CHEMICAL SAFETY REPORT

Legal name of applicant:	Bard & Brazier Ltd
Submitted by:	Bard & Brazier Ltd
Date:	31st October 2025
Substance:	Chromium trioxide EC : 215-607-8 CAS : 1333-82-0
Use title:	Use of chromium trioxide for the chromium electroplating of sanitaryware and associated accessory components for the purpose of creating a coating to provide very specific performance characteristics and to match existing components and those supplied from other sources.
Use number:	3 - Functional chrome plating with decorative character

CONTENTS

1. SUBSTANCE INFORMATION

Chromium trioxide has a harmonised classification as Carcinogen Cat. 1A and Mutagen Cat. 1B with H350 and H340 according to CLP.

Based on studies which show its genotoxic potential, the Risk Assessment Committee (RAC) concluded that Chromium trioxide Cr(VI) should be considered as non-threshold substance with respect to risk characterisation for carcinogenic effect of hexavalent chromium (reference to the studies examined are included in the RAC document "Application for Authorization: Establishing a reference dose response relationship for carcinogenicity of hexavalent chromium " (RAC/ 27/2013/06 Rev.1).

RAC confirmed that it is not possible to determine a "derived no-effect level" for the carcinogenic properties of chromium trioxide and therefore Cr(VI) should be considered as non-threshold substance.

RAC established a reference dose response relationship for carcinogenicity of hexavalent chromium (RAC/27/2013/06 Rev.1) which has been used in this AfA.

Cr(VI) causes lung tumours in humans and animals by the inhalation route and tumours of the gastrointestinal tract in animals by the oral route. These are both local, site-of-contact tumours and there is no evidence that Cr(VI) causes tumours elsewhere in the body.

Dose-response relationships were derived by linear extrapolation. Extrapolating outside the range of observation inevitably introduces uncertainties. As the mechanistic evidence is suggestive of non-linearity, it is acknowledged that the excess risks in the low exposure range (below 1 µg/m^3 or 1 µg/kg bw/day of Cr(VI)) might be an overestimate.

The use of chromium trioxide for the decorative chromium electroplating of sanitaryware and associated accessory components has the purpose of creating a coating to provide specific performance characteristics which will ensure product longevity and functionality.

The metallic chromium outer layer enhances corrosion resistance, durability and achieves the recognisable surface appearance of high specification components, in combination with other important functional characteristics.

Functional chrome plating with decorative character represents the surface treatment of metal or other substrates with a water-based chromium trioxide mixture (namely chromic acid) to deposit a thin metallic chromium outer layer using an electrolytic plating process. The surface of the finished product is entirely free of hexavalent chromium, with the chromium coating being essentially inert. The metallic chromium electroplated coating is fully recyclable.

The following values are used as benchmarks for controls:

PERSONAL AIR MONITORING

Analysis Method : BS ISO 16740:2005
Workplace Exposure Limit (WEL) : 0.010mg/m^3 [10µg/m^3] (8hr-TWA)
The binding Occupational Exposure Limit (OEL) set under the EU Directive 2004/37/EC is 5 µg/m^3 as an 8-hour TWA.
Test Frequency : Annually
Action Level : 0.005mg/m^3 [5µg/m^3] (8hr-TWA)

BIOLOGICAL MONITORING

Testing Method : Urine samples collected post shift.

Analysis Units : Chromium µmol/mol Creatinine
Biological Monitoring Guidance Value (UK) BMGV
HSE Guidance Note EH40 Table 2 : 10 µmol/mol Creatinine
Unexposed level : 2.9 µmol/mol Creatinine
Test Frequency : Annually
Action Level : 5.0 µmol/mol Creatinine

AIRBORNE MIST TESTING

Testing Method : MDHS 52/4 & MDHS 14/4.
Test Frequency : Every month
Workplace Exposure Limit (WEL) : 0.025mg/m^3 [25µg/ m^3] (8hr-TWA) Process Generated
Action Level : 0.01mg/m^3 [10µg/ m^3] (8hr-TWA)

SURFACE TENSION OF THE ELECTROLYTE

Testing Method : External Laboratory Analysis
Test Frequency : Every month
Industry Standard : Must not exceed 40 dyne/cm (40 mN/m)
Action Level : 40 dyne/cm (40 mN/m)

2. COMPANY BACKGROUND

Bard & Brazier (the applicant) is a small business and manufacturers, under its own brand name, a wide range and bespoke, handmade towel warmers and together with its sister company Lefroy Brooks, offer a range of high specification sanitaryware and associated accessory components for luxury bathrooms. Both companies are located on the same site, on the south side of Wolverhampton in well-appointed workshops.

Bard & Brazier are the primary manufacturers and employ a team of highly skilled craftsmen and its metal finishing unit benefits from long serving and experience employees. The chromium plating process is carried out in a single dedicated unit on the site and is the final stage of what can be a complex process of component manufacture.

Bard & Brazier and Lefroy Brooks are both members of the Davroc Group, a well-established organisation serving both retail showroom customers across the UK and high-profile contract clients in the hotel and leisure sectors. In recent years, Davroc has successfully delivered prestigious international projects, including The Singapore Hotel and the Airport Link in Bangkok, demonstrating its capacity to meet complex specifications and regulatory expectations across diverse environments.

The chrome plating line was installed on this site in 1997 and together with several other plating lines was operated and managed by a different metal finishing company. During 2021-2022, that company joined up with the Surface Engineering Association Chromium Trioxide Authorisation Consortiums, to be part of their application for authorisation (AfA) for the use of Chromium Trioxide under UK REACH. This application was submitted on 30th June 2022.

That metal finishing company continued to operate from that point using the application made by the SEA (Sanitaryware) Consortium (Ref. AFA025-01) and the final decision by DEFRA was made on 20 January 2025. Authorisation was granted and an authorisation number was issued.

During the application period, this metal finishing company relocated its operations, transferring all equipment to a new site **except** for one plating line. This specific line was purchased, in situ, by the applicant in January 2023, forming the basis of a partial business acquisition.

In accordance with **TUPE**, employees whose roles were wholly or mainly associated with the plating line activities were deemed to be part of the undertaking transferred.

