Introduction
Chromium trioxide (as flakes or crystals) and the soluble form as chromic acid are used in the electroplating industry.

This sheet covers the risks from skin contact and absorption, along with ingestion (via skin contact) as potential routes of exposure. It outlines the control measures that are considered necessary in the electroplating industry and includes information on health surveillance.

The inhalation risk from chromic acid mist is covered in a separate Joint SEA/HSE guidance sheet Prevention of exposure and Control of chromic acid mist.

Note: the text refers to chromic acid but this also implicitly refers to chromium trioxide.

Effects on Health
The main health effects from skin contact and ingestion are:

- occupational contact dermatitis and skin sensitisation, and
- severe burns,

and the health effects from breathing in chromic acid mist are

- lung cancer, and
- occupational asthma.

Historically, breathing in chromic acid mist has always created most concern as it has been assigned as a Category 1 (proven human) carcinogen and a Category 2 mutagen (toxic for reproduction). However, as chromic acid causes direct DNA damage, this suggests cancer can result from any form of occupational contact including from skin contact.

A positive link has been demonstrated between surface and hand contamination and urinary chromium levels amongst workers (not just platers) in the chromium plating industry. Wherever skin exposure occurs, there will also be an increased risk of inadvertent ingestion exposure because of hand to mouth contact. See HSE Research Report RR963
Prevention of Exposure – What the law says

Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) is the current system that regulates the supply and use of chemicals (including solvents) in Europe. It became law in the UK on 1 June 2007. REACH includes an obligation for substances supplied in quantities of one tonne per year or more to be ‘registered’ with the European Chemicals Agency (ECHA). REACH also includes an ‘authorisation’ procedure for substances that have been identified as “Substances of Very High Concern” (SVHCs) and included within Annex XIV (which is regularly updated). When a substance has been listed on Annex XIV it will be necessary for companies wishing to supply and use these substances to seek an ‘authorisation’ from the EC unless it meets one of the exemptions in the REACH regulations. Further information can be found in the leaflet REACH Authorisation produced by the UK REACH Competent Authority.

Chromic acid has been added to Annex XIV for substances of very high concern (SVHC’s) which requires ‘authorisation’ in order to continue its supply and use for specific applications. The authorisation process will have wide ranging effects on the use of chromic acid. The SEA’s current opinion (September 2014) is that hexavalent chromium will not be authorised for ‘decorative chrome’ applications and some passivation processes, as trivalent chrome is a viable alternative. The latest application date for authorisation will be 21st March 2016, and the sunset date will be 21st September 2017, after which the supply and use of chromium trioxide will not be allowed unless it is covered by the authorisation.

There will be noticeable changes to the information suppliers provide to the user in the new ‘extended’ safety data sheets (eSDS) (see REACH and safety data sheets), including a move from risk phrases (R) to hazard statements (H). Once chemicals are registered, safety data sheets will list their ‘registration’ numbers and may also include exposure scenarios. The supplier is required to send the user a new eSDS and also on request by the user at any time. This information should be used to inform decisions in the COSHH assessment (see below). An exposure scenario describes the operating conditions and risk management measures that have been identified by the supplier as being necessary to use the chemical safely. REACH requires the user to follow the advice on risk management measures given in the exposure scenario attached to the safety data sheet. However, the user can choose to use different risk management measures to those described in the exposure scenario. The user should then be able to justify why their measures offer an equivalent (or better) level of protection for human health (and the environment) to those described in the exposure scenario. Information in the eSDS will reflect the requirements of the approved authorisation.

Current users of chromic acid should discuss the implications of REACH with their chemical and equipment suppliers as a matter of priority.

Further information on REACH can be obtained from HSE’s REACH web pages

The Control of Substances Hazardous to Health (COSHH) Regulations requires that exposure to hazardous substances is prevented, or where this is not reasonably practicable, adequate control is achieved. For a carcinogen/asthmagen like chromic acid, adequate control means reducing exposure to as low a level as is reasonably practicable (ALARP).

There are additional specific requirements for control of carcinogens in Regulation 7(5) of COSHH which are in addition to applying all the
“principles of good practice for the control of exposure to substances hazardous to health” contained in Schedule 2A of COSHH. Controlling chromic acid mist is also important for skin risks (and ingestion) because the mist will deposit on adjacent surfaces increasing overall contamination. Information on controlling chromic acid mist is contained in Joint SEA/HSE Guidance sheet - Prevention and Control of Chromic Acid Mist.

