined on each sample.

None of the control samples showed any measurable asbestos fibres, but all other samples gave positive counts possibly underestimated by about 10 per cent since bright field rather than phase contrast techniques were employed in the estimations. The results (expressed as fibres/cm³) were as follows:

Test No.	Fibre concentration on sample		
	Chest (worn)	Head (worn)	Laboratory (static)
1	4·17	3·86	0·75
2	3·88	3·61	2·09
3	4·60	2·37	3·41
4	4·45	4·15	1·78
5	3·27	3·60	2·53
6	4·01	3·71	2·11
Mean	4·06	3·55	2·11
95% Conf. limits	±0·47	±0·61	±0·87
99% Conf. limits	±0·72	±0·93	±1·32

These values clearly demonstrate the significant enhancement of detection and the greater reproducibility of results obtainable with a personal air sampler than with a static air sampler.

The Draft Asbestos Regulations seek to prevent exposure of workers to dust containing asbestos to such an extent as to endanger health, and H.M. Factory Inspectorate have given general advice that for Chrysotile, Amosite or Anthophyllite the provisional Threshold Limit Value (TLV) will be 2 fibres/cm³. Where the concentration is between 2 fibres/cm³ and 12 fibres/cm³ the duration of exposure and the level of concentration will be taken into account when deciding what measures are necessary to comply with the Regulations and, where the level is above 4 fibres/cm³, control measures will be required. Concentrations exceeding 12 fibres/cm³ will not be permitted except where respiratory protection is provided.

On the results of these tests it appears that a worker wearing asbestos protective clothing could be exposed to airborne concentrations in his breathing zone well above the tentative TLV. Even at a distance of 6 ft from the worker, the concentration could exceed the TLV. The actual airborne concentration will depend on the type of clothing worn, on local environmental conditions and the nature of the work: other investigations which we have carried out indicate that if vigorous work is undertaken, such as might occur in common operations in heavy industry such as furnacework, the TLV could conceivably be exceeded by a factor of 6 or more. Since the same garments were worn throughout the tests, it is apparent that fibres are released from the material

over a considerable time, and the wearer is continuously exposed to airborne asbestos and carries his own dust cloud with him.

Thus it appears that under conditions of arduous work the wearing of asbestos garments of a type commonly worn in industry could give rise to local environmental levels requiring the use of a respirator. For less arduous conditions of work it might be possible for an asbestos apron and asbestos gauntlets to be worn for about one-half a working day without significant hazard (the time weighted concentration then being nominally 2 fibres/cm^3). However it would be prudent to confirm the levels obtained for any particular type of work by test measurement. When these conditions cannot be satisfied it is suggested that cotton-backed, aluminised asbestos garments should be worn or otherwise that approved respiratory protection be provided.

Further, by analogy with our findings on resuspension of radioactive dust from contaminated coveralls, it seems reasonable to suppose that a similar situation could arise with ordinary protective clothing contaminated with asbestos. Since such contamination would normally arise from operations requiring the wearing of a respirator, it is recommended that such clothing be removed immediately on completion of the work and before removing the respirator.

It would be of interest to know the experience of other workers in this field in view of the recently heightened interest in asbestos aerosols.

H. A. Bamber
R. Butterworth

Health Physics & Safety Department
United Kingdom Atomic Energy Authority
Springfields Works
Salwick
Preston, PR4 0XJ
Lancs.

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Asbestos release from battery boxes

Sir,

Asbestos is incorporated into a number of materials, and when the end-product is friable and liable to release fibres on mechanical abrasion, there is likely to be an inhalation hazard. It has been considered, however, that when asbestos is bound into a plastic base, any subsequent disintegration might release only coated fibres of low toxicity.

Annually, many hundreds of thousands of battery boxes are manufactured, for which crocidolite is mixed with bitumen or pitch and moulded. The superfluous pieces (flashings) are removed by filing and may subsequently be trampled underfoot. Examination of crushed material from the floor by polarised light microscopy has revealed free fibres of asbestos, as demonstrated by the Fig. 1.

Air analysis has not detected any asbestos fibres at the operator's nose level, but 0·5 fibre/cm³ were measured at a height of 10–12 in. above the operation of flashing removal. These observations suggest that there may be other operations where there is an unsuspected but significant exposure to asbestos fibres.

Permission to publish this letter was given by Dr T. LLOYD DAVIES, Senior Medical Inspector of Factories. Atmospheric estimations of crocidolite and photomicroscopy were undertaken by the Industrial Hygiene Division of HM Factory Inspectorate, Department of Employment and Productivity.

M. GREENBERG

HM Medical Inspector of Factories
HM Factory Inspectorate
Department of Employment and Productivity
1–13 *Chepstow Place*
*London, W.*1.