Hexavalent Chromium Supplier Guidance SGV1.0

Engine Run Parts – Advice on Hazards, Risks & Controls

HSE SME – Occupational Hygiene Team

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Please Note: To ensure consistency in our control advice for Rolls-Royce activities this pack should be delivered in its entirety. Additional slides detailing specific local exposure scenarios may be added, but no content is to be removed or omitted without prior consultation and consent of the Rolls-Royce Occupational Hygiene SME team

Hexavalent Chromium Health Hazard

Background to Topic

- Hexavalent chromium, also known as Chromium VI or Cr(VI), is one of the chemical valance states of the metal chromium. It is not naturally occurring but can be formed during certain industrial activities.
- At Rolls-Royce there is chromium present primarily in metal alloys, corrosion resistant paints and surface treatments. Cr(VI) can be formed when chromium containing alloys on our engines, reacting with calcium, are exposed to temperatures exceeding 300°C.
- Given Rolls-Royce cannot eliminate Cr(VI) from its processes and chemical substitution is not viable due to product safety issues, other control measures need to be considered when there is potential contact with engine run parts and components.
- Protecting the health of our employees, and those suppliers who work with us, is part of the Rolls-Royce Safety First commitment.
- **Rolls-Royce have taken action to manage potential risks in our operations and this guidance pack has been produced to provide information and guidance for our suppliers to implement their own controls to minimise risk.**

Why can Hexavalent Chromium be a health hazard?

Hexavalent Chromium Health Hazard

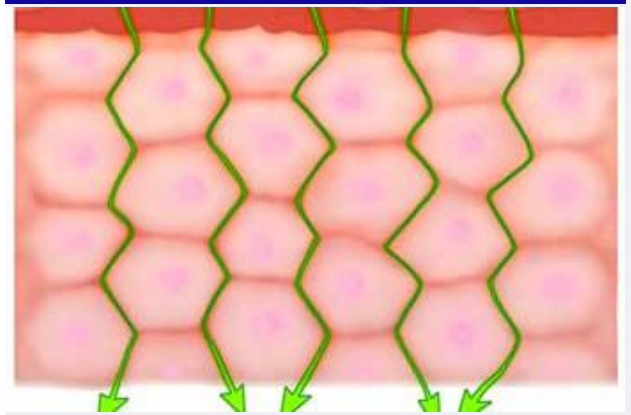
Source: https://www.bbc.co.uk/news/magazine-32809173

- Cr(VI) can cause skin and respiratory sensitisation
- Cr(VI) can irritate skin, eyes and cause skin and mucosal ulcerations
- Cr(VI) is a known carcinogen; it can cause cancer through inhalation.

Illness mechanism	Health effect
Skin sensitiser	Allergic contact dermatitis
Irritant	Skin and respiratory irritation Nasal mucosal ulceration (Cr(VI) mists)
Respiratory sensitiser	Occupational Asthma
Carcinogen	Lung cancer

What are the potential exposure routes of Cr(VI)?

Skin Absorption



Direct skin contact or skin contact with contaminated clothing/materials

Example;

- Skin contact with Cr(VI) residue on engine run components
- Skin contact with Cr(VI) containing paint

Inhalation

Inhalation of aerosolised Cr(VI) containing substances/materials

Example;

- Inhalation of Cr(VI) dust created by abrasive activities e.g. grinding, drilling

Ingestion

Eating or drinking contaminated food/drink/smoking products

Example

- Eating/drinking Cr(VI) contaminated food/drinks
- Not hand-washing after Cr(VI) exposure before eating, drinking or smoking

Potential Chromium VI Exposure Scenarios

Control measure and health surveillance advice

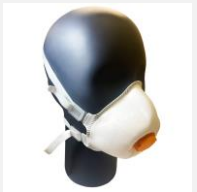
Exposure Scenario	Control Options	PPE Type	Health Surveillance / Monitoring
New build engine – Zero hours run time	No specific PPE controls required	None specific to Cr(VI)	Any skin issues require direct OH referral
Direct Contact **Engine run parts** General handling activities (with or without visible residue)	Segregate activity Skin control	Disposable Nitrile gloves	Skin surveillance
Direct Contact **Engine run parts** Work which may reasonably be expected to disturb residue/ dust e.g. grinding, drilling	Segregate activity Engineering controls (if practical) Skin control Protective clothing Respiratory protection	Disposable Nitrile gloves Disposable coveralls Suitable Respiratory Protective Equipment (RPE)	Skin surveillance Spirometry Biological monitoring

- **Review the hazardous substances risk assessment for the work you undertake for Rolls-Royce if Cr(VI) exposure could be a potential risk, and implement the appropriate recommended controls**

- If you are unsure if a Cr(VI) risk exists in the work you undertake for Rolls-Royce, assume that it is where this guidance has advised there is a potential risk.

Rolls-Royce Personal Protective Equipment (PPE) Control Advice

NOTE: PPE should not be relied on as a single control and should be used as a supplementary control with effective local exhaust ventilation (LEV) or isolation/ enclosure as appropriate

PPE Required	PPE Examples	Equipment required
Based on the risk assessment, if task(s) will <u>not</u> foreseeably generate a Cr(VI) aerosol e.g. careful handling of engine run parts, inspections etc. **Disposable Nitrile gloves** (e.g. MAPA Solo 977)		Additional PPE may be required – refer to task specific risk assessment Wet wipes + hazardous waste bags **Effective glove removal procedure to be followed. Treat all single use gloves and wet wipes as hazardous waste and dispose of accordingly**.
Based on the risk assessment, if there is a foreseeable risk of task(s) generating a Cr(VI) aerosol e.g. grinding, drilling or abrasive cleaning **Disposable Nitrile gloves** (e.g. MAPA Solo 977) **Disposable Coveralls** (e.g. Tyvek 500 Xpert) **Respiratory Protective Equipment (RPE)** • **E.g. FFP2/N95 Respirator** (tight fitting face-fit tested RPE and wearer always clean shaven) • **E.g. Powered Air Purifying Respirator** (PAPR) systems fitted with P2 filters (where clean shaven can't be achieved/maintained)	   	Additional PPE may be required – refer to task specific risk assessment Wet wipes + hazardous waste bags Where re-usable PPE/RPE is used, suitable decontamination, cleaning and maintenance procedures shall be in place. **Effective decontamination procedures to be followed. Treat all single use gloves, coveralls, disposable respirators and wet wipes as hazardous waste and dispose of accordingly**.

