WATCH COMMITTEE PAPER			WATCH/ 2009/1
Meeting date:	24th February 2009	**Open Govt. Status:**	**open**
Type of paper:	For Discussion	**Paper File Ref:**	
Exemptions:			

WATCH COMMITTEE

Control banding for certain tasks involving asbestos

Issue

1. Proposals for a scheme to identify risk / control bands for tasks involving exposures to asbestos.

Timing Considerations

2. Routine.

Recommendation

3. WATCH is invited to discuss the criteria for risk / control banding, and give an opinion on whether, and if so how, the approach should be developed.

Background

4. Previous discussions at WATCH concerned the interpreting of risk models for cancer caused by asbestos, and their applicability to 'low level' exposures. At the October 2008 meeting, WATCH concluded that:

   a. the Hodgson and Darnton (H&D) risk model was a good reflection of the relevant epidemiological data which allows estimation of lifetime risks, for example as set out in Table 1,
   b. these numbers should not be taken as reliable estimates of absolute risk because of various limitations in the underlying data,
   c. the H&D model is sufficiently robust to differentiate relative magnitudes of risk for different exposure ranges (for the different fibre types).

   WATCH agreed that the H&D model could be used as the basis for a control banding approach for tasks involving remaining asbestos and that this should be considered at a subsequent meeting.

Table 1: Estimated lifetime (to age 80) risk of asbestos related cancer per 100,000, for cumulative asbestos exposures accrued over 5-years from age 30

Cumulative exposure (fibres/ml.years)	Crocidolite Best (min-max)**	Amosite Best (min-max)**	Chrysotile Best (min-max)**
10	5600 (3200 - 8400)	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.

5. Control banding matches the risk severity with a control option. The less tolerable the risk, the more stringent the preventive control required. For asbestos, the H&D model provides a means of associating risks with specific 'task scenarios' via the degree and type of exposure these typically entail. There are a limited number of options for control, or combinations of control that match the potential exposure for that task.

6. The aim of control banding is to tend towards a precautionary degree of control. It should describe good control practice for the defined task, to guide non-experts and to inform experts. Control banding is done through evidence-based expert judgement and peer review. Control bands reduce uncertainty to within one 'box or band' of the model, but have the disadvantage of 'fragility' at the boundaries. However, if there are a number of bands and the level of controls increase proportionately to risk an error of assigning risk between two control bands will make only a small difference to the overall level of risk.

Existing use of control banding for asbestos

7. Current asbestos legislation already includes a 2-level control banding scheme by requiring asbestos work with the potential to release high fibre concentrations to air and which represent a higher risk to workers to be carried out under an HSE licence. Work is exempt from licensing when it meets the following conditions:
   - workers' exposure to asbestos fibres is 'sporadic and of low intensity'. This means that asbestos in the air is not liable to exceed 0.6 fibres per cm^3 measured over 10 minutes; *and*
   - the risk assessment shows that exposure won't exceed the Control Limit of 0.1 fibres . per cm^3 measured over 4 hours; *and*
   - the work involves one of the following activities:
     - *short, non-continuous maintenance activity on asbestos insulation or asbestos insulating board.*
       'Short duration' work, from start to clear-up, means:
       - any one person carries out such work for less than one hour in a seven-day period on insulation, asbestos coatings or asbestos insulating board
       - the total time spent by all workers on the work should not exceed a total of two hours
       - the time includes activities such as building enclosures and cleaning.
     - *removal of materials that have their asbestos fibres firmly linked in a 'matrix'.* This means work to remove materials such as:
       - asbestos cement
       - textured decorative coatings and paints which contain asbestos
       - articles of bitumen, plastic, resin or rubber which contain asbestos eg vinyl floor tiles, electric cables, roofing felt
       - other insulation products eg gaskets, washers, ropes and seals
     - *other specific work*
       - encapsulation or sealing of asbestos-containing materials which are in good condition
       - air monitoring and control
       - the collection and analysis of samples to find out if a specific material contains asbestos.

8. HSG210, 'Asbestos essentials' sets out precautionary guidance on control of exposure to asbestos for a range of non-licensed work tasks associated with 'sporadic and low intensity exposure'. Annex 1 sets out a list of the tasks in this guidance, and 'stratifies' these according to the control recommended. Expert judgement and peer review deemed the controls to be proportionate to the risks, as known at that time (2006). Adopting such controls reduces the risk of cancer caused by asbestos by reducing exposures. However, the extent to which risks are reduced in specific circumstances is uncertain and depends on the effective implementation of controls.

9. HSE guidance document OC 265/48 Version 3 Exposure to Asbestos from work activities: Advice for employers sets out general advice about exposure to asbestos from work activities and the associated risks to health. In particular, it provides 4 ordered bands to indicate in broad terms which activities are likely to be associated with higher or lower levels of risk. These are reproduced in Table 2 below and plausible cumulative exposure ranges have been assigned in an additional column.