For more information on COSHH see the Approved Code of Practice and guidance.

Tasks need to be identified where skin may be exposed to chromium trioxide or chromic acid (both directly and indirectly) including:

- unjigging and unmasking operations,
- product washing down activities
- loading and unloading manual plating lines,
- contact with contaminated surfaces or control dials, buttons, levers and switches,
- preparing and making additions to plating solutions,
- testing plating solutions,
- disposing of bags that contained chromium salts,
- cleaning up dry or wet spills of plating solutions, and
- plant maintenance activities such as cleaning tanks,

Consideration should be given to how these tasks can be avoided or carried out in a different way to prevent skin exposure. For example, automatic dosing of plating baths will avoid any potential skin exposure from splashing during decanting/mixing of concentrated plating solutions or from direct contact with chromium trioxide flakes/crystals.

**Substitution**

COSH first requires that consideration is given to substituting hexavalent chromium for a less hazardous material. As Trivalent chromium chemistry is commonly used for decorative chrome finishes and for passivation processes substitution would be expected. You should keep aware of research into new plating technologies as this will enable considered and timely substitution decisions.

Where prevention of exposure and/or substitution are not reasonably practicable, safe working practices should be established to minimise exposures. All areas where skin exposures may potentially occur (directly and indirectly) need to be properly managed from storage, to safe handling and use, through to disposal.

**Skin Protection and Reducing Exposure**

Where prevention cannot be achieved, control measures will need to be introduced to minimise skin contact. The following issues should be considered:

- identifying materials and/or conditions likely to cause skin rashes;
- organising work to reduce contact with harmful substances;
- providing and/or modifying equipment to reduce skin contact eg using barrel plating;
- providing adequate and accessible washing and hygiene facilities;
- the provision and proper use of protective clothing and equipment to minimise skin contact;
- provision of suitable gloves which resist permeation of liquids and flakes etc containing chromium compounds which allow for adequate dexterity and also protects against mechanical hazards;
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- having a skin contact and protection training programme for employees
- appropriate use of skin creams
- implementing a programme of health surveillance

See the HSE publication HSG262 Managing skin exposure risks at work for further information.

**Work Planning and Housekeeping**

A safe system of work that addresses the skin exposure risks should be devised and documented. Specific modifications to plating work methods and equipment may include:

- routine replacement of filters and loading anode cages,
- pumping rather than pouring liquid tank additions,
- restricting access to the plating line,
- providing impermeable, easy-to-clean work surfaces,
- rinsing the work on the flight bar to reduce the build up of chromium salts,
- dealing with spills immediately, preferably using a suction device, and
- ensuring all storage containers are labelled and safely kept (away from oxidisable and combustible materials).

Work equipment and all adjacent surfaces, such as working platforms, handrails and control panels etc, can become contaminated directly from splashing or the deposition of mist/aerosols (which contain chromium) or indirectly from contamination via employees and personal protective equipment (PPE) or other equipment. All these surfaces should be subject to a cleaning schedule which minimises cross contamination and helps prevent skin exposure to chromium. This cleaning schedule could coincide with some aspects of a normal preventative maintenance regime.

Floors, walls and other surfaces should be cleaned at regular intervals and whenever necessary. This applies equally to ‘clean’ areas such as changing rooms, rest areas and canteens. Soft furnishings should be avoided as they harbour contaminants and cannot be readily cleansed. Surface contamination can be checked with a surface sampling test kit. Searching on “chromium test kit” in an internet search engine should generate a list of suppliers.

Good personal hygiene is important in decontaminating hands especially after handling plating solutions and particularly before eating, drinking, smoking, before going to the toilet or otherwise leaving the ‘dirty’ contaminated working areas. All contaminated work clothing and other PPE should also be removed (and cleaned as necessary) on leaving the working areas to prevent spread of contamination. The location of the washing facilities is important in enabling all personnel to practice good personal hygiene.

All eating and drinking should only be allowed in specified rest/canteen areas and never in working areas that may be contaminated. Smoking should only be allowed in external areas away from the working areas and other relevant risks (eg combustible materials). Workers should always clean their hands prior to smoking due to the possible risk of ingestion arising from hand to mouth contact (and probable additional exposure from ‘roll-ups’ being contaminated).

**Personnel Protective Equipment (PPE)**

Use of PPE is considered to be the ‘last line of defence’ in the hierarchy of control.

Working practices with direct hand immersion into treatment tanks and direct handling of heavily contaminated components should
always be avoided. When it is not reasonably practicable to avoid such practices, a robust management programme covering selection, use and maintenance of PPE, is required.

