

MANAGEMENT OF HEXAVALENT CHROMIUM Cr(VI) IN DEFENCE

Introduction

1. There are a large number of Hexavalent Chromium (Cr(VI)) compounds, all of which are hazardous to health, and most are known carcinogens. This Annex addresses the management of Cr(VI) in Defence, it subsumes the information that was previously provided in the Defence Instruction Notice (DIN) 2020DIN06-024.
2. There are three areas of concern regarding Cr(VI) in Defence:
 - a. Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) authorised Cr(VI) compounds which are managed using REACH.
 - b. Legacy materials containing Cr(VI) which are managed under Control of Substances Hazardous to Health (COSHH).
 - c. Cr(VI) generated through the welding, braising, or high temperature operation of chromium containing alloys.

Roles and responsibilities summary

3. This information is applicable to anyone who may be working in the presence of Cr(VI) and its compounds, and anyone who authorises such work.
4. Authorisers are responsible for:
 - a. assessing the risks to health and any precautions needed for protection;
 - b. preventing any exposure to Cr(VI) or, where this cannot be reasonably be achieved, adequately control exposure;
 - c. maintaining all fume and dust controls in efficient working order;
 - d. providing fit testing of any tight-fitting respirators;
 - e. finding out how much chromium staff may be exposed to, normally through a monitoring programme, and informing staff of the results;
 - f. arranging any necessary health checks; and
 - g. informing, instructing, and training all colleagues who may be exposed to Cr(VI).
5. If you may be working in the presence of Cr(VI), you **should**:
 - a. be aware of where Cr(VI) can be found, as detailed in this Annex and the associated risk assessments;
 - b. use extraction equipment or any other control measures correctly;
 - c. use the protective clothing and equipment provided;
 - d. always use the washing facilities provided;

- e. if you have to wear a respirator, ensure it fits properly, is clean, and that the filter is changed regularly;
- f. report defects in enclosures, extraction equipment, or other control measures; and
- g. do not eat or drink in work areas where Cr(VI) may be present.

Cr(VI) residues

6. Cr(VI) can present as white, yellow, orange, or dark brown powder residues. They have been found in association with high chromium alloys, particularly high temperature nickel, and stainless-steel alloys. They can be formed when such alloys are brazed or welded. It is also possible that small amounts of Cr(VI) can be formed if these alloys are heated above ~300°C in the presence of catalysing agents such as calcium barium and magnesium, which can be found in greases and anti-seize compounds. Cr(VI) residue has been found around gas turbine propulsion systems.

7. This is a developing picture, potentially across all equipment, where high chrome alloys are exposed to high temperatures. It **must** be noted that the presence of staining is not necessarily indicative of the presence of Cr(VI) and the lack of visible staining does indicate that there is no Cr(VI) present on a surface. Until the risks associated with high chrome alloys have been fully assessed, any such alloys which are subject to temperatures over 300°C **should** be treated as having Cr(VI) present.

Cr(VI) in the supply chain

8. The list of compounds that are subject to REACH authorisation is given at paragraph 13. There are a number of Cr(VI) compounds that are not subject to authorisation but **should** be managed in line with HazMat policy and COSHH Regulations. There are many examples in aircraft, land vehicles, ships, weapons, and equipment where Cr(VI) has been used in the past and, whilst no longer applied, or procured, could still be present. In this case these are covered under COSHH, and the additional REACH safety and reporting requirements do not apply. (for further information then please contact the DE&S Quality, Safety & Environmental Engineering ([QSEE](#)) team). In many cases these compounds are still present on legacy equipment within Defence.

9. Since July 2017, certain Cr(VI) compounds have been banned from use under Annex XIV of the Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) Regulation (EC) No 1907/2006, due to their carcinogenic properties. As a result, these chemicals now require authorisation before use based on specific use cases and supply chain availability.

10. After a transition period the EU REACH Regulations were brought into UK law under the European Union (Withdrawal) Act 2018. REACH, and related legislation, were replicated in the UK with the necessary changes to make it operable in a domestic context and the key principles of the EU REACH Regulations were retained.