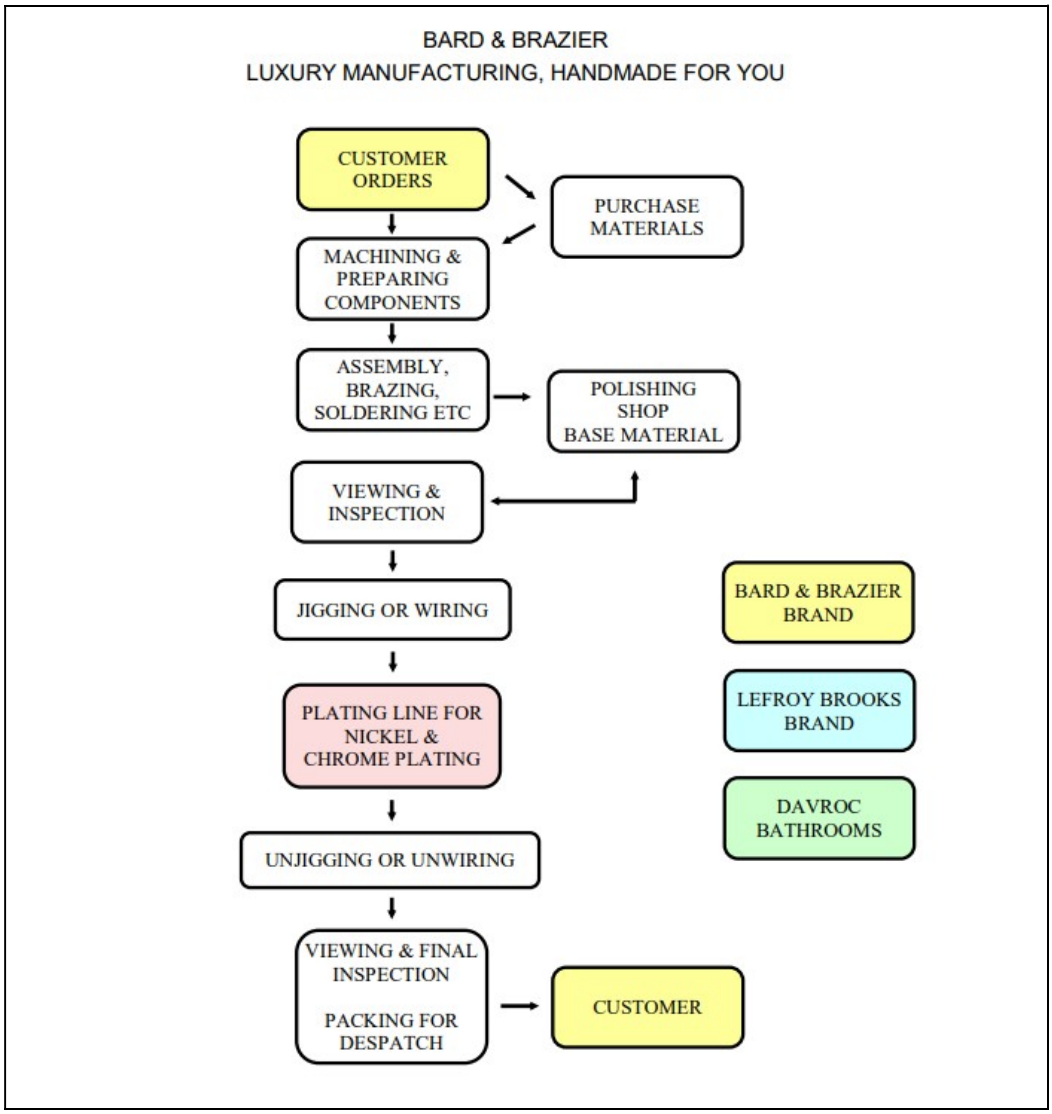
On the advice of the Surface Engineering Association, it was decided that the applicant was required to make a fresh application for authorisation, to cover the activities associated with this single plating line.

3. DESCRIPTION OF ACTIVITIES

The applicant has additional plating facilities, which are located within the plating shop such as variations on nickel, brass, bronze and gold finishes, together with trivalent chrome. This AfA focusses on the hexavalent chrome process.

Figure 3.1 is a schematic diagram of the tasks involved in the manufacture and plating of luxury towel warmers, high specification sanitaryware and associated accessory components. It highlights where chrome plating takes place and the work involved in manufacturing components which will meet customer's expectations and performance requirements.

Figure 3.1



BARD & BRAZIER

HAND MADE IN WOLVERHAMPTON

4. THE USE OF CHROMIUM TRIOXIDE

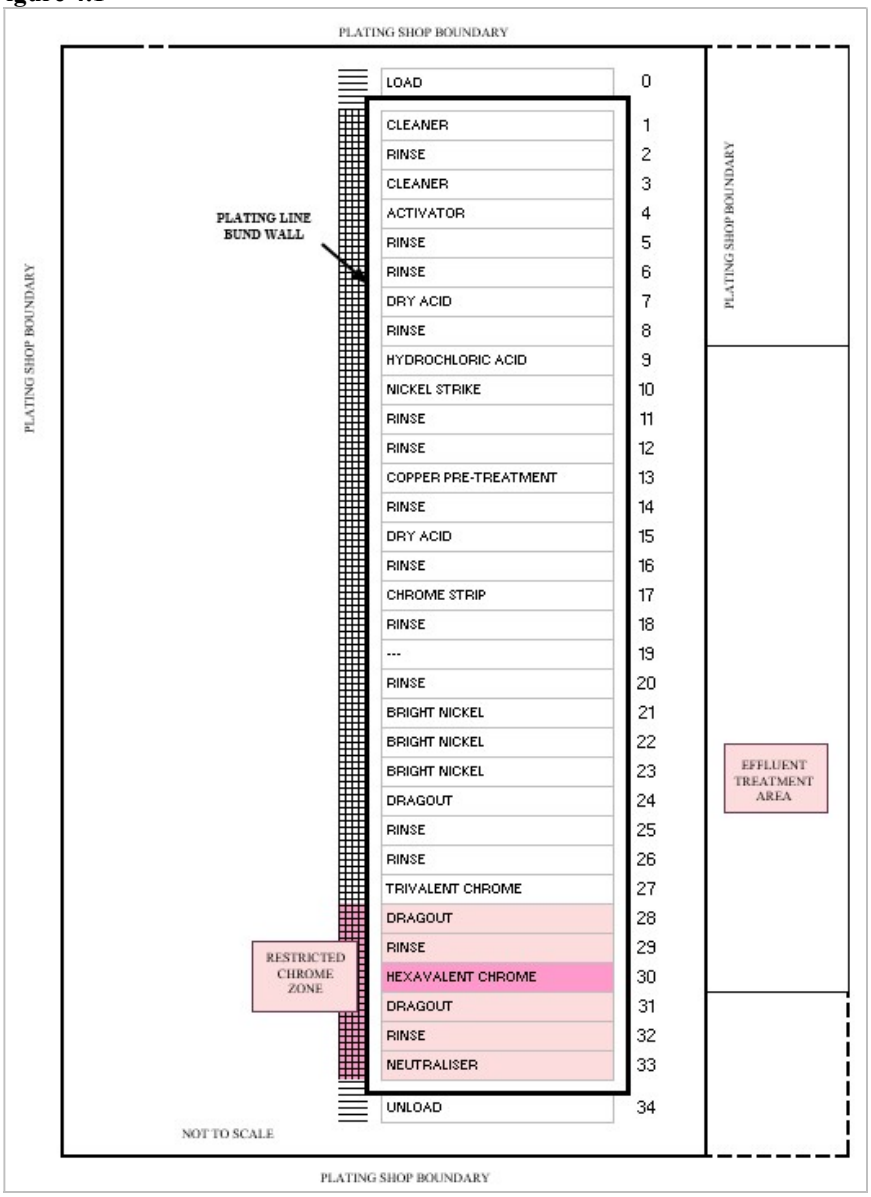
The key functionalities for chromium trioxide plated products are primarily corrosion resistance, chemical resistance, hardness and resistance to wear and abrasion, UV resistance, heat resistance colour and shine stability, surface consistency and smoothness.

