

FINAL WATCH POSITION ON ASBESTOS RISK ASSESSMENT: FEBRUARY 2011

In 2000, authors Hodgson and Darnton* reviewed the then available published data and fitted a mathematical model for the relationship between asbestos exposure and subsequent risk of lung cancer and mesothelioma. The Hodgson and Darnton (H&D) model is based on exposure scenarios for which observed data are available - adult workers known to have been exposed to different types of asbestos in historical situations. The situation modelled is adult workers receiving in 5 years, from age 30, specified cumulative exposure levels of asbestos of different fibre types, and followed to 80 years of age.

In its 2008 assessment WATCH considered that for different fibre types and different exposure levels within, and reasonably close to, the exposure range within which observational data are available, the H&D model appears generally robust and can be used to differentiate between the relative magnitudes of risk. In this 2010 assessment, WATCH considers that the results of additional epidemiological studies published up to 2010 on historical worker cohorts generally reinforce the validity of the H&D model for such worker populations and the estimated range of exposures that they experienced.

The mathematical relationships of the H&D model can also invite predictions to be made, by extrapolation, of the risks of asbestos-induced cancer in other scenarios for which observed data are not available. In the published paper in which the model first appears, some extrapolations are presented and understandably questions can be asked of other scenarios involving other (lower) levels of exposure, earlier commencement of exposure (including in non-work situations), longer durations of exposure, different patterns of exposure and different durations of follow-up after commencement of exposure.

In the context of estimating the risks of cancer arising from exposure to the various types of asbestos in different situations, WATCH emphasises that there are many relevant issues that remain uncertain or for which there are limitations in understanding. These include:

- the reliability of the exposure assessments for the worker cohorts studied;
- the validity of the assumption that cumulative exposure is the relevant dose metric, regardless of the duration of exposure and the pattern of fluctuating airborne concentrations within the overall period of exposure;
- the toxicological mechanism(s) involved in the asbestos-induced cancer processes;
- the relative susceptibility to asbestos-induced effects of the lungs of typical adult workers in the worker populations studied compared to other sections of the population today, for example babies and young children; and
- the underlying cause(s) of so-called "spontaneous" or "background" mesothelioma in those believed not to have experienced any significant exposure to asbestos.

WATCH considers that all of these uncertainties impose limitations on the reliability of risk estimates produced by the H&D model, particularly when it is extrapolated to exposure situations and populations beyond those covered by observed data. Hence WATCH confirms the statement in its 2008 conclusion that risk estimates derived by extrapolation of the model should not be taken to be reliable absolute risk values. The limitations on the reliability of risk estimates derived using the H&D model become more pronounced the further the model is extrapolated from the occupational exposure scenarios and data on which it is based.

Therefore, as recommended in the WATCH position of 2008, WATCH considers that extrapolated risk estimates might be most useful as rough indicators of the magnitude of risk that might be involved in different situations; and hence the relative extent of concern and prompting towards risk management action that can be justified in different situations. WATCH observes that deriving risk estimates by extrapolating the H&D model is a straightforward process; however, there was a variation of opinions across the committee, with no clear majority or consensus view as to the appropriateness of presenting such estimates in numerical form or using them for decision-making in a way that might be taken by others to imply confidence in their numerical accuracy.

In an extension of its 2008 position, the scientific judgement of WATCH is that there are risks of asbestos-induced cancer arising from work-related cumulative exposures below 0.1 fibres/ml.years. The risk will be lower, the lower the exposure, but “safe” thresholds are not identifiable. Where potential exposures to amphiboles, particularly crocidolite, are below 0.1 fibres/ml.years (for example, 0.01 fibres/ml.years), the available scientific evidence suggests no basis for complacency, but rather a basis for active risk management.

In this context, flexible use of the best available monitoring approaches and consideration of the scope for further improvements in techniques for the measurement of relatively low airborne asbestos concentrations, would be useful, to help better understanding of such situations.

WATCH position from October 2008 (finalised by post-meeting consultation by correspondence)

WATCH decided that the H&D2000* model is a good reflection of the available data and can be used to estimate lifetime risk of mesothelioma and lung cancer from occupational exposure to asbestos. However, WATCH also advised that the model may be less reliable when extrapolating beyond the exposure ranges for which there are epidemiological data, due to uncertainties in the dose-response relationship at lower levels.

In addition to such uncertainties, the predictions from the model are subject to a number of other uncertainties in the original epidemiological data available including:

- *exposure assessment*, caused by the absence of reliable contemporaneous measurements and by differences in assessment methods between studies
- *cancer diagnosis*, such as completeness of identifying mesotheliomas in the past
- *potential confounding factors*, such as absence of control for smoking in some studies of lung cancer

The H&D2000 model can be used to produce estimated lifetime risks of asbestos-related lung cancer and mesothelioma (the two tumour types combined) per 100,000 individuals, for a 5-year duration of exposure to different concentrations of the various forms of asbestos, from age 30, for example:

fibres/ml.yr (best max/min**)	Crocidolite	Amosite	Chrysotile
10	5600 (3200– 84 00)	2300 (960–4000)	56 (23–340)
1	750 (250-1600)	180 (35-570)	6 (1-45)
0.1	120 (24-360)	21 (2-100)	1 (0.1-7)

**Best estimate from the H&D 2000 best-slope model with maximum and minimum estimates based on the range of predictions consistent with the H&D2000 high-slope and low-slope models. All models give cumulative risk up to age 80.

These numbers should not be taken to be reliable absolute risk values

However, WATCH concluded that the model is sufficiently robust to be used to differentiate the relative magnitudes of risk for the different fibre types in different exposure ranges and thereby distinguish between different operations in a manner that is amenable to a control-banding approach.

WATCH recommended that further work be done to develop such a control-banding approach for tasks involving remaining asbestos. Such an approach would emphasise proportionality, requiring action that is commensurate with the risk.

WATCH recommends that at a subsequent meeting it should seek to progress the ideas in the three paragraphs immediately above.

* Hodgson, JT and Darnton A (2000). Quantitative risks of mesothelioma and lung cancer in relation to asbestos exposure. *Annals of Occupational Hygiene*, 44; 565-602.