11. The domestic regime operating in the UK since the 1 January 2021, is known as UK REACH. Please visit HSE [UK REACH](#) for more information.

12. The following are the Cr(VI) substances that are subject to authorisations known to be in use across Defence. Additional Cr(VI) are also subject to authorisation and these can be found on the UK REACH Authorisations list (annex XIV) at this link: <https://www.hse.gov.uk/reach/authorisation-list.htm>. There are a small number of Cr(VI) compounds not subject to authorisation which are captured in the list of REACH authorisations - granted and applications in progress at the link to <https://www.hse.gov.uk/reach/applications-for-authorisation.htm>.

- a. Strontium Chromate.
- b. Potassium Hydroxyoctaoxodizincatedichromate.
- c. Potassium Dichromate.
- d. Sodium Dichromate.
- e. Sodium Chromate.
- f. Dichromium Tris(chromate).
- g. Chromium Trioxide.

13. The existing authorisations permit selective uses of Cr(VI) with the implementation of appropriate risk management measures. The Control of Substances Hazardous to Health (COSHH) 2002 and REACH Regulations form part of the legal framework to control the use and exposure to hazardous substances and materials, including Cr(VI), within the workplace. However, the requirements for the use of Cr(VI) under a REACH authorisation exceed the requirements for the management of Cr(VI) under COSHH as it currently stands.

14. Recent changes to these authorisations have resulted in extra safety and reporting requirements from those at risk of exposure, known as Downstream Users (DUs). DUs are defined as organisations or individuals who use a substance or material, either on its own or in a mixture in their industrial or professional activities, across Defence this is likely to include some service personnel.

15. To ensure the safety and wellbeing of personnel, Defence has a responsibility to manage hazardous substances and materials in accordance with legislative and policy requirements. It is the Delivery Team and/or Equipment Authority responsibility to ensure these requirements are met through Risk Assessments, Safety Data Sheets and MOD Technical Dossiers in accordance with the Acquisition Safety and Environmental Management System (ASEMS) and JSP 418. In addition, Delivery Teams and/or Equipment Authorities are required to communicate with the relevant Original Equipment Manufacturers (OEMs) and DU's, to make sure that the supply of new equipment is compliant with REACH, including any authorisation requirements.

16. The OEMs are the authorisation holders who form part of the consortia for each respective authorisation and ultimately responsible for the REACH Cr(VI) authorisations in place for the products they supply. It is their responsibility under REACH to provide information to the Delivery Team and/or Equipment Authority often through Safety Data Sheets. However, it is essential that DU's, for example Military commands, make sure the necessary risk assessments are carried out, controls are put in place, and any monitoring requirements of the individual authorisations are completed. This includes any additional exposure data monitoring is submitted within the authorisation timelines, in addition to, their REACH Cr(VI) reporting obligations.

17. The Chief Environment and Safety Officer (CESO) or equivalent, points of contact (PoC) **should** collate this REACH Cr(VI) data for each of the sites, units or platforms affected and submit to the Health and Safety Executive. Use of any Cr(VI) substance under a REACH authorisation currently requires at a minimum annual exposure monitoring to be conducted. Further information can be provided by the DE&S Quality, Safety & Environmental Protection ([QSEE](#)) Team.

18. The fulfilment of these terms to supply and control Cr(VI) products is a legal requirement and is essential that Delivery Teams and/or Equipment Authorities comply with the requirements in the authorisations and thus the products to which they apply. This also includes the use of new 'old stock' or repurposing old stock in a new build, if not covered by the authorisation under REACH. In instances where this has occurred, work **should** stop immediately and be reported to QSEE, who will investigate and provide guidance.

19. If there is a requirement to use chromates outside the authorisation in the interests of Defence or a security concern under the authorisations, there is potential for a REACH Defence exemption (this will be directed through QSEP to the Secretary of State, who will make the final decision). However, this **must** be requested with an accompanying submission pack a minimum of 4-6 months prior to use. Noting that in many cases the health and safety requirements under the authorisation would still apply. Failure to comply under REACH authorisation or apply for a Defence exemption is a breach of regulation and may result in certain chromate products being no longer available.