The use of PPE is always the last resort to control exposure where there is still a residual risk as identified by your risk assessment. Suitable PPE should be chosen which is appropriate for the activity/task being undertaken. A responsible person should be assigned responsibility for the implementation of any PPE programmes.

**Gloves**

Gloves/hands should never be routinely immersed in plating solutions. Alternatives methods of working should always be used which avoids persons putting their gloves/hands into the plating solutions.

For tasks where dexterity is required (e.g. unjigging and unmasking) a single use splash resistant nitrile glove (BS EN 374) are suitable. These gloves should be replaced every time they are removed (eg at break times or when going to the toilet). The correct way to remove this type of glove without contaminating your hands is shown in Appendix 1, Figure 1. The maximum time a disposable glove can be worn is four hours (without removal) because of breakthrough (permeation) of plating solutions through the glove material.

For tasks where protection against abrasion or sharp edges (eg on the plating line or handling bulk chemicals) is needed, reusable chemically resistant gloves (up to 0.5 mm) (BS EN 374 and BS EN 388) should be used. Reuse of these gloves should only follow where the manufacturer's instructions allow. This may not be recommended due to degradation and breakthrough of the plating solution through the glove material. Contamination of the inside of the glove during glove removal and refitting is also a factor to be considered. Where these gloves are used, they can cause hand sweating so it is recommended that reusable/disposable cotton or silk liners are provided. These not only keep the skin in better condition but also facilitate easier glove removal without contaminating the skin. Figure 2 in Appendix 1 shows how to remove these reusable gloves that have only been used for a short period of time.

Using gloves to control exposure to chromium can only be effective if supported by a suitable glove programme which includes:

- selection as part of the risk assessment for the process,
- use,
- storage,
- disposal, and
- training.

**Eye protection**

Eye protection (BS EN 166) or a full-face visor should be provided where there is any risk of splashing (although work methods should avoid splashing where possible).

**Other PPE**

Make sure that forearms are covered where there is a risk of splashing or other contact with plating solutions (including finished products). An impervious apron is usually necessary for a manual line and where handling bulk chemicals. Coveralls should be provided by the employer where there is a risk of contamination. The employer should arrange for coveralls to be laundered at least once per week and replaced as necessary. Taking work wear home for laundering should be prohibited as this spreads contaminated material outside the workplace into cars and peoples homes and potentially exposes vulnerable persons (eg children).
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Suitable accommodation, such as a lockable locker, should be provided for each worker’s PPE. A suitable changing room should also be provided.

**Facilities for Rest, Meals and Washing**
Suitably located washing facilities with wash stations having running hot and cold, or warm water are essential. Soap and towels should also be provided and the facilities should be kept clean and tidy. These washing facilities should be located adjacent to exits from ‘dirty’ contaminated working areas so that workers can wash their hands before eating, drinking, smoking, and before going to the toilet or otherwise leaving these working areas.

It is recommended that showering facilities are provided to allow employees to decontaminate themselves fully – however, this is not required presently under health and safety law.

Facilities for rest and eating food (away from production areas) are also required because food eaten in the workplace could become contaminated with chromium. Eating facilities should include a means of obtaining a hot drink and should also be kept clean and tidy.

On leaving the plating area (to go to the rest room, office etc) PPE should be removed and appropriately stored.

**Skin Care**
Workers need to practice good personal hygiene to ensure that their hands are kept clean and in good condition. Using pre-work creams may help to make removing chromium (and other contaminants) easier. They do not provide an effective barrier and therefore, creams are not an alternative to using gloves. After-work creams are particularly beneficial because they help restore the natural moisture content of the skin after washing hands. These products should be made available adjacent to the washing facilities.

For more information on skin care see HSE webpages Skin at work

**Emergency Showers and Eye-wash Stations**
Emergency showers and eye-wash stations are recommended because of the hazards associated with chromic acid and other chemicals used in the plating shop. See EN15154 for specifications required.

**Exposure Monitoring**
Exposure monitoring for dermatitis and inhalation risks is a complex issue and is therefore, described in a separate Joint SEA/HSE guidance sheet - Monitoring for exposure to Chromium (VI) arising from electrolytic hexavalent chromium processes.

Biological monitoring (urine sampling) can show possible skin exposure (as well as inhalation and ingestion exposure routes). Observation of work methods can identify possible skin exposure. The use of surface sampling kits can also identify key areas for improvement to reduce contamination and consequently reduce skin exposure.

