

Monitoring for Electrolytic Hexavalent Chromium Processes

Background

Monitoring for electrolytic chromium processes has been legally required for over 30 years. Initially, this required a test every 14 days of the efficiency of the control measures, carried out by a responsible person appointed by the factory occupier. Most companies chose to sample the air above the plating tank for chromic acid. Monitoring using air sampling became legally established when the Control of Substances Hazardous to Health Regulations (COSHH) 1984 replaced the Chromium Plating Regulations.

Concerns have been expressed that air sampling for chromic acid may not always be carried out properly because:

- **The sampling method has been changed a number of times but some companies may be using outdated techniques;**
- **The procedure can be time consuming and often carried out inaccurately;**
- **Some companies have been known to change operating procedures (eg adding surfactant immediately before carrying out the test) so it was not representative of normal conditions;**
- **The tests may not be carried out at all or completely inappropriately (eg using Draeger tubes. NB The lowest detection level for these tubes is 20x the Maximum Exposure Limit);**

This guidance sheet explains what monitoring means in practice and the options available to chromium platers/chromic acid anodisers to comply with the law.

What processes are covered?

Schedule 5 of COSHH requires monitoring every 14 days for spray given off from vessels where an electrolytic chromium process is carried out (except trivalent chromium). These includes:

- **hard chrome plating;**
- **decorative chrome plating - bright and black chrome;**
- **anodising; and**
- **some passivation processes.**

What is monitoring?

Monitoring means using appropriate techniques to estimate employees' exposure to hexavalent chromium. It is not a one-off check but ongoing tests of the operating environment to ensure that employees are being protected.

Monitoring every 14 days is an additional legal requirement to confirm that employees are not being exposed to hexavalent chromium. It is separate to direct checks of control measures such as using tensiometers to measure surfactant concentration and anemometers to measure LEV performance, which need to be carried out much more frequently (ie between 4 and 40 hours).

What type of monitoring should be carried out?

1. air sampling above the tank every 14 days; and
2. if skin exposure, ingestion etc is possible, or control relies on PPE biological monitoring by analysis of urine samples (collected at the end of a work shift) may be a useful addition to the exposure assessment. Biological monitoring is not compulsory and the frequency of urine monitoring should depend on the results obtained - more frequent monitoring should follow high results. If biological monitoring results are below the guidance value monitoring at 6 monthly intervals or when the process changes may be appropriate.

Important note - If the process has not been run for more than 14 days, the appropriate checks must be carried out as soon as it is brought back into use.

Air sampling for chromic acid mist

The potential for mist generation will depend on a number of process variables, particularly:

- **the concentration and temperature of the electrolyte;**
- **the surface area of the articles treated;**
- **the current density;**
- **and the length of time current is passed through the solution.**

The amount of mist in the air is controlled by a combination of spray suppressant, level of freeboard (ullage) and local exhaust ventilation (LEV). These control measures are discussed in more detail in the Guidance Sheet Prevention and Control of Chromic Acid Mist.

Initial air sampling should be carried out under worst-case conditions ie highest current, longest plating time etc. and the control measures established. This will need to be recorded ie surface tension (mN/m, previously measured as dynes/cm), freeboard distance (measured between the level of electrolyte and the top of the tank), and average capture velocity (from a representative sample of measurements taken at the duct opening in the lip extraction).



Sufficient air samples should be taken to establish a reliable benchmark of exposure under these conditions (ie at least two if they are consistent; more if they differ significantly). If the amount of mist emitted from the tank is below the maximum exposure limit (MEL) of 0.05 mg/m³ (8 hour time weighted average), it is likely that adequate control is being achieved at the time of the test.

Thereafter, if the control measures are maintained at the same or a better level than when initially established, the employer can be confident that emissions from the bath are being adequately controlled. The fortnightly air sampling should confirm this is the case.

Air Sampling procedure for chromic acid mist

Whoever carries out the sampling must be competent to do so. In-house personnel will probably need to attend a half-day training session on the sampling technique*.



Adjusting the Pump flow rate

The latest sampling and analytical procedure for chromic acid mist, Hexavalent chromium in chromium plating mists MDHS 52/3, should be used to check for chromic acid mist. Sampling pumps and ancillary equipment are outlined in General methods for sampling and gravimetric analysis of respirable and total inhalable dust MDHS 14/3.

Dedicated sampling kits for MDHS 52/3 are now available*. Anyone using an original kit (probably from SB Instruments)

will need to check that the sampling pump is still working correctly and is accurately calibrated. It may be possible to have existing equipment refurbished.

Air Sampling results

Each sampling position should be clearly identified for record purposes and the analytical results recorded for each sample taken. Any result higher than normal should be investigated to find out why. Where checks are representative of identifiable employees' exposure, a record must be made and kept available for at least 40 years. Otherwise records must be kept for at least 5 years.

Biological Monitoring

Urine samples should be collected at the end of a work shift and analysed for total chromium. HSE's biological monitoring guidance value for hexavalent chromium is 10 (mol/mol creatinine. This is an occupational hygiene-based guidance value and is not health-based. Exceeding this value should prompt further sampling. An investigation of exposure and its control should follow if results regularly exceed the guidance value. Chromium is found in urine of people not occupationally exposed to hexavalent chromium and although the levels found are generally below 2 (mol/mol creatinine occasionally a result may exceed the guidance value.

Other publications

Chromium Code of Approved Practice
Metal Finishing Association
Tel: 0121 237 1122/3 Fax: 0121 237 1124

*Kits are available from Procon Electronics, 450 Blandford Road, Poole Dorset BH16 5BN (tel 01202-632310) and SKC Ltd, Unit 11 Sunrise Park, Higher Shaftesbury Road, Blandford Forum, Dorset DT11 8ST (tel 01258-480188).

Procon Electronics can also calibrate and refurbish SB Instruments pumps.

SKC Ltd can carry out training for personnel on the sampling procedure.