slope for those cohorts with clearly positive results. This might be predicted from the flattening of regression slopes by inaccuracies in exposure estimates. But it can also reflect inadequacies in baseline rates. For example, the two-fold difference between the cohort average and regression slope measures for the Quebec cohort reflects the SMR of about 1.3 seen in all the low dose subgroups, and which the authors interpret as non-asbestos related. Nevertheless, the broad agreement between the two measures across studies suggests that valid conclusions can be drawn from the cohort average measure.

Appendix B

FIBRE-PARTICLE CONVERSION FOR CROCIDOLITE CIGARETTE FILTER COHORT NOTE BY DR G. BURDETT

The measurements in 1952 which gave an average of 80 particles per ml, within the Massachusetts standard of 175 particles per ml, almost certainly refer to impinger measurements, which were frequently made for insurance company purposes.

The normal units are millions of particles per cubic foot (mppcf). As one cubic foot is equivalent to 28 316.8 ml the value of 80 particles per ml is equivalent to 2.265 mppcf and 175 particles per ml is equivalent to 5 mppcf.

Five mppcf was the threshold value in force from the 1930s to the 1960s (maybe even until 1972) when it was replaced by a membrane filter limit of 10 f/ml, which has been falling ever since.

As the units suggest, the method only counted particles using relatively low powered microscopy and would overlook many of the respirable fibres and is a very indirect measurement of the fibre level. It should also be remembered that impingers have poor capture efficiency below 1 μm.

It is also noted that cotton and acetate fibres were mixed, carded and deposited on crepe paper under dry conditions. This would suggest that fibres made up many of the particles but I have not referred to the patent to work out quantities used to estimate the fibre percentage.

My best guesstimate is that 30% of the particles were fibres but only about 10% of the fibres seen would be crocidolite (it is more dusty, but has very few >1 μm fibres compared to the other dusts).

This would mean about 3% of the count was crocidolite fibres or about 2.5 f/ml>1 μm wide. To convert to the current index we generally find one can assume only some 4% of the >5 μm long crocidolite fibres were visible as compared with the current index. This is equivalent to a concentration of about 60 crocidolite fibres per ml using a modern version of the membrane filter method.

This is several times higher than the better factories at this time but not too far away from what was probably present assuming some exhaust control on the bag opening, carding and mixing areas. Unfortunately no mention of the control system is made.

Also it is probably an average value that has been given for both the wet and dry methods as both were in use. It is probable given that the sampling locations are unknown that higher concentrations occurred in the dry areas: around 100 f/ml as measured by the current method.

Of course this is very approximate, but 100 f/ml looks to be a good maximum exposure with TWA of 60 f/ml.

Appendix C

DEVELOPMENT OF ADJUSTMENTS TO THE SOUTH AFRICAN MINES COHORT DATA

The starting point for the adjustment of the reported results from this cohort is the data given in Tables 1 and 2 of the published paper, which give illustrative data on exposure levels in different periods (Table 1) and a breakdown of the whole cohort by year of birth and date of first exposure (Table 2).

The average age at first exposure of the groups represented by the cells of Table 2 can be estimated using the mid points of the year of birth and year of first employment categories (1900 and 1935 were assumed for the earliest birth and employment categories respectively). Age specific all cause and lung cancer rates for white South African men in 1955, 1965 and 1975 were then used to calculate the distribution of expected lung cancer deaths by time since first exposure in each cell. The rates for 1955 were also used for the cells relating to first employment between 1941 and 1950, but the expected number was reduced by a factor of 0.64 to allow for the fact that cause specific follow up was only recorded from 1949.

The total expected lung cancers calculated in this way (39.3) agrees quite closely to the value reported in the paper (36.6) and the proportion of expected lung cancer deaths arising from follow up less than 10 yr from first exposure is 0.23. The reported observed and expected lung cancers in the two pure fibre subcohorts have therefore been reduced by 0.23 times the expected numbers given.

The data reported in Table 1 was used to estimate approximate relative exposure levels at ten year intervals from 1945. Taking 1945 as 1, the numbers used were 1, 0.6, 0.35, 0.25 for amosite; and 1, 0.5, 0.25, 0.15 for crocidolite. Exposures in the 1930s were assumed to be the same as in the 1940s. To derive an expected lung cancer weighting for this relative exposure pattern, the expected lung cancers in each birth-start cell from the 10th anniversary of first employment to the end of follow up in 1980 was calculated in a similar way to that described for the first 10 yr of follow up. The resulting distribution of