Table 2: Exposure scenarios and likely associated exposure ranges/bands		
Exposure band	**Exposure scenario**	**Fibres/ml-year**
A: Lower band	One-off disturbance with prompt clear-up	<0.0001
B: Intermediate band	Being an occupant in a building which has asbestos-containing materials in poor condition that are disturbed regularly and release fibres	0.0001 –0.0099
C: Higher band	Regular powered tool cutting, drilling, breaking or smashing high-hazard materials eg as part of maintenance and refurbishment work	0.01 – 0.99
D: Highest band	Licensable work done without suitable controls	>1

http://www.hse.gov.uk/foi/internalops/fod/oc/200-299/265-48-1.htm)

Argument

10. A starting point for further development of control bands was to define a series of risk and exposure bands which are directly underpinned by risk estimates from the H&D model. This was produced by tabulating for each main asbestos type the cumulative exposures associated with different orders of magnitude of lifetime risk. These are shown in Table 3 and were derived assuming exposure starting at age 30 and accrued over approximately 5 years, as in previous considerations of risk estimates.

Table 3: Exposures for orders of magnitude of lifetime risk (mesothelioma and asbestos related lung cancer combined) as predicted by the H&D model for exposures starting at age 30 and accrued over 5 years.

Disease risk		**Exposure* fibre/ml-years**		
Lifetime risk per million	Annual risk per million	Crocidolite	Amosite	Chrysotile
10^5 (1 in 10)	2000	18 (12, 26)	33 (25, 45)	820 (190, 1700)
10^4 (1 in 100)	200	1.4 (0.49, 3.6)	4.9 (2, 10)	130 (32, 170)
10^3 (1 in 1000)	20	0.078 (0.013, 0.41)	0.56 (0.095, 2.1)	17 (2.6, 27)
100 (1 in $10^{4)}$	2	37×10^{-4} (29×10^{-5}, 0.043)	0.043 (29×10^{-4}, 0.38)	1.7 (0.016, 5.5)
10 (1 in $10^{5)}$	0.2	17×10^{-5} (62×10^{-7}, 0.043)	23×10^{-4} (14×10^{-6}, 0.053)	0.11 (62×10^{-4}, 0.96)
1 (1 in $10^{6)}$	0.02	81×10^{-7} (13×10^{-8}, 43×10^{-5})	11×10^{-5} (15×10^{-7}, 61×10^{-4})	59×10^{-4} (17×10^{-5}, 0.13)
0.1 (1 in $10^{7)}$	0.002	38×10^{-8} 29×10^{-10}, 43×10^{-6}	53×10^{-7} (33×10^{-9}, 64×10^{-5})	28×0^{-5} (38×10^{-7}, 0.015)

* Best estimate and range based on H&D minimum and maximum models

11. The exposure values from Table 3 have then been taken to represent boundaries for categories of cumulative exposure which define bands of lifetime risk of the same order of magnitude, for example: 1-10 per million; 10-100 per million; 100-1000 per million; etc. These corresponding risk bands are shown in Table 4 below.

Table 4: Suggested ordered risk bands for various exposure ranges for the three main asbestos fibre types					
Risk band	**Disease risk per 10^6**		**Exposure, fibre/ml-years**		
	Lifetime	Annual	Crocidolite	Amosite	Chrysotile
6	$>10^5$	>2000	>18	>33	>820
5	10^4 to 10^5	200 to 2000	1.4 to 18	5 to 33	130 to 820
4	10^3 to 10^4	20 to 200	0.08 to 1.4	0.6 to 5	20 to 130
3	100 to 1000	2 to 20	0.004 to 0.08	0.04 to 0.6	2 to 20
2	10 to 100	0.2 to 2	$2x10^{-4}$ to 0.004	0.002 to 0.04	0.1 to 2
1	1 to 10	0.02 to 0.2	$8x10^{-6}$ to $2x10^{-4}$	0.0001 to 0.002	0.006 to 0.1
0	<1	<0.02	$<8x10^{-6}$	$<1x10^{-4}$	<0.006

12. The practical use of these risk bands is demonstrated through a series of relevant scenarios as set out in Table 5 below. The scenarios concern work on Asbestos Insulating Board (AIB) and work on Asbestos Cement (AC). These constitute two widely encountered products one of which (AIB) requires a licensed remover to work on the material if it exceeds the requirements listed in paragraph 7. AIB usually contains amosite and AC usually contains chrysotile asbestos. Consideration of the typical exposure concentration, type of fibre and likely duration, as well as the pattern of how such exposures might be repeated over a five-year period, allows calculation of cumulative exposure and assignment to risk band using Table 4.

13. The rate of so called “spontaneous” mesotheliomas becomes relevant when considering the lower risk bands since it provides useful contextual information about levels of risk. For example, risk bands can be considered for asbestos exposures with equivalent levels of lifetime risk as spontaneous mesotheliomas. There is some uncertainty about the level of lifetime risk for spontaneous mesotheliomas, but if it was as high as 25 per 100,000 (250 per million), an asbestos exposure with an equivalent level of risk would be assigned to risk band 3.