20. DE&S Quality, Safety & Environmental & Engineering ([QSEE](#)) has notified the European Chemicals Agency (ECHA) (pre Jan 2020) and the Health and Safety Executive (post Jan 2020) of the location of all known Cr(VI) across Defence. The use of any new products containing Cr(VI) **must** be reported to QSEE as there is a legal requirement to notify HSE within 3-months of first use.

Cr(IV) at the end-of-life

21. When equipment containing embodied Cr(VI) is placed on the market by the MOD, purchasers **should** be informed of the presence and location of Cr(VI) when known by the Authority. Information relating to the presence of Cr(VI) **should** be passed to the National Armaments Director (NAD) Group, Defence Recycling and Disposal Team (DRDT) to allow this information to be included in the particulars of sale.

Cr(IV) related health hazards

22. The adverse effects on health associated with exposure to chromium vary according to valency state and water solubility, but it is the Cr(VI) compounds (chromium VI) which are of most concern.

23. The health hazards associated with Cr(VI) relate to inhalation/ingestion of dust, mist, and spray, or contact with the skin and eyes.

24. **Respiratory effects.** There is an increased risk of lung cancer from exposure to Cr(VI) compounds. Other effects associated with the inhalation of dust, mist, or spray from Cr(VI) compounds are:

- a. chemical irritation causing wheeze;

- b. the development of breathing difficulties (including wheeze and/or a cough at night) that gets better at the weekend or while on holiday, and then returns when at work; and
- c. irritation of the inside of the nose which may progress to an ulcer or unusual bleeding inside the nose.

25. **Skin effects.** The effects of Cr(VI) compounds on the skin include: (a) irritant reactions which may progress to an ulcer. This is particularly the case where skin cuts and abrasions already exist. The skin **should** be checked regularly (with help from an Occupational Health team if required), as any red and inflamed skin **should** be considered something worthy of referral to Occupational Health, if employees are working in Cr(VI) generating work processes.

26. **Eye effects.** Direct contact and contamination of the eyes can result in irritation, and possibly ulceration. Again, any eye irritation or any problems in any aspect of vision, in those working in Cr(VI) generating processes, **should** be referred to an appropriate Occupational Health provider for review.

People at risk of Cr(VI)

27. People at risk of exposure include those:

- a. working on articles previously coated with Cr(VI) paints, for example, cutting, drilling, filing fettling abrading or machining painted articles.
- b. conducting 'hot work' on high chrome alloys, such as welding and brazing or handling parts that are subject to high temperatures in normal use.
- c. handling the Cr(VI) containing substances at paragraph 9 covered by the existing Cr(VI) authorisations that support the use of certain products in the aerospace and other industries.
- d. maintaining gas turbines (for example, aviation and maritime engines) where high chromium heat resisting alloy components are exposed to high temperatures (~300 °C and above).

Prevention and control of exposure to Cr(VI)

28. All work with, or exposure to, Cr(VI) **must** be managed by undertaking and recording a suitable and sufficient COSHH risk assessment in accordance with this chapter which mandates all hazardous substances and materials **should** be managed using risk assessment and compliance with Control of Substances Hazardous to Health (COSHH) 2002 and REACH Regulations.

29. **Risk assessment.** An assessment of the health risks arising from the handling of Cr(VI) containing substances, materials or activities where Cr(VI) may be present **must** be undertaken, together with the precautions necessary to prevent or adequately control them. This may require air sampling and biological monitoring.

30. **Prevention of exposure.** This **should** always be considered first. It may be possible to substitute the Cr(VI) containing substance or material with another less hazardous substance able to achieve the performance specifications required.

31. **Control of exposure.** Where Cr(VI) containing substances or materials need to be used or are anticipated to be found during maintenance activities, exposure **must** be adequately controlled by a suitable combination of engineering and process control measures, along with the use of personal protective equipment (PPE), as appropriate.