Figure 4.1 is a layout of the plating line where the process that uses chromium trioxide is located. The plating shop is totally segregated from the rest of the factory and only authorised employees are allowed to work in this unit. As can be seen in the diagram, a restricted chrome zone has been identified (2 metres either side of the chrome plating tank) and time spent in this zone is kept to the absolute minimum needed to perform the task.

The plating line is a manually operated in-line rack plating line containing a total of 33 process stations. At the loading station 0, the plater will load jigs/frames onto a flight bar. The flight bar is lifted using an electronically operated trolly by the plater and lowered into various tanks on the line. When the selected process has been completed, the jigs/frames are unloaded from the plating line.

Hosing down of plated components is not performed.

Figure 4.1



5. SUMMARY OF RISK MANAGEMENT MEASURES

There have been regulations in place in the UK regarding the use of chromium trioxide in chromium electroplating operations since 1931 and over the years the Health & Safety Executive and the chromium plating industry have developed codes of practice which has meant that chromium trioxide can be used safely in electroplating processes with exposures similar to background levels.

The following is a summary of the Risk Management Measures which are used to control exposure to chromium trioxide.

Segregation

The plating shop is totally segregated from the rest of the factory and only authorised employees are allowed to work in this unit. A restricted chrome zone has been identified (2 metres either side of the chrome plating tank) and time spent in this zone is kept to the absolute minimum needed to perform the task.

Containment

Within the plating shop there is a plating line containing 33 process stations, which in total contains approximately 31,400 litres of various rinses & process chemicals. Approximately 15,800 litres is the total of active process chemicals, with remaining volume being rinses & swills. The whole plating line is surrounded by a large bund of approximately 15 cu m (15.000 litres).

Waste rinse water from the plating processes, which will contain trace amounts of chromium trioxide, is channelled to the effluent treatment plant. The chromium trioxide content, in the wastewater, is reduced to its trivalent form and following further treatment, the final result is a precipitate and water suitable for disposal to sewer. The applicant operates under a consent to discharge to public water sewer, issued by the Severn Trent Water (STW). (Consent Ref: 009400V).

The precipitate is in the form of a sludge which is subsequently passed through a filter press and disposed of as a hydroxide cake, free of chromium trioxide, to hazardous land fill.

Mist Suppressants

To reduce surface tension and reduce/prevent mist development, a non-PFOS mist suppressant is used and added in small quantities to the electrolyte on a daily basis. Regular airborne mist testing and surface tension monitoring takes place.

Ventilation

Lip extraction is in operation on the plating line between stations 01 – 23. The plating shop, which covers a total area of approximately 850 sq. metres, is also ventilated by three roof fans.

Exposure Monitoring

A programme of personal air monitoring and biological monitoring takes place.

Personal Protective Equipment

The use and type of PPE will vary dependent on the task being performed.

- **Gloves**

  Chemically resistant gloves: EN ISO 374-1:2016 / TYPE A are used as a minimum. These gloves are resistant to 96% concentrated sulphuric acid with a breakthrough time of at least 30 minutes

Offline tasks are performed using lighter weight cotton gloves and vinyl gloves. It is the employee's choice depending on the task being performed.

- **Eye Protection, Chemical Proof Overalls & Safety boots**

  These are worn as standard.

- **Emergency Eye Wash Stations**

  There are two Eye Wash stations located on the plating line. One station is located close to loading station, and the other is mid-way along the plating line.

- **Respiratory Protective Equipment (RPE)**

  For various tasks in the plating shop, RPE is worn. As standard, FFP3 half masks are used.

Training

In house training is provided on the hazards of Cr(VI) exposure and how the hazards should be controlled. Subjects that have been covered include:

- Removing gloves
- Hygiene
- Removal and storage of PPE & overalls
- Subcontractors

Various handouts have been downloaded from the HSE website and video clips have also been downloaded as additional training aids. HSE publication "Chromium and You" indg346 is issued to all employees. This training is also provided for new starters at induction and highlights the dangers and hazards of all chemicals being used on the site.

General Hygiene Precautions

The following disciplines are employed:

- Eating and drinking is prohibited in all shop floor areas
- Designated rest areas are provided for the purpose of eating and drinking.
- Washing facilities are available close to the plating area and rest areas
- Platers are instructed to wash hands on leaving the plating line
- A designated decontamination area is in place for the platers
- Each plater has a personal facility for the storage of their PPE
- No plating shop personnel take their overalls home.
- Overalls are laundered by Jacksons Workwear Ltd on a weekly basis and they have been informed of potential exposure to Cr VI.

Standard Operating Procedures

Tasks that have the potential for exposure to Cr(VI) have a standard operating procedure in a series entitled "Working with Chromium". These deal with the correct method of performing a task and how exposures to Cr(VI) are controlled. Procedures that are in place are shown below:

- Checking Chrome Temperatures
- Taking Samples for Chrome Analysis
- High Results from Monitoring Surveys
- Rules For Working in Chrome Area
- Making The Chrome Additions
- Checking Condition of Anodes
- Removing Potentially Contaminated Gloves
- Hygiene
- Rules For Sub-Contractors

- Unloading Chemicals & Moving to Storage
- Removing PPE & overalls

Regular maintenance

The good working order of the plating line and mechanical equipment is assessed during normal operations, and the plater will notify management at the first sign of malfunction.

