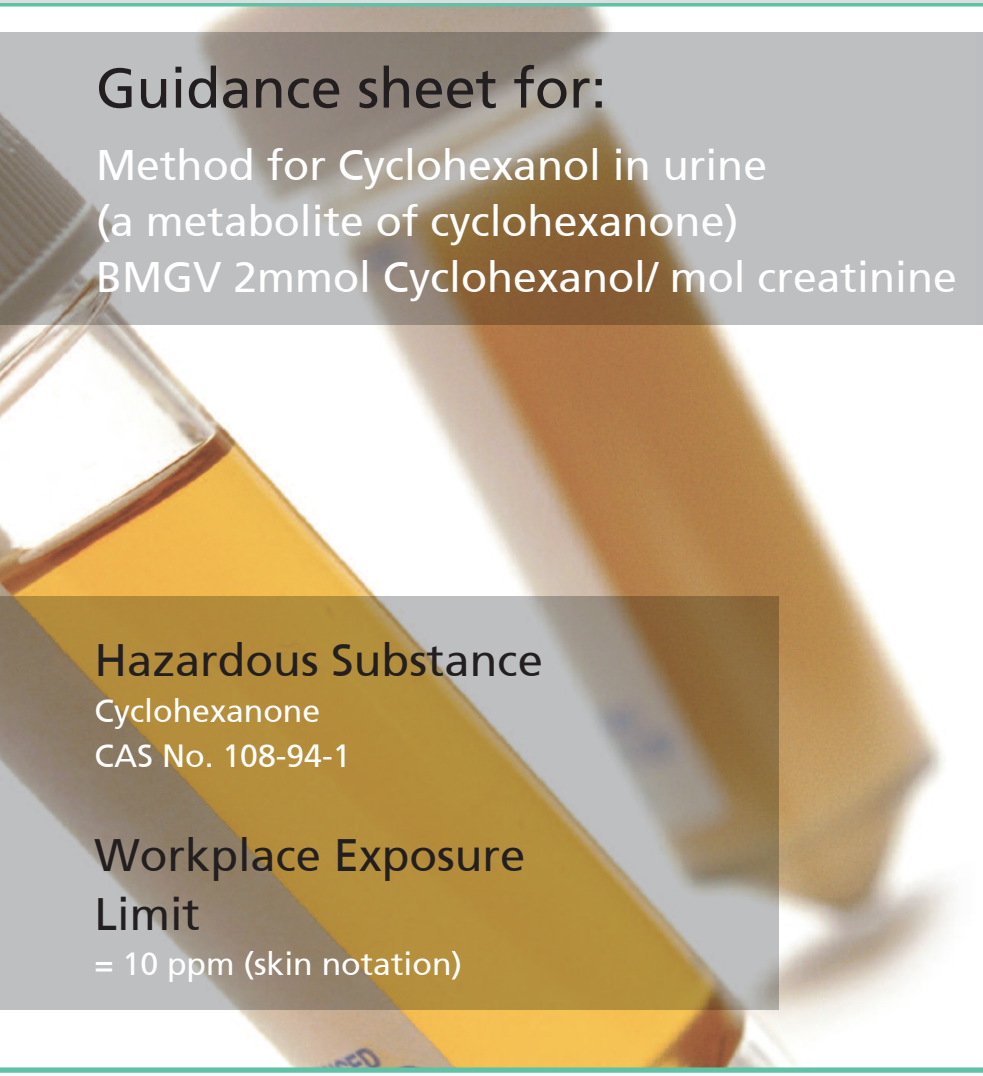
Biological Monitoring Guidance Values

Guidance sheet for:

Method for Cyclohexanol in urine
(a metabolite of cyclohexanone)
BMGV 2mmol Cyclohexanol/ mol creatinine



Hazardous Substance

Cyclohexanone
CAS No. 108-94-1

Workplace Exposure Limit

= 10 ppm (skin notation)

The Health and Safety Laboratory is an Agency of the Health and Safety Executive

HEALTH & SAFETY LABORATORY

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Biological Monitoring Guidance Value:

Guidance Value - 2 mmol cyclohexanol/mol creatintine
Conversion: 1 mmol/mol = 0.886 mg/g

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 48h of collection. If any delay is anticipated, store at –20°C. Packaging must comply with Post Office Regulations.

Description of Suggested Method

Cyclohexanol and cyclohexanediols can be measured in urine after acid hydrolysis of glucuronide conjugates, extracting twice into diethyl ether and analysed by gas chromatography with flame ionisation detection or selected ion monitoring mass spectrometry.

Analytical Evaluation

Precision
- within day <3% RSD at 25 µmol/l
- day to day <16% RSD at 25 µmol/l

Detection Limit
- 3x background - 5 µmol/l

Calibration Range
- typically 0-100 µmol/l

Sample Stability
- > 4 days at ambient

Analytical Interferences
- None known

Other Information

Elimination half-time

For cyclohexanol in urine - approximately 1 - 2 hours.

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

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Confounding Factors

Cyclohexanol is a metabolite of cyclohexane so any co-exposure to cyclohexane or cyclohexanol may contribute to the urinary excretion of 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. drinking during work-time) needs to be noted as it will affect the conversion of cyclohexanone to cyclohexanol.

Unexposed Levels None

Creatinine Correction Advised

Quality Assurance

Internal QC - must be established

Interpretation

Urinary cyclohexanol results reflect systemic exposure to chlorobenzene 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 indicate that control of exposure may not be adequate. Under these circumstances employers will need to look at current work practices to see how they can be improved to reduce exposure.

Other Guidance Values

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

Links

EH40 List of Approved Workplace Exposure Limits http://www.hse.gov.uk/coshh/table1.pdf

Biological Monitoring at HSL
http://www.hsl.gov.uk/online-ordering/analytical-services.aspx

References

Ong C N, Sia G L, Chia S E. Phoon W H, Tan K T (1991a). Determination of cyclohexanol in urine and its use in environmental monitoring of cyclohexanone exposure. J. Anal. Tox. 15, 13-16. Mraz J, Galova E, Nohova H, Vitkova D (1994). Uptake, metabolism and elimination of cyclohexanol in humans. Int. Occup. Environ. Health. 66, 203-208 Kawai T, Nakahara Y, Hoiguchi S, Zhang Z, Higashikawa K, Ikeda M (1999) Monitoring of occupational exposure to cyclohexanone by diffusive sampling and urine analysis. Biomarkers. 4(5), 328-341.

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