32. The provision of adequate control depends on:

a. keeping personal exposures as low as is reasonably practicable and to below the workplace exposure limits (WELs) assigned for chromium and its compounds. As per the Health and Safety Executive's guidance¹, these are as follows:

(1) for chromium (VI) products, 0.01 milligrams per cubic metre of air averaged over an 8-hour period (0.01 mg/m³ 8-hr TWA).

(2) for process generated chromium (VI) compounds (for example, welding fumes), 0.025 milligrams per cubic metre of air averaged over an 8-hour period (0.025 mg/m³ 8-hr TWA).

b. high standards of housekeeping to prevent or minimise contamination;

c. the proper use of suitable PPE to avoid skin or eye contact and, where necessary, prevent inhalation of dust, mist, or spray;

d. good personal hygiene standards. Skin conditions, cuts, and abrasions, in particular, **should** be protected from contamination; and

e. careful handwashing before eating, drinking, and smoking, with care to ensure domestic/dining areas adjacent to Cr(VI) containing work processes are kept clean (with regular confirmation of cleanliness - CESOs [or equivalent] and Occupational Hygiene can advise).

33. **Engineering control systems** may comprise total enclosure of the process or use of local exhaust ventilation systems. Work methods **must** not raise Cr(VI) containing dust and the use of compressed air for cleaning **should** be prohibited. Use wet wipes or a vacuum cleaner (with high-efficiency particulate air (HEPA) filters) to trap and remove the suspected Cr(VI) containing substances where possible.

34. Further specific measures which may be required by the risk assessment, include:

a. minimising the number of persons exposed and periods of exposure;

b. prohibiting smoking, eating, and drinking in contaminated areas;

c. regularly cleaning work surfaces by a suitable safe method, to minimise contamination;

d. the provision of suitable washing and changing facilities near at hand;

e. demarcating potentially contaminated areas and displaying suitable warning signs; and

f. safe storage, handling, and disposal of Cr(VI) containing substances or materials.

¹ EH40/2005 (Fourth Edition 2020)

35. **Personal Protective Equipment (PPE)**. Where PPE is identified as a control measure in the risk assessment this may include, but **should** not be limited to:
- facial PPE - a half-face mask with safety glasses/goggles which has been fit tested (QLFT), or a full-face mask which has been fit tested (QNFT), whereby the correct filtration will be determined based upon the known hazard;
 - disposable chemical resistant gloves (EN 374-3 or equivalent);
 - disposable coveralls with hood (Type 5/6 for particulate/limited splash, and Type 4 or Type 3 for chemical/liquid protection, depending on the hazard); and
 - boot coverings.

Maintenance of control measures

36. The maintenance of control measures **should** be covered as part of the COSHH risk assessment. All control measures **should** be maintained in efficient working order and good repair at all times.
37. Engineering control measures, especially extract ventilation systems, **must** be examined, and tested by a competent person and appropriate records kept, including but not limited to commissioning certificates and inspection/testing records. It is recommended that all engineering control measures in use also receive frequent visual inspections at least weekly.
38. Preventative maintenance procedures **should** indicate which engineering control measures are required for the work to be carried out, by whom, and how any defects found will be put right.
39. PPE **should** also be properly maintained, replaced as necessary, cleaned, and suitably stored when not in use.
40. Respiratory protective equipment (RPE) **should** be regularly maintained in accordance with the manufacturer's instructions to ensure that it remains effective. Maintenance includes replacing filters, cleaning, disinfection, examination, repair, testing, and record keeping.

Exposure monitoring

41. The need for Exposure Monitoring is well defined in COSHH Regulations (Regulation 10). It offers an additional way to 'ring-fence' the hierarchy of control and thus assure the effectiveness of those controls. Authorisations granting the use of Cr(VI) have additional obligations which go beyond the COSHH exposure monitoring requirements and **must** be reported annually to the HSE.
42. Subject to a suitable and sufficient COSHH risk assessment, the Duty Holder may request support from an appropriate Occupational Health provider to assist in the periodic measurement of potential Cr(VI) exposure in the population at risk (PAR).

