**Dichloromethane (DCM)**

***Who is this guidance for?***

This guidance is primarily aimed at employers or individuals with delegated responsibility for managing workplace exposure to substances. Whilst it is not exhaustive, the information presented is intended to demonstrate how biomonitoring can help with this duty. Some simple advice is presented to help non-specialist users to get the most out of biomonitoring covering (1) when to take a sample to ensure reliable and comparable results over time; (2) putting the result into context with respect to background (environmental) levels or what can reasonably be achieved with good exposure control; and (3) some basic technical data that can help to evaluate an analytical service provider. For further information you should consult your chosen analytical service provider who should be happy to discuss your specific requirements and find solutions.

**Dichloromethane (DCM)**

Monitored by analysis of carbon monoxide (CO) in breath

**BMGV**: 30ppm carbon monoxide in end-tidal breath

**Hazardous Substance:**

Dichloromethane CAS number: 75-09-2

Alternative name Methylene chloride

**Workplace Exposure Limits:**

8-hour TWA: 100ppm, 350mg/m3

15-minute STEL: 300ppm, 1060mg/m3

Skin notation

***Biological Monitoring Guidance Value (BMGV)***

30ppm end-tidal breath CO

***Other Guidance Values***

**This BMGV is based on a historic method. Subsequent improvements to available analytical instruments mean that quantifying DCM itself, in urine, is now the method of choice. Whilst the methodology outlined in this guidance remains valid, most analytical service providers no longer offer breath CO monitoring. Given the relative ease of obtaining a urine sample, this is the recommended sample for routine biomonitoring. A urine sample will reflect the previous few hours exposure to DCM, so samples for exposure assessment can be collected either at the end-of-shift or within 2 hours of potential exposure arising from a specific task. DCM is volatile, so care needs to be taken to avoid losses during transit to the laboratory – your analytical service provider will provide specific details.**

The ACGIH BEI value is based on the measurement of DCM in urine: 0.3mg/L urine (3.5µmol/L). The DFG BAT is based on the measurement of DCM in whole blood: 1mg/L whole blood (11.8µmol/L). Guidance values set by different organisations will vary, based on factors including available data and scientific knowledge at the time and interpretation of the toxicology data.

***Sample Collection***

Breath CO is measured on-site using a portable CO breath analyser, which gives a direct readout of CO in ppm, or the equivalent percentage of carboxyhaemoglobin. Breath should be analysed at the end of the shift.

***Description of Suggested Method***

Dichloromethane is metabolised to carbon monoxide and so biological monitoring is possible using blood carboxyhaemoglobin or breath CO as a measure of uptake. The good relationship between breath CO and carboxyhaemoglobin levels in blood means that measurement of CO in end-tidal breath is a reliable, non-invasive approach to biological monitoring. This is measured using a portable, direct-reading CO monitor. These are based on electro-chemical sensors and can display CO concentration in the breath, or its blood carboxyhaemoglobin equivalent.

**Analytical Evaluation**

Detection limit: 2-3ppm

Calibration range: Typically 0-500ppm

Drift: Less than 2% a month

Analytical Interferences: None likely to be encountered in breath. Negligible effect from organic solvents. Environmental CO exposure can influence the measurement; it is recommended to carry out breath analysis in an environment removed from external CO sources. Evaluation of a representative electrochemical CO monitor has shown no measurable influence from 400ppm DCM.

Quality assurance: Not practical, but monitor should be regularly calibrated in accordance with manufacturer specifications.

***Elimination Half-Life***

Elimination half-life is a measure of the rate of removal of a substance that has been taken into the body. It helps to identify when it is best to take a sample following potential exposure and indicates the potential ‘exposure window’ that will be reflected by a result.

Following DCM exposure, the elimination half-time of carboxyhaemoglobin in the blood has been reported to be as high as 13 hours. This compares with an elimination half-time of 4-5 hours for carboxyhaemoglobin produced following CO exposure. The increased carboxyhaemoglobin half-time following DCM exposure may be explained by ongoing metabolism of DCM stored in body tissues, especially fat. Levels of COHb are reported to return to normal by 24-48 hours after cessation of DCM exposure.

**Other Information**

***Confounding factors***

CO exposure from confined vehicle exhaust emissions and tobacco smoke (see below).

Other dihalomethanes (such as bromochloromethane) are also metabolised to CO.

Passive smoking will not significantly influence breath CO levels.

**Unexposed levels**

* in non-smokers: <6 ppm
* in light smokers: <20 ppm
* in heavy smokers: >20ppm

Unexposed levels are much higher in smokers than non-smokers, and can be above 20ppm in heavy smokers. Therefore smoking during the workshift will reduce the value of the end-of-shift breath CO measurement as a measure of DCM exposure. If the worker has not smoked during the shift its confounding influence is reduced. Although smoking during the shift can complicate the interpretation of the BMGV for DCM for that individual, assessment of biological monitoring on a group basis may still be useful in determining the effectiveness of control.

***Interpretation***

Carbon monoxide levels in exhaled breath reflect systematic exposure to dichloromethane that may have entered the body by inhalation or through the skin. If biological monitoring results are greater than the guidance value it does not necessarily mean that ill health will occur, but it does mean that exposure is not being adequately controlled. Under these circumstances employers will need to look at current work practices to see how they can be improved to reduce exposure.

**Links**

EH40 List of Approved Workplace Exposure Limits <http://www.hse.gov.uk/pubns/books/eh40.htm>

Biological Monitoring: A tool for helping to assess workplace exposure (August 2021). Published by British Occupational Hygiene Society (www.bohs.org). [BOHS-Biological-Monitoring-A-tool-for-helping-to-assess-workplace-exposure-rebranded.pdf](https://www.bohs.org/app/uploads/2021/08/BOHS-Biological-Monitoring-A-tool-for-helping-to-assess-workplace-exposure-rebranded.pdf)

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**Biological Monitoring at HSE**

<https://www.hsl.gov.uk/online-ordering/analytical-services-and-assays/biological-monitoring>