Platers are also responsible for ensuring the effectiveness of the pollution prevention infrastructure and thus reducing the likelihood of pollution to the environment. This includes the inspection of bunding, condition of tanks, solution levels, pumps, pipework and heaters etc.

6. EXPOSURE MONITORING

6.1 Airborne Mist Testing

Airborne chromic acid mist testing has been taking place for several years and provides strong viable data to assess workshop exposure. Records since the transfer of ownership are available back to January 2023.

To reduce surface tension and reduce/prevent mist development, a non-PFOS mist suppressant is used and added in small quantities to the electrolyte on a daily basis.

An external chemist performs the testing process on a monthly basis using the Colour Metric Comparator (Lovibond) and testing methods MDHS 52/4 & MDHS 14/4.

An analysis of results from January 2023 to April 2025 is shown in Table 6.1

Table 6.1

No of tests	Highest Reading mg/m³	Geometric Mean mg/m³	90th Percentile mg/m³	Median mg/m³
26	0.02	0.0105	0.010	0.01

Workplace Exposure Limit (WEL) : 0.025mg/m^3 (8hr-TWA) Process Generated Action Level : 0.01 mg/m^3 (8hr-TWA)

6.2 Personal Air Monitoring

A programme of personal air monitoring of the platers has commenced and will continue every 6 months until 10 personal exposure data points have been obtained. Each monitoring survey is carried out using method MDHS 14/4 and inhalation exposure sampling is measured on the worker's lapel and on the outside of any respiratory protection equipment that may be being worn. Samples are sent to an external laboratory for the measurement of Cr(VI).

The laboratory supplies the sample media in the form of a pre-treated quartz filter and once the sampling has been completed, the filter is despatched to the laboratory who uses the analysis methodology specified in BS ISO 16740:2005 to determine Cr(VI) exposure.

Once the 10 personal exposure data points have been obtained and provided that the 90th percentile of personal exposure to Cr(VI) does not exceed the action level of 5 μg/m^3 (8hr-TWA) we shall revert to carrying out annual surveys.

A standard operating procedure is in place which provides a corrective action plan which will be employed if any exposure readings for an employee exceeds the action level of 5 μg/m³.

The first results from our personal air monitoring surveys are shown in table 6.2

Table 6.2

Worker	Sample Date	Activity	Laboratory	Sampling Duration mins	Cr(VI) Exposure (8hr TWA) µg/m³
Main Plater	14/07/2025	Plating activities as detailed in WCS3 Working on the plating line	Marchwood	360	<0.014
Cover Plater	15/07/2025	General jigging / unjigging duties within the plating shop	Marchwood	360	<0.014
Supervisor	16/07/2025	General supervisory duties in and around the plating shop	Marchwood	330	<0.015

Workplace Exposure Limit (WEL) : 10µg/m³ (8hr-TWA)
Action Level : 5µg/m³ (8hr-TWA)

6.3 Biological Monitoring

A programme of biological monitoring of the platers has commenced and will continue annually.

Urine samples are requested at the end of shift. Samples are then despatched to an external laboratory for analysis.

A standard operating procedure is in place which provides a corrective action plan which will be employed if any exposure readings for an employee exceeds the action level of 5 µmol chromium/mol creatinine.

The first results from our biological monitoring surveys are shown in table 6.3

Table 6.3

Worker	Sample Date	Laboratory	Result µmol/mol creatinine
[redacted]	[redacted]	Marchwood	3.80
[redacted]	[redacted]	Marchwood	<3.20
[redacted]	[redacted]	Marchwood	<0.45

Biological Monitoring Guidance Value (UK) BMGV
HSE Guidance Note EH40 Table 2 : 10 µmol/mol Creatinine
Action Level : 5.0 µmol/mol Creatinine

No occupational health issues have been detected with any plater while being employed at the company. No issues with nasal septum perforation, skin ulceration, dermatitis or occupational asthma.

6.4 Surface Tension of The Electrolyte

To monitor the quality and concentration of the chrome solution, monthly checks are carried out. A sample of the solution is taken from the tank and analysed by an external laboratory.

In addition to providing a chemical analysis, the laboratory is able to determine the surface tension.

To reduce surface tension and reduce/prevent mist development, a non-PFOS mist suppressant is used and added in small quantities to the electrolyte by the Supervisor on a daily basis.

The results from our last two analysis reports are shown in table 6.4

Table 6.4

Sample Date	Surface Tension dyne/cm
01/05/2025	41
21/07/2025	35

Action Level : 40 dyne/cm (40 mN/m)

9. EXPOSURE ASSESSMENT (and related risk characterisation)

9.1 Introduction

This exposure assessment is part of the AfA for the continued use of chromium trioxide (CAS: 1333-82-0, EC: 215-607-8) in specific decorative chromium plating applications where a set of performance requirements must be met.

9.1.1 Overview of uses and Exposure Scenarios

Tonnage information:

The applicant is a small enterprise for the purpose of REACH authorisation applications and only uses a total weight of 50-75 kg per annum. The chromium trioxide (CT) is purchased as flake in 25kg sealed drums.

The following table lists all the exposure scenarios (ES) assessed in this CSR.

Table 9.1 Overview of Contributing Scenarios

Contributing scenario	ERC / PROC	Name of the contributing scenario	Size of the exposed population
ES 1:			
ECS1	ERC 6B	Use of chromium trioxide for the chromium electroplating of sanitaryware and associated accessory components for the purpose of creating a coating to provide very specific performance characteristics and to match existing components and those supplied from other sources.	Local
WCS 1	PROC 1	Receipt & storage of chromium trioxide	1
WCS 2	PROC 4	Offline jigging / unjigging / inspection of components	3
WCS 3	PROC 13	Working on the Plating Line Activity 1 : Working outside Chrome Zone Activity 2 : Working inside Chrome Zone	1
WCS 4	PROC 8b	Sampling the chrome tank	1

WCS 5	PROC 8b	Concentration adjustment of the chrome tank (Making additions)	1
WCS 6	PROC 28	Maintenance activities	2
WCS 7	PROC 28	Wastewater / effluent treatment	1

Further details on each of the various exposure scenarios.

