



Pergamon

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The Quantitative Risks of Mesothelioma and Lung Cancer in Relation to Asbestos Exposure

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Mortality reports on asbestos exposed cohorts which gave information on exposure levels from which (as a minimum) a cohort average cumulative exposure could be estimated were reviewed. At exposure levels seen in occupational cohorts it is concluded that the exposure specific risk of mesothelioma from the three principal commercial asbestos types is broadly in the ratio 1:100:500 for chrysotile, amosite and crocidolite respectively. For lung cancer the conclusions are less clear cut. Cohorts exposed only to crocidolite or amosite record similar exposure specific risk levels (around 5% excess lung cancer per f/ml.yr); but chrysotile exposed cohorts show a less consistent picture, with a clear discrepancy between the mortality experience of a cohort of chrysotile textile workers in Carolina and the Quebec miners cohort. Taking account of the excess risk recorded by cohorts with mixed fibre exposures (generally <1%), the Carolina experience looks untypically high. It is suggested that a best estimate lung cancer risk for chrysotile alone would be 0.1%, with a highest reasonable estimate of 0.5%. The risk differential between chrysotile and the two amphibole fibres for lung cancer is thus between 1:10 and 1:50.

Examination of the inter-study dose response relationship for the amphibole fibres suggests a non-linear relationship for all three cancer endpoints (pleural and peritoneal mesotheliomas, and lung cancer). The peritoneal mesothelioma risk is proportional to the square of cumulative exposure, lung cancer risk lies between a linear and square relationship and pleural mesothelioma seems to rise less than linearly with cumulative dose. Although these non-linear relationships provide a best fit to the data, statistical and other uncertainties mean that a linear relationship remains arguable for pleural and lung tumours (but not for peritoneal tumours).

Based on these considerations, and a discussion of the associated uncertainties, a series of quantified risk summary statements for different levels of cumulative exposure are presented. Crown Copyright © 2000 Published by Elsevier Science Ltd on behalf of British Occupational Hygiene Society. All rights reserved

Keywords: asbestos; amphibole hypothesis; exposure-response; lung cancer; mesothelioma; quantified risk assessment

INTRODUCTION

There has been much debate on the relative hazard-ousness of the three main asbestos types: crocidolite, amosite and chrysotile (commonly known as blue, brown and white asbestos respectively), but no systematic attempt to quantify the differences. Existing published quantitative risk assessments have mostly not distinguished between the fibre types, and none

has produced quantified estimates of the risk from amphiboles (a collective mineralogical term covering crocidolite and amosite). A review commissioned by the HSE in the 1980s from Professors Richard Doll and Julian Peto (1985) gave estimates for chrysotile alone; more recently a review by the Health Effects Institute (1991) produced estimates for an unspecified mixture of fibre types. An INSERM review (1996) also ignored differences in fibre type, and drew heavily on the HEI review.

The studies included in this review were selected by reviewing the material referenced in the Doll and Peto, HEI and INSERM reports and identifying all cohort mortality reports for which quantified data on

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