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)
Biological Monitoring Guidance Value:

Guidance Value - 2 mmol cyclohexanol/mol creatinine
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 urine 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.
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