ECS 1- Functional chrome plating with decorative character

Waste

All the solid waste containing traces of chromium trioxide is sent for disposal as hazardous waste via a licensed waste contractor. Analysis of solid waste (dated 24/11/23) shows chromium trioxide traces of <0.1 mg/kg.

Water

Wastewater generated by the process is sent through the company's effluent treatment plant. This neutralises any chromium trioxide present.

Environmental emissions

No stack emissions data is available for the site as there is no local exhaust ventilation associated with the chromic acid tank and there is no formal requirement to undertake emissions monitoring.

Air monitoring in the workplace for personal exposures has been found to be very low. It is anticipated that the significant dilution of any releases in the workplace will occur i.e. environmental releases will be significantly lower than personal exposures.

WCS 1- Receipt & storage of chromium trioxide

The chromium trioxide, which is purchased for the purpose of concentration adjustment of the chrome plating tank, arrives at the company as flake in 25kg sealed steel drums. Upon receipt, checks are carried out to ensure the goods are in good condition and undamaged. The containers remain unopened and are moved, by an operative using forklift or pallet truck, to the dedicated stores area. Access to this area is controlled and only approved employees are allowed access.

WCS 2 – Offline jigging / unjigging / inspection of components

A. Before components can be processed on the plating line, they have to be loaded onto specially designed jigs or attached by copper wire to specially designed frames.
B. The jigs/frames are then loaded onto the plating line. Performed by the plater and is included in WCS 3.

On completion of the plating process:

C. The jigs/frames are unloaded from the plating line. Performed by the plater and is included in WCS 3.
D. Components are removed from jigs/frames and wiped, then
E. Components are inspected and packed. Performed by operatives outside the plating shop

Operations A and D are considered in this WCS and can be performed by one of three operatives within the plating shop and well away from the plating line.

WCS 3 – Working on the Plating Line

The plating shop is totally segregated from the rest of the factory and only the main plater, cover plater and supervisor are allowed to work on the plating line. A restricted chrome zone on the plating line has been identified (2 metres either side of the chrome plating tank) and time spent in this zone is kept to the absolute minimum needed to perform the task.

The plating line is a manually operated in-line rack plating line containing a total of 33 process stations. At the loading station 0, the plater will load jigs/frames onto a flight bar. The flight bar is lifted using an electronically operated trolly by the plater and lowered into various tanks on the line. While manually operating the plating line, the plater has the opportunity to assess quality and performance of processes and monitor the condition of the tanks, solution levels, pumps, pipes and heaters. When the required process sequence has been completed, the plater will unload the jigs/frames at the unload station 34.

This scenario represents a full shift for the plater and includes estimates of the time spent loading and unloading.

WCS 4 – Sampling the chrome tank

To monitor the quality and concentration of the chrome solution, monthly checks are carried out. A sample of the solution is taken from the tank and analysed by an external laboratory who will report on various parameters and recommend any adjustments that will be required to ensure that the electroplating solution remains within specified performance tolerances.

WCS 5 – Concentration adjustment of the chrome tank (Making additions)

When the result of the sample analysis shows that there is a need for additions to be made to the chrome solution, the supervisor will make the addition of chromium trioxide flake to ensure that the optimal concentration of the electroplating solution is maintained.

WCS 6 – Maintenance activities

Periodic maintenance activities are carried out and include:

- General maintenance of cleaners & rinses on rotation (Fridays)
- Approximately every 6 months - Checking condition of anodes in the chrome tank

WCS 7 – Wastewater / effluent treatment

Waste rinse water from the plating processes, which will contain trace amounts of chromium trioxide, is channelled through to the effluent treatment plant. The chromium trioxide content, in the wastewater, is reduced to its trivalent form and following further treatment, the final result is a precipitate and water suitable for disposal to sewer. The precipitate is in the form of a sludge which is subsequently passed through a filter press and the resulting solid is disposed of as a hydroxide cake, free of chromium trioxide, to hazardous land fill.

Stage 1 changes hexavalent chromium (Cr^{+6}) to trivalent chromium (Cr^{+3}).

The final precipitate is chromium hydroxide $Cr(OH)_3$

The treatment of the wastewater is automated, and a control panel controls the amount of the various chemicals needed to treat the effluent through the sequence of treatment. The use of dosing tanks and pumps provide a controlled addition rate of reagents to reduce hexavalent chrome to its trivalent form, control pH, neutralisation and sludge settling. An alarm will sound if any of the monitored parameters are out of the preset ranges.

The water being discharged to sewer is regularly sampled by STW and analysed to ensure that the effluent does not exceed the limits of concentration of the substances listed in the consent. The applicant also employs an external agency to regularly sample and analyse water being discharged. (Rodol Ltd)

On a daily basis, the manager reviews the operating conditions within the effluent plant. Checking that the processing equipment, such as pumps and feeds are working efficiently. Dosing rates are monitored, ph and concentrations are recorded as necessary.

On a weekly basis, the manager or other trained operative will top up the levels of the dosing tanks.

On a monthly basis, the filter press is opened, by one of three trained operatives, and the solid cake is dispensed into the holding skip.

9.1.2 Introduction to the assessment

9.1.2.1 Environment

The quantity of chromium trioxide purchased is very small, 50-75 kg per annum.

Releases of Cr(VI) to the worker and environment are limited by the use chrome mist suppressant which reduces / prevents mist development at the chrome plating tank. A qualitative assessment indicates that there are negligible releases to environment from the site and there are no releases to watercourses.

All chromium trioxide waste is treated on-site by chemical reduction before disposal via sewer (Severn Trent Water). Once components have been coated, there is no residual chromium trioxide and so, there is no potential for health impacts during use of the finished articles.

Scope and type of assessment:

Waste effluent monitoring is carried out by Severn Trent Water via site sampling of discharge to foul sewer before transfer to the local wastewater treatment works where it is further diluted before onward discharge.

Table 9.1.2.1 Concentrations of chromium (total) in wastewater

mg / L	Consent Limit	Average	Median	Min	Max
CR (TOT)	4.00	0.53	0.34	0.00	3.04

Analysis of solid waste (dated 24/11/23) shows chromium trioxide traces of <0.1 mg/kg.

9.1.2.2 Human via environment

Scope and type of assessment:

Cr(VI) causes lung tumours in humans and animals by the inhalation route and tumours of the gastrointestinal tract in animals by the oral route. These are both local, site-of-contact tumours and there is no evidence that Cr(VI) causes tumours elsewhere in the body.

It is considered therefore, that exposure to humans via the environment is solely by releases to air with all material being in an inhalable format. i.e. the oral route is not considered.

