**Cyclohexanone**

**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.

**Hazardous Substance:**

Cyclohexanone

CAS number: 108-94-1

**Workplace Exposure Limits:**

8-hour TWA: 10 ppm, 41 mg/m3

15-minute STEL: 20 ppm, 82 mg/m3

Skin notation

**Cyclohexanone**

Monitored by analysis of cyclohexanol in urine

**BMGV**: 2 mmol cyclohexanol /mol creatinine

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

2 mmol cyclohexanol /mol creatinine

Conversion: 1 mmol/mol = 0.886 mg/g

***Other Guidance Values***

The ACGIH BEI is 8mg/g (approx. 6mmol/mol creatinine). 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***

Urine samples should be collected at the end of shift into polystyrene universal containers (30mL).

***Sample Transport to Laboratory***

Send samples to the laboratory by first class post (or equivalent) to arrive within 48 hours of collection. If any delay is anticipated, store samples chilled – ideally frozen if suitable facilities are available. Packaging must comply with relevant postal regulations for biological samples (UN3373).

Care needs to be taken to minimise analyte loss through volatilisation during transit to the laboratory.

***Description of Suggested Method***

Urine samples are hydrolysed to release free cyclohexanol and cyclohexanediols, followed by extraction into diethyl ether. Analysis is then carried out by gas chromatography with mass-spectrometry detection.

***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.

**Analytical Evaluation**

Detection limit: 5 µmol/L (3 x background)

Calibration range: Typically 0-100 µmol/L

Precision:

- within day <3% RSD at 25 µmol/L

- day to day <16% RSD at 25 µmol/L

Sample stability: at least 4 days at ambient temperature

Analytical Interferences: None known

Quality assurance: External QA is not available.

For cyclohexanol in urine, the half-life is approximately 1-2 hours. Results will reflect exposure over the previous 5-10 hours.

**Other Information**

***Confounding factors***

Cyclohexanol is a metabolite of cyclohexane and so any co-exposure to cyclohexane or cyclohexanol may contribute to total urinary cyclohexanol and needs to be noted. The metabolism of cyclohexane to cyclohexanol is mediated by alcohol dehydrogenase and so any co-exposure to ethanol (e.g. alcoholic drinks during work time) needs to be noted as it will affect the conversion of cyclohexanone to cyclohexanol.

***Unexposed level***

None detected.

**Creatinine correction is advised**

Cyclohexanediols can also be measured but their longer half-life means that with repeated exposure they may accumulate and their concentration in end-of-shift urine samples will increase during the week. As an example, after repeated daily exposure to 10ppm for 8 hours, the concentration of 1,2 and 1,4 cyclohexanediols in end-of-shift urine samples on the 4th day would be around 44 and 23 mmol/mol respectively.

***Interpretation***

Urinary cyclohexanol results reflect systematic exposure to cyclohexanone 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)

For further advice, please contact us:

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**Biological Monitoring at HSE**

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