**Health Surveillance**
All employees exposed or liable to have their skin exposed to hexavalent chromium should be under suitable health surveillance. An occupational health professional needs to be involved in preparing a health surveillance programme. A responsible person should be appointed to carry out the checks. This can be one of the company’s own employees but they will require some simple training by an occupational doctor or nurse.
As a minimum the health surveillance (for skin issues) should include the following:

- assessing the overall skin condition of employees as soon as possible after they are initially employed,
- regularly inspecting employees’ hands, forearms, face and neck and completing a questionnaire annually,
- checking for nasal septum perforations and asking the worker about skin conditions which could indicate the presence of chrome ulcers
- having any abnormal results referred to you so that you can arrange for them to be interpreted by your occupational health provider,
- ensuring that the employees are aware that they should inform the responsible person of any symptoms that occur between checks, so that this can be referred to the occupational health provider, and
- keeping a health record for each individual for forty years.

The health record should include:

- the activity that can cause dermatitis, chrome ulceration and nasal septum perforation,
- the worker’s name, address and National Insurance number,
- the process that they work on and how often,
- the protective measures provided,
- the date of starting work,
- the results of the skin inspections, and
- the summary on fitness (or otherwise) received from the occupational health provider.

A suitable record sheet for skin inspections is included in the Appendix.

For further information see COSHH Essentials Sheet G403 - Health surveillance for occupational dermatitis and HSE’s webpage Health surveillance

**Note:** health surveillance for occupational asthma from exposure to chromic acid mist is described in Joint SEA/HSE guidance sheet Prevention of exposure and control of chromic acid mist.

### Reporting adverse health conditions

Besides referring skin or respiratory problems for medical opinion, there is a separate legal requirement under the Reporting of Injuries, Diseases and Dangerous Occurrences (RIDDOR) Regulations 2013 to report to HSE any cases of:

- Occupational dermatitis;
- Occupational cancer where this relates to workplace exposure to a known carcinogen;
- Occupational asthma

which are related to exposure to hexavalent chromium compounds. Chrome ulceration of the nose or throat, or to the skin of the hands or forearm are no longer required to be reported following the introduction of the 2013 RIDDOR Regulations.

To report a case of occupational disease you should complete the Form F2508A- Case of ill health notification online.

### Information, Instruction and Training

Information, instruction and training are a key part of your health risk management and without it the measures implemented as a result of your risk assessment will not be fully effective. They are best delivered as toolbox talks or classroom style as opposed to printed
material handed to employees, although the latter can be used to supplement a personal delivery approach.

Employees should be told about:

- the symptoms of dermatitis, chrome ulceration and nasal septum perforation,
- who they should immediately report symptoms to,
- the safe systems of work,
- the glove programme, and
- the collective results of any health surveillance.

Induction training for new employees should cover:

- all risks to health arising from exposure to chromium and its compounds
- the correct use and maintenance of control measures,
- the work practices which prevent or reduce exposure of the skin to chromium; and
- the emergency procedures, particularly the emergency showers and eye-wash stations.

Information, instruction and training should be understandable to all employees, so you should consider their language and writing/reading skills. It should be reviewed and updated whenever there are significant changes to the work. You may consider summarising and documenting the key points, laminating the resulting page or pages and displaying them at appropriate points in the plating shop.

Further Information

1. **HSE Research Report RR963**
   Exposure to hexavalent chromium, nickel and cadmium compounds in the electroplating industry

2. **HSE leaflet Chromium and You INDG346**
   Working with chromium - Are you at risk?

3. **HSE website**
   Health and safety in surface engineering

4. **Joint SEA/HSE guidance sheet**
   Prevention of Exposure to Hexavalent Chromium and Control of Chromic Acid Mist

5. **Joint SEA/HSE guidance sheet**
   Monitoring for exposure to Chromium (VI) arising from Electrolytic Hexavalent Chromium Processes

6. **Joint SEA/HSE guidance sheet**
   Nickel and Nickel Alloy Plating Operations: Controlling the Risk of Skin Exposure

7. **Joint SEA/HSE guidance sheet**
   Nickel and Nickel Alloy Plating Operations: Controlling the Risk of Inhaling Mist Containing Nickel

8. **EN15154**
   Safety Showers

9. **COSHH**
   Approved Code of Practice and guidance.

10. **HSE guidance note HSG262**
    Managing skin exposure risks at work for further information.

11. **COSHH Essentials Sheet**
    Health surveillance for occupational dermatitis