43. Any request to Occupational Health, for Exposure Monitoring, **should** be made following an appropriate Occupational Hygiene assessment, in order to further establish the risk to employees in light of an appropriate COSHH risk assessment review (with subject matter expert (SME) advice on the PAR and how best to reduce risk to As Low As Reasonably Practicable (ALARP)).

44. Occupational Hygiene specialists will then work in conjunction with Occupational Medicine to offer a suitable biological monitoring process to assist in ensuring the health and wellbeing of all potentially exposed personnel.

45. Be aware that an Exposure Monitoring programme **should** be accompanied by an appropriate information and education package to ensure all relevant employees understand the programmes' purpose, its scope, and outcomes. As Exposure Monitoring for Cr(VI) involves biological monitoring, it is essential that employees have all necessary information required to give informed consent. Early / proactive information and support, together with support throughout the process, yields better engagement and retention.

46. In the case of Cr(VI), Exposure Monitoring involves urine sampling in those identified as being PAR by the COSHH risk assessment. Where this is necessary, the Duty Holder is advised to establish a suitably qualified and experienced 'Tiger-team' to deliver a periodic programme with Occupational Hygiene and Occupational Health advisors included.

47. Where Exposure Monitoring is instigated, either as a result of a risk assessment review or as a result of a significant uncontrolled release of Cr(VI), the accountable person is to prioritise the health and wellbeing of the workforce and ensure appropriate information flow, education and wellbeing support for all employees associated with the work process.

48. The Duty Holder may also need to consider appropriate public relations support.

Health surveillance

49. The need for health surveillance and its extent **should** be determined as part of the COSHH risk assessment, where health surveillance is a separate regulated activity under COSHH (Regulation 11). Its purpose is to identify disease before there is a loss of function (disablement) in any one employee.

50. Where health surveillance is necessary it **should** be carried out under the direction of a suitably qualified health professional, for example occupational health doctor or nurse (where Armed Forces Primary Care have suitably qualified and experienced assets). Further detail on health surveillance is set out in [Chapter 14](#) – (Health Surveillance and Health Monitoring) of JSP 375, Volume 1.

51. Appropriate health surveillance may include initial health assessment along with periodic health assessment. Commanders or managers **should** seek occupational health support to establish the most appropriate health surveillance strategy, suitable for their COSHH risk assessment. This will link with exposure monitoring where appropriate.

52. Regular skin inspection of hands and forearms **should** be carried out by an occupational health professional or, where appropriate, by a suitably trained responsible person (within the workforce).

53. An effective system **should** be provided for reporting to a responsible person any skin complaint, nasal or respiratory symptoms, or other effects which may be attributable to exposure to Cr(VI) pigments. Care **should** be taken to respond to reports appropriately and in a timely fashion.
54. An appropriate occupational medical opinion **should** be sought where ill-health effects are identified, so that prompt remedial action can be taken.
55. Personnel **must** be informed of the results of any tests for Cr(VI) and the results of any health surveillance. Care **should** be taken to make sure appropriate information is passed to the employer on a group basis (with individual information passed where appropriate and advised by an occupational health professional cognisant of relevant data protection regulations).
56. Health surveillance data **must** be stored securely in the appropriate health record (for Service Personnel this is the integrated medical record - in Defence Medical Information Capability Programme (DMICP)).
57. Where a suitably qualified health professional reports occupationally attributable health effects related to Cr(VI), the Duty Holder **must** immediately conduct a risk assessment review (including a review of the effectiveness of all elements in the hierarchy of control) to establish the PAR and that risk is ALARP. This risk assessment review may include a consideration with respect to periodic Exposure Monitoring (as above), to ensure the continued health and wellbeing of employees. The Duty Holder therefore needs a low-threshold to involve Occupational Hygiene SMEs where any line manager or responsible person reports cases that may attribute to Cr(VI) exposure.