Calculation methods

Calculation of exposure with regard to the specified reference periods

108 This section reproduces the approved methods for the calculation of exposure in relation to the 8-hour, short-term and one-year reference periods. **These methods are legally binding because they have been approved by the Health and Safety Commission.**

Notice of approval

The Health and Safety Commission has on 9 November 2004 approved the methods of calculation set out in the Schedule to this Notice for the purpose of determining exposure in relation to the reference periods for workplace exposure limits as specified in regulation 2(1) of the Control of Substances Hazardous to Health Regulations 2002 (as amended) and occupational exposure limit for lead as specified in Regulation 2(1) of the Control of Lead at Work Regulations 2002.

Signed
SUSAN MAWER
Secretary to the Health and Safety Commission
9 November 2004

Schedule

Part 1 The 8-hour reference period

1 The term '8-hour reference period' relates to the procedure whereby the occupational exposures in any 24-hour period are treated as equivalent to a single uniform exposure for 8 hours (the 8-hour time-weighted average (TWA) exposure).

2 The 8-hour TWA may be represented mathematically by:

$$\frac{C_1T_1+C_2T_2+\ldots C_nT_n}{8}$$

where C_1 is the occupational exposure and T_1 is the associated exposure time in hours in any 24-hour period.

Example 1

3 The operator works for 7 hours 20 minutes on a process in which he is exposed to a substance hazardous to health. The average exposure during that period is measured as 0.12 $mg.m^{-3}$.

The 8-hour TWA =

7 h 20 min (7.33 h) at 0.12 $mg.m^{-3}$
40 min (0.67 h) at 0 $mg.m^{-3}$

That is

$$\frac{(0.12 \times 7.33) + (0 \times 0.67)}{8}$$

$$= 0.11 \text{ mg.m}^{-3}$$

Example 2

4 The operator works for eight hours on a process in which he is exposed to a substance hazardous to health. The average exposure during that period is measured as 0.15 $mg.m^{-3}$.

The 8-hour TWA =

$$\frac{(0.15 \times 8)}{8}$$

$$= 0.15 \text{ mg.m}^{-3}$$

Example 3

5 Working periods may be split into several sessions for the purpose of sampling to take account of rest and meal breaks etc. This is illustrated by the following example:

Working period	Exposure ($mg.m^{-3}$)	Duration of sampling (h)
0800-1030	0.32	2.5
1045-1245	0.07	2
1330-1530	0.2	2
1545-1715	0.1	1.5

Exposure is assumed to be zero during the periods 1030 to 1045, 1245 to 1330 and 1530 to 1545.

The 8-hour TWA =

$$\frac{(0.32 \times 2.5) + (0.07 \times 2) + (0.20 \times 2) + (0.10 \times 1.5) + (0 \times 1.25)}{8}$$

$$\frac{0.80 + 0.14 + 0.40 + 0.15 + 0}{8}$$

$$= 0.19 \text{ mg.m}^{-3}$$

Example 4

6 An operator works for eight hours during the night shift on a process in which he is intermittently exposed to a substance hazardous to health. The operator's work pattern during the working period should be known and the best available data relating to each period of exposure should be applied in calculating the 8-hour TWA. These should be based on direct measurement, estimates based on data already available or reasonable assumptions.

Working period	Task	Exposure ($mg.m^{-3}$)
2200 to 2400	Helping in workshop	0.1 (known to be exposure of full-time group in workshop)
2400 to 0100	Cleaning elsewhere in factory	0 (assumed)
0100 to 0400	Working in canteen	0 (assumed)
0400 to 0600	Cleaning-up after breakdown in workshop	0.21 measured

The 8-hour TWA =

$$\frac{(0.10 \times 2) + (0.21 \times 2) + (0 \times 4)}{8}$$

$$= 0.078 \text{ mg.m}^{-3}$$

Example 5

7 The operator works a 12-hour shift each day for five days, and then has seven days' rest. The exposure limits are based on an 8-hour reference period in each 24 hours in which an exposure occurs; the seven days' rest makes no difference. While at work, the operator is exposed to 4 $mg.m^{-3}$.

The 8-hour TWA=

$$\frac{(4 \times 12)}{8}$$

$$= 6 \text{ mg.m}^{-3}$$

The short-term reference period

8 Exposure should be recorded as the average over the specified short-term reference period, normally 15 minutes, and should be determined by sampling over that period. For short emissions of less than the reference period, which still may have the potential to cause harm, appropriate action should be taken to ensure that a 'suitable and sufficient' risk assessment is carried out to ensure that there is no risk to health from such exposures.

Methods of measurement and calculation for determining the fibre concentrations of MMMF

109 These paragraphs reproduce the Notice of Approval which is based on the methods detailed in MDHS59 *Man-made mineral fibre.*[34] **The methods are legally binding because they have been approved by the Health and Safety Commission**.

Notice of approval

The Health and Safety Commission has on 9 November 2004 approved the methods of measurement and calculation set out in the Schedule to this notice for the purpose of determining the fibre concentration of MMMF (also known as man-made mineral fibres, machine-made mineral fibres and man-made vitreous fibres) in air for comparison with the workplace exposure limit specified in the Health and Safety Commission's approved list of workplace exposure limits.

Signed:
SUSAN MAWER
Secretary to the Health and Safety Commission
9 November 2004

Schedule

1 The method shall measure the exposure of employees by sampling in the breathing zone of the employee exposed.

2 'Fibre' means a particle with a length >5 µm, average diameter <3 µm, and a ratio of length to diameter >3 to 1, which can be seen using the system specified in paragraph 3.

3 Fibres shall be counted with a phase contrast microscope of such a quality and maintained in such condition at all times during the use that Block 5 on the HSE/NPL Test Slide Mark II would be visible when used in accordance with the manufacturer's instructions. The microscope shall be tested with the Slide frequently enough to establish this. The microscope magnification shall be between 400x and 600x. During counting, the difference in refractive index between the fibres and the medium in which they are immersed shall be between 0.05 and 0.30. The microscopist shall be properly trained in relevant techniques.

4 The results shall be regularly tested by quality assurance procedures to ensure that the results are in satisfactory agreement with the average of results obtained by British laboratories participating in a national quality assurance scheme using the methods specified in paragraphs 1-3.