**Chromium**

***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 Substances:**

Chromium and its water soluble compounds.

Hexavalent chromium (CrVI) (CAS number 18540-29-9)

**Workplace Exposure Limits:**

8-hour TWA: 0.5 mg/m3 for elemental chromium and trivalent chromium (Cr III) compounds

8-hour TWA: 0.01 mg/m3 for non-process generated

and 0.025 mg/m3 for process generated for hexavalent chromium compounds (CrVI).

**Chromium**

Monitored by analysis of chromium in a urine sample

**BMGV**: 10 µmol chromium/mol creatinine

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

10 μmol chromium/mol creatinine derived from a HSE study of workplaces where those with good control 90% of the chromium workers had a level below 10 µmol/mol creatinine.

***Other Guidance Values***

The DFG BAR (representing general population background level) is 0.6 μg/L, 11.5 nmol/L (approx. 1 μmol/mol creatinine). The ACGIH BEI is 25µg/g (approx. 40µmol/mol creatinine), however, this value is almost 20 years old and may not reflect current scientific knowledge.

***Sample Collection***

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

***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. Packaging must comply with UN3373 Biological Substances, **Category B** requirements.

**Suggested Method and Analytical Evaluation**

Analytical technique: Inductively coupled plasma mass spectrometry single quadrupole (ICP-MS) with collision cell gas mode.

Limit of Quantitation: 1 nmol/L (approx. 0.1 µmol/mol creatinine)

Calibration range: Typically 0-4000 nmol/L

Precision:

- within day <5% RSD at 80 nmol/L

- day to day <10 % RSD at 80 nmol/L

Sample stability: 2 days at ambient temperature, >3 months at 20°C

Analytical Interferences: Argon and chloride interferences should be removed by use of collision cell mode. It is also possible to use an ICPMS tandem quadrupole instrument and use a reaction cell gas to remove the interference.

Quality assurance: UK NEQAS for Trace Elements ([www.surreyeqas.org.uk/trace-elements-teqas](http://www.surreyeqas.org.uk/trace-elements-teqas)); G-EQUAS (www.g-equas.de).

***When to take a sample***

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.

Urinary chromium levels can reflect both past and recent exposure, with daily accumulation occurring through the working week of the occupationally exposed. The absorption and excretion of chromium in urine depends on the chromium compound, its solubility, route of exposure and level of exposure.

This can mean that elimination overnight is not complete and, if exposure is repeated, it gives rise to gradually increasing pre-shift and post-shift levels during the week, with a significant fall over the weekend. Urine chromium levels in more highly exposed workers will not return to normal over the weekend and in circumstances of significantly high, long term exposure levels they may not return to normal for some years following cessation of exposure.

Evidence from published studies suggest that in welders following an inhalation exposure have suggested that levels of chromium in urine rise during the working day and then decline with elimination half-lives of 7 hours, 15 - 30 days and 3 - 5 years1,2. Whereas, studies in chrome platers have shown a two-stage process with half-lives of 2-3 days followed by 1 month3.

It is advised to sample for exposure to chromium at the end of a shift towards the end of the working week.

**Other Information**

***Confounding factors***

None known

***Unexposed level***

Below 2.9 μmol chromium/mol creatinine

**Creatinine correction is advised**

***Interpretation***

Urinary chromium results reflect systematic exposure to all chromium compounds 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. An elevated result should be re-tested as soon as possible to help establish whether it represents ongoing workplace exposure or a ‘one-off’ event. If necessary, employers will need to look at current work practices to see how they can be improved to reduce exposure.

***Further information***

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

Working with chromium are you at risk? <https://www.hse.gov.uk/pubns/indg346.pdf>

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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registration.sample@hse.gov.uk

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**Biological Monitoring at HSE**

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