The plating shop has lip extraction in operation on the plating line between stations 01 – 23 and several ventilation fans in the plating shop, so it is possible that air emissions could arise from these.

The only available measured Cr(VI) concentrations in internal air are those measured above the chrome tank. Since the only source of Cr(VI) is the chrome tank contents, it is expected with a high degree of confidence that the concentration in internal air, generally, is going to be significantly lower. This can be justified by reviewing the exposure results of personal air monitoring being performed (Table 6.2) and estimates of exposure using the Advanced REACH Tool 1.5 (ART) exposure model.

Airborne mist testing has been taking place for several years, Table 6.1 shows a median concentration figure of 0.01 mg m^3, measured above the chrome tank.

Since there are no Cr(VI) concentrations in air vented to atmosphere available, an estimation of the concentration has been made, based on the 0.01 mg m^3, measured above the chrome tank.

Following a qualitative assessment of the roof ventilation it has been decided that they make a negligible contribution to the Cr(VI) concentrations in air being vented to atmosphere. All three fans are in the roof and are tens of metres away from the source.

Using the Environment Agency's H1 impact assessment tool, a quantitative estimation of the contribution the lip extraction makes to the Cr(VI) concentrations in air being vented to atmosphere has been made. Table 9.1.2.2 details the quantitative estimate of emissions of Cr(VI) expressed in terms of tonnes/year.

Table 9.1.2.2 Estimated emissions of Cr(VI) expressed in terms of tonnes/year

Mass released annually	At exit point to atmosphere	Units
Estimation of the Cr(VI) concentration	0.000179	mg/m^3
Emissions of Cr(VI) expressed in terms of tones/year	0.000000821	tonnes/year

This equates to 0.821grams per year.

The whole plating line sits inside a large bund in line with Best Practice. Waste rinse water from the plating processes, which will contain trace amounts of chromium trioxide, is reduced to its trivalent form and discharged to foul sewer. Solid waste is sent for disposal as hazardous waste using a registered waste contractor.

9.1.2.3 Workers

Scope and type of assessment:

In the absence of sufficient personal exposure data, the worker exposure via inhalation for the Worker Contributing Scenarios have been assessed and estimated using the Advanced REACH Tool 1.5 (ART) exposure model. ART is a model calibrated to assess exposure to inhalable dust, vapours, and mists and these Exposure Scenarios are within the scope of ART.

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). Although RPE is used by workers in several scenarios, there is no account being taken for RPE and no adjustments made for RPE to any ART results in this CSR. Therefore, worst case scenarios are being assumed in all cases.

A programme of personal air monitoring and biological monitoring has commenced but significant statistical data is limited at this time. Airborne mist testing has been taking place for several years and provides strong viable data to assess workshop exposure.

Chromium trioxide is classified as a Category 1 carcinogen (H350: 'May cause cancer') and, as such, does not have any Derived No Effect Limit (DNEL). Therefore, WEL and BMGV values together with internally set action levels are used as benchmarks for controls.

The conditions of use detailed within this CSR specify that all handling of the substance by the worker should be done while wearing appropriate PPE relative to the task.

The conditions of storage, use and handling of the substance are detailed within this CSR and are utilised as the RMM's.

9.1.2.4 Consumers

There is no exposure to consumers from the use of chromium trioxide in accordance with this Application for Authorisation.

There are negligible releases of chromium trioxide to the environment from any part of the site and therefore the process operations involving chromium trioxide make no contribution to this potential route of human exposure.

9.2 Exposure scenario 1 for workers

In the absence of sufficient specific task based exposure data, personal exposure was modelled using ART 1.5 tool. The input values of a constant nature are summarised in Table 9.2

Table 9.2 Inhalation Exposure modelling – Constant Parameters

Constant Parameters (relating to the plating shop) used in ART tool		
Operational Conditions	Near-field exposure	Far-field exposure (Where Applicable)
Surface contamination		
Process fully enclosed?	No	No
Effective housekeeping practices in place?	Yes	Yes
Dispersion		
Work area	Indoors	Indoors
Room size	3000 m³	3000 m³
Risk Management Measures		
Localised controls		
Primary	No localized controls (0.00 % reduction)	No localized controls (0.00 % reduction)
Secondary	No localized controls (0.00 % reduction)	No localized controls (0.00 % reduction)
Segregation	---	No segregation (0.00 % reduction)
Dispersion		
Ventilation rate	No restriction on general ventilation characteristics	No restriction on general ventilation characteristics

Note:
Work area volume and ACH used in WCS7 adjusted for outdoors

9.2.1 Worker contributing scenario 1 - WCS 1

This contributing scenario covers the potential exposure during receipt, transfer and storage of Chromium Trioxide solution.

9.2.1.1 Conditions of use

WCS 1 – Receipt & storage of chromium trioxide	Method
Product (article) characteristics	

▪ Sealed container containing dry flake/granule form containing >99.8% Chromium Trioxide.	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ 1x 25kg container. Every 4 months on average. No exposure as sealed container. ▪ Duration of activity : 30 minutes ▪ Number of workers: One	
Technical and organisational conditions and measures	
▪ Keep sealed in original container. Transfer to storage location.	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, overall, eye protection in case of accidental spillage. ▪ Training - Working with Chromium - Standard Operating Procedure in place	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Use mechanical aids for movement and lifting where possible. ▪ Regular refresher training - Working with Chromium	

Exposure assessment

Inhalation exposure and dermal exposure have been assessed qualitatively. As the material is received in sealed containers exposures by inhalation and skin contact are considered to be negligible.

Exposure and risks for workers

The exposure concentrations have been assessed qualitatively. These are summarised in table 9.3

Table 9.3 Exposure concentrations and risks for workers (WCS1)

Route of exposure	Exposure value (8h TWA, mg/m^3)	Exposure value (8h TWA, µg/m^3) *	Exposure value corrected for frequency (µg/m^3) **
Inhalation	0	0	0

*Conversion x1000 **Frequency correction n/a

9.2.2 Worker contributing scenario 2 – WCS 2

This contributing scenario covers the potential exposure to chromium trioxide during the offline jigging of components in preparation for the plating process and the unloading / final inspection prior to wrapping for despatch.