14. Based on recent results from a long term US study to measure airborne asbestos concentrations (Lee and Van Orden, 2008), the outdoor background for asbestos fibres has an averaged concentration around 20 fibres/m^3 (2 x 10^{-5} fibres/ml). The average background concentrations in buildings containing asbestos materials are of the order of 100 fibres/m^3. These averages are based on monitoring of 3979 samples for inside all buildings and 1678 outdoor samples. Earlier UK measurements (Burdett and Jaffrey, 1986) in asbestos containing buildings which included some routine maintenance work averaged 500 fibres/m^3. Most occupational measurements range between 10^6 and 10^9 fibres/m^3. (*Conversion: 1 fibre/ml = 10^6 fibres/m^3*). The concentrations are for asbestiform fibres, ie those of countable size using phase-contrast microscopy (WHO, 1997). All epidemiological analysis has been based upon this metric, so there is little value in considering other techniques that are more sensitive or detect finer fibres.

Table 5: Scenarios for various work with asbestos materials: exposure and risk band				
Amosite AIB, non-licensed	Fibres/ml, typical concentration	Hours worked per year (proportion of working time doing task*)	Cumulative exposure (Fibres/ml-year) over 5 years	Risk band (Table 4)
Simple occupancy	0.0001	1920 (100%)	0.0005	1
Work close to/ brush against	0.01	96 (5%)	0.0025	2
Limited damage, eg maintenance	1	25 (30 min per week)	0.065	3
Significant damage, eg breakage	10	25 (30 min per week)	0.65	4
Uncontrolled removal	100	96 (5%)	25	5
Amosite AIB, Licensed	Fibres/ml, typical concentration	Hours worked per year (proportion of working time doing task*)	Cumulative exposure (Fibres/ml-year) over 5 years	Risk band (Table 4)
Limited damage	1	576 (30%)	1.5	4
Significant damage	10	576 (30%)	15	5
Uncontrolled removal	100	576 (30%)	150	6
Chrysotile AC, non-licensed	Fibres/ml, typical concentration	Hours worked per year (proportion of working time doing task*)	Cumulative exposure (Fibres/ml-year) over 5 years	Risk band (Table 4)
Simple occupancy	0.0001	1920 (100%)	0.0005	0
Work close to / brush against	0.01	96 (5%)	0.0025	0
Limited damage, eg maintenance	0.05	96 (5%)	0.0125	1
Significant damage, eg breakage	0.1	96 (5%)	0.025	1
Uncontrolled removal	1	96 (5%)	0.25	2

*Assumed to be plausible proportions of working time for each scenario.

15. Cumulative exposures in Table 5 are calculated by assuming the pattern of exposure continues over 5 years and the assigned risk bands are appropriate for such exposures starting at age 30. The scenarios cover worker's and the bystander's exposures. It would be possible to reanalyse the values for a different base age, or different patterns of work. Consideration of the consequences of short term single exposure events are not necessarily appropriate since many such events, if they truly happened in isolation, would be assigned to the lower risk – and hence lower control – bands. However, proper risk control needs to address repeated exposures, which collectively constitute much higher risks than any one of the single component exposure events.

16. The efficacy of control in exposure reduction remains a combination of reviewing on-site measurements and a degree of expert judgement, a literature survey on this matter has

been published. With specific reference to asbestos it is likely that correctly applied controls can nearly always reduce the higher airborne concentration to below 1 f/ml. With the correct training and face-fitting, the respirator recommended for many non-licensed tasks should be capable of achieving the assigned protection factor (APR) of 20, ie offers 20-fold reduction in exposure. Positive pressure respirators used for asbestos removal respirators have APR >1000. However, the actual in-service protection achieved depends on a number of human factor issues and lower values are usually applied by HSE.

17. The analysis above proposes boundaries for risk and exposure bands and avoids applying descriptors to these or identifying a target band it is necessary to achieve when controls are applied. Also, it has not been attempted in this paper to identify the control options necessary to reduce the higher band to a set target band or select what this lower band would be. These could be possible topics for a further paper, the specification for which may emerge from WATCH discussion.

Link to HSE Strategy

18. The R2P2 framework and CAR, 2006 are the primary strategy documents to which this paper is linked.

Consultation

19. There has been no wider consultation on the content of this paper beyond HSE at this stage.

European Context

20. There are no specific links to EU procedures or activities.

Action

21. WATCH is asked to consider the approach offered by this paper and to form an opinion on its scope and development.

Annexes

Annex 1 – list of 'Asbestos essentials' tasks as published in HSG210

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References

Burdett, G.J.; Jaffrey, S.A.M.T. (1986) Airborne asbestos concentrations in buildings, Annals of Occupational Hygiene, 30, 2, 185-199.

Health Effects Institute - Asbestos Research, Asbestos in public and commercial buildings: A literature review and synthesis of current knowledge. 1991.

Lee, R.J. and Van Orden, D.R. (2008) Airborne asbestos in buildings. Reg. Tox. and Pharm., 50, 218-225.

WHO, Determination of airborne fibre number concentration. A recommended method by phase-contrast optical microscopy (membrane filter method). World Health Organisation, Geneva. 1997.