Please seek specialist PPE advice where there is the need for compatibility with other workplace PPE or hazardous working environments e.g. cut resistance or explosive (ATEX) zones

Advice for protecting from Ingestion Risk

GOOD HYGIENE PRACTICES

- Employees should wear PPE such as gloves and respiratory protection where required
- There should be no eating or drinking in the work areas
- Employees should remove any PPE before leaving the work area and dispose/store appropriately
- Employees should wash hands and face before eating, drinking or smoking

Health Surveillance Advice

- Health surveillance is a system of ongoing health checks to detect early signs of ill-health caused by exposure to workplace hazards, collect data on health risks, and evaluate the effectiveness of control measures.
- Health Surveillance should be undertaken for employees where a hazardous substances risk assessment indicates there remains a residual risk of exposure to Chromium VI.
- Where identified as necessary, employees should receive health surveillance to establish a baseline and identify any underlying conditions. The type of assessments are outlined below.

Exposure Route	Health Surveillance	Purpose	Frequency
Inhalation	Spirometry or Lung Function testing	Measures pulmonary output and effectiveness	Annual questionnaire Spirometry
Skin	Skin Assessments/ Inspections	Identify any skin conditions from contact with Cr(VI) Higher or Lower-level surveillance dependant on residual risk	Annual employee questionnaire Regular visual inspections by a responsible person

For Information: there have been no recorded health effects from potential Cr(VI) exposure for Rolls-Royce employees who have had contact with engine run parts

What testing has been done at Rolls-Royce to check the exposure risk and confirm controls are effective?

Swab Sampling

Swab samples identifying Chromium VI.

Cr(VI) has been detected on various engine run parts which had both visible residue and no visible residues. As visual inspection cannot be used to assess risk you should assume all engine run parts may have some contamination.

Skin contact is considered the main risk when handling engine run parts, and it is essential that appropriate PPE is worn.

Air Monitoring

Personal Air Monitoring within individual's breathing zone and static location sampling.

Results of monitoring projects during handling were below the Limit of Detection (<LOD) and the UK Workplace Exposure Limit.

The only positive results were from certain tasks generating aerosols - Exposure was controlled using PPE.

Overall, inhalation risk is considered to be low during normal strip/build and general handling activities.

Biological Testing

Urine sampling analyses concentration of total chromium (not specifically Cr(VI)).

Testing has shown that total chromium urine results were not detected or well below the UK HSE Biological Monitoring Guidance Value (BMGV).

Information, Instruction & Training (IIT) Advice

Employees should be trained on all associated hazardous substance risk assessments.

Results and findings from any Occupational Exposure Monitoring or Health Surveillance should also be shared with employees and fed into the risk assessment review process.

To provide refresher training at Roll-Royce the IIT guidance is displayed on boards within our facilities.

The boards show the hazards, risk and controls for potential Cr(VI) exposure. This maybe something you could use for your employees.

Information, Instruction & Training (IIT)

Example Employee Guidance

Do’s & Don’ts working with Hexavalent Chromium

- ✓ Familiarise yourself with the risk assessment for your area, and any hazards associated with Hexavalent Chromium.
- ✓ Assume Hexavalent Chromium deposits are present and take all necessary precautions.
- ✓ Wear disposable nitrile gloves (Specification EN374) when handling/ working with engine run components.
- ✓ If you see evidence of potential Hexavalent Chromium, follow PPE requirements and clean the affected area using engine approved wet wipes to remove any residue.
- ✓ Treat all single use PPE (coveralls, gloves, respirators) and wet wipes as hazardous waste and dispose of accordingly.
- ✓ Understand how to recognise and report (to your Line Manager or Occ. Health) any changes in skin condition or lung function.

- × Generate airborne dust by sweeping, brushing, using compressed air or abrasing engine components.
- × Attempt to clean up contaminated areas without PPE.
- × Eat, smoke, drink or go to the toilet after handling Engine-run parts without first washing your hands.
- × Take overalls, other clothing or PPE home which are potentially contaminated with Hexavalent Chromium
- × Wear tight fitting respirators with FFP2/N95 filters if you are not clean shaven or have not been face fit tested. You should seek alternative Respiratory Protective Equipment (RPE).
- × Forget to store, clean and maintain your re-usable PPE and RPE accordingly.

Hexavalent Chromium Additional Information

Where can I get more information?

- Engage with your Company Health & Safety Advisor
- If requiring specialist support engage a qualified occupational/industrial hygienist or equivalent in your country

  - British Occupational Hygiene Society (BOHS) Directory of OH Services
  - American Industrial Hygiene Association (AIHA) Consultants Directory | AIHA

Other sources of information include:

  - United Kingdom HSE – Chromium and you https://www.hse.gov.uk/pubns/indg346.pdf
  - United States OSHA - Hexavalent Chromium https://www.osha.gov/hexavalent-chromium
  - United States Centers for Disease Control and Prevention Hexavalent Chromium | CDC Archive