9.2.2.1 Conditions of use

WCS 2 - Offline jigging / unloading / inspection of components	**Method**
Product (article) characteristics	

▪ During unloading jigs/frames plated components contaminated with chromium trioxide solution trapped in features.	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Very small amount (unquantified) ▪ Duration of activity : Daily (Typically 1 hour exposure to plated components) ▪ Number of workers: One worker in the plating shop	
Technical and organisational conditions and measures	
▪ The final stage in the plating process is the immersion of jigs & components in neutralising and rinsing solutions. ▪ Components allowed to dry before being removed.	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, overalls, eye protection ▪ Training - Working with Chromium - Standard Operating Procedure in place ▪ Good hygiene practices - Standard Operating Procedure in place	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Regular refresher training - Working with Chromium	

Exposure assessment

In the absence of sufficient specific task based exposure data, personal exposure was modelled using ART 1.5 tool. The input values are summarised in table 9.4.

Table 9.4 Inhalation Exposure modelling for WCS 2 - Offline jigging / unloading / inspection of components

Variable Parameters used in ART tool	Total duration (mins): 60 Non-exposure period (mins): 420	
Operational Conditions	Near-field exposure	Far-field exposure (Not Applicable)
Substance emission potential		
Substance product type	Liquids	---
Process temperature	Room temperature	
Vapour pressure	0.01 Pa	
Liquid weight fraction	Minute	
Viscosity	Low	
Activity emission potential		
Activity class	Handling of contaminated objects	
Situation	Activities with treated/contaminated objects (surface 0.1-0.3 m²)	
Containment level	Contamination < 10 % surface	

Exposure and risks for workers

The exposure concentration estimated using the ART 1.5 model is reported in Table 9.5.

Exposure duration: 60 min : 90th percentile full-shift exposure : One worker

Table 9.5 Exposure concentrations and risks for workers (WCS2)

Route of exposure	Modelled Exposure value (8h TWA, mg/m^3)	Modelled Exposure value (8h TWA, µg/m^3) *	Exposure value corrected for frequency (µg/m^3) **
Inhalation	0.00000021	0.00021	0.00021

*Conversion x1000 **Frequency correction Every shift n/a

9.2.3 Worker contributing scenario 3 – WCS 3

This contributing scenario covers the potential exposure to chromium trioxide whilst working in the plating shop via airborne mist.

9.2.3.1 Conditions of use

WCS 3 - Working on the Plating Line	**Method**
Product (article) characteristics	
▪ Chromium trioxide solution containing approximately 25% chromium trioxide.	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Manual plating line with potential worker exposure to airborne mist while adjacent to the chrome plating tank (Inside Chrome Zone). ▪ The operator enters the Chrome zone, performs trolly movements, immerses components into chrome tank and moves away to perform other tasks. On completion of the plating process the operator re-enters the chrome zone to remove components and perform trolly movements until completing process at unload station 34. - Maximum time in Chrome Zone: 5 mins total per load ▪ The operator may also enter the chrome zone to perform tasks not associated with the chrome plating process. Performing other rinsing operations and moving trolly to the unload station 34. Maximum time in Chrome Zone: 1.5 min per load ▪ Number of workers: One Plater	
Technical and organisational conditions and measures	
▪ Suppressant used to reduce surface tension and reduce/prevent mist evolution. ▪ Good ventilation	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, overalls, eye protection ▪ Task specific Standard Operating Procedure in place ▪ Training - Working with Chromium - Standard Operating Procedure in place ▪ Good hygiene practices - Standard Operating Procedure in place	
Other conditions affecting workers exposure	
▪ Far field exposure applies for plater while not in the Chrome Zone	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Regular refresher training - Working with Chromium	

Exposure assessment

In the absence of sufficient specific task based exposure data, personal exposure was modelled using ART 1.5 tool. This scenario consists of two activities. Each activity has been assigned a name and

duration in minutes. The activities together represent one working shift and the total duration is 480 minutes.

The input values are summarised in table 9.6

Table 9.6 Inhalation Exposure modelling for WCS 3 - Working on the Plating Line

Activity 1 : Working outside Chrome Zone		
Variable Parameters used in ART tool	Total duration (mins): 300 per shift	
Operational Conditions	Near-field exposure	Far-field exposure
Substance emission potential		
Substance product type	Liquids	Liquids
Process temperature	Room temperature	40°C
Vapour pressure	0.01 Pa	0.01 Pa
Liquid weight fraction	Minute	25%
Viscosity	Low	Low
Activity emission potential		
Activity class	Handling of contaminated objects	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Activities with treated/contaminated objects (surface <0.1 m²)	Open surface 0.3 - 1 m²
Containment level	Contamination < 10 % surface	n/a
Activity 2 : Working inside Chrome Zone		
Variable Parameters used in ART tool	Total duration (mins): 90 per shift	
Operational Conditions	Near-field exposure	Far-field exposure (Not Applicable)
Substance emission potential		
Substance product type	Liquids	---
Process temperature	40°C	
Vapour pressure	0.01 Pa	
Liquid weight fraction	25%	
Viscosity	Low	
Activity emission potential		
Activity class	Activities with relatively undisturbed surfaces (no aerosol formation)	
Situation	Open surface 0.3 - 1 m²	
Containment level	---	

Exposure and risks for workers

The exposure concentration estimated using the ART 1.5 model for a full shift of two activities is reported in Table 9.7.

Total duration (mins): 480 Non-exposure period (mins): 90
Exposure duration: 390 min : 90th percentile full-shift exposure : One worker

Table 9.7 Exposure concentrations and risks for workers (WCS3)

Route of exposure	Modelled Exposure value (8h TWA, mg/m^3)	Modelled Exposure value (8h TWA, µg/m^3) *	Exposure value corrected for frequency (µg/m^3) **
Inhalation	0.0017	1.7	1.7

*Conversion x1000 **Frequency correction Every shift n/a

9.2.4 Worker contributing scenario 4 – WCS 4

This contributing scenario covers the potential exposure to chromium trioxide while taking samples from the chrome plating tank.

9.2.4.1 Conditions of use

WCS 4 - Sampling the chrome tank	**Method**
Product (article) characteristics	
▪ Chromium trioxide solution containing approximately 25% chromium trioxide.	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ 100ml typically every two months. ▪ Maximum time in Chrome Zone: 10 minutes total ▪ Number of workers: Supervisor only	
Technical and organisational conditions and measures	
▪ Slowly submerging sample container into chrome trioxide solution using long handled tongs. ▪ Seal sample container and thoroughly neutralise and rinse before moving from the plating line. ▪ Good ventilation	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, overalls, eye protection ▪ Task specific Standard Operating Procedure in place ▪ Training - Working with Chromium - Standard Operating Procedure in place ▪ Good hygiene practices - Standard Operating Procedure in place	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Avoid repetitive handling to keep exposure to a minimum ▪ Regular refresher training - Working with Chromium	

Exposure assessment

In the absence of specific task based exposure data, personal exposure was modelled using ART 1.5 tool. The input values are summarised in table 9.8.

Table 9.8 Inhalation Exposure modelling for WCS 4 - Sampling the chrome tank

Variable Parameters used in ART tool	Total duration (mins): 480 Non-exposure period (mins): 470	
Operational Conditions	Near-field exposure	Far-field exposure (Not Applicable)
Substance emission potential		
Substance product type	Liquids	---
Process temperature	40°C	

Vapour pressure	0.01 Pa	
Liquid weight fraction	25%	
Viscosity	Low	
Activity emission potential		
Activity class	Handling of contaminated objects	
Situation	Activities with treated/contaminated objects (surface <0.1 m²)	
Containment level	Contamination > 90 % of surface	

Exposure and risks for workers

The exposure concentration estimated using the ART 1.5 model is reported in Table 9.9.

Total duration (mins): 480 Non-exposure period (mins): 470
Exposure duration: 10 min : 90th percentile full-shift exposure : One worker

Table 9.9 Exposure concentrations and risks for workers (WCS4)

Route of exposure	Modelled Exposure value (8h TWA, mg/m³)	Modelled Exposure value (8h TWA, µg/m³) *	Exposure value corrected for frequency (µg/m³) **
Inhalation	0.00015	0.15	0.00375

*Conversion x1000 **Frequency correction Once every 2 months 1/40

9.2.5 Worker contributing scenario 5 – WCS 5

This contributing scenario covers the potential exposure to chromium trioxide while making concentration adjustments to the chrome plating tank. (Making additions). This scenario consists of two activities. Activity 1 represents time spent, outside the chrome zone, in preparation and cleaning up. Activity 2 represents time spent, inside the chrome zone, doing the dispensing. The activities together represent a total of 15 minutes per month.

9.2.5.1 Conditions of use

WCS 5 – Making Additions	**Method**
Product (article) characteristics	
▪ Dry flake/granule form containing >99.8% Chromium Trioxide.	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ 2kg typically every month on average ▪ Average 15 mins per session (Total activity duration) ▪ Maximum time in Chrome Zone: 5 mins ▪ Number of workers: Supervisor only	
Technical and organisational conditions and measures	
▪ Good ventilation ▪ Keep sealed in original container, in specified area when not in use	
Conditions and measures related to personal protection, hygiene and health evaluation	

▪ Wear chemically resistant gloves, overalls, eye protection ▪ Wear FFP3 filter mask ▪ Task specific Standard Operating Procedure in place ▪ Training - Working with Chromium - Standard Operating Procedure in place ▪ Good hygiene practices - Standard Operating Procedure in place	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Neutralise and rinse equipment ▪ Regular refresher training - Working with Chromium	

Exposure assessment

In the absence of specific task based exposure data, personal exposure was modelled using ART 1.5 tool. The input values are summarised in table 9.10.

Table 9.10 Inhalation Exposure modelling for WCS 5 – Making Additions

Activity 1 : Working outside Chrome Zone : Preparation and Clean up		
Variable Parameters used in ART tool	Total duration (mins): 10	
Operational Conditions	Near-field exposure	Far-field exposure (Not Applicable)
Substance emission potential		
Substance product type	Powders, granules or pelletised material	---
Process temperature	Room temperature	
Dustiness	Granules, flakes or pellets	
Mostureness	Dry product (<5 % moisture content)	
Powder Weight Fraction	Pure material (100%)	
Activity emission potential		
Activity class	Transfer of powders, granules or pelletised material	
Situation	Falling of powders, granules or pelletised material. Transferring 1 -10 kg/minute	
Type of handling	Careful transfer	
Drop height	<0.5 m	
Containment level	Open process	
Activity 2 : Working inside Chrome Zone : Dispensing		
Variable Parameters used in ART tool	Total duration (mins): 5	
Operational Conditions	Near-field exposure	Far-field exposure
Substance emission potential		
Substance product type	Powders, granules or pelletised material	Liquids
Process temperature	Room temperature	40°C
Dustiness	Granules, flakes or pellets	n/a
Mostureness	Dry product (<5 % moisture content)	n/a
Powder Weight Fraction	Pure material (100%)	n/a
Vapour pressure	n/a	0.01 Pa

Liquid weight fraction	n/a	25%
Viscosity	n/a	Low
Activity emission potential		
Activity class	Transfer of powders, granules or pelletised material	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Falling of powders, granules or pelletised material. Transferring 1 -10 kg/minute	Open surface 0.3 - 1 m²
Type of handling	Careful transfer	n/a
Drop height	<0.5 m	n/a
Containment level	Open process	n/a

Exposure and risks for workers

The exposure concentration estimated using the ART 1.5 model is reported in Table 9.11.

Total duration (mins): 480 Non-exposure period (mins): 465
Exposure duration: 15 min : 90th percentile full-shift exposure : One worker

Table 9.11 Exposure concentrations and risks for workers (WCS5)

Route of exposure	Modelled Exposure value (8h TWA, mg/m^3)	Modelled Exposure value (8h TWA, µg/m^3) *	Exposure value corrected for frequency (µg/m^3) **
Inhalation	0.017	17	0.85

*Conversion x1000 **Frequency correction Once per month 1/20

9.2.6 Worker contributing scenario 6 – WCS 6

This contributing scenario covers the potential to chromium trioxide during maintenance of equipment on the plating line. This scenario consists of two activities. Activity 1 represents time spent, outside the chrome zone, performing weekly cleaner & rinse maintenance. Activity 2 represents time spent, inside the chrome zone, checking the condition of the anodes in the chromic acid tank.

9.2.6.1 Conditions of use

WCS 6 – Maintenance activities	**Method**
Product (article) characteristics	
▪ Chromium trioxide solution containing approximately 25% chromium trioxide.	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Checking anodes ▪ Typical time spent in Chrome Zone: 60 mins ▪ Frequency : Every 6 months ▪ Weekly cleaner & rinse maintenance ▪ Typical time spent outside Chrome Zone: 240 mins ▪ Frequency : Once per week ▪ Number of workers: Main Plater and Cover Plater together	
Technical and organisational conditions and measures	
▪ Plating process must be stopped before any maintenance commences. ▪ Good ventilation	

Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, overalls, eye protection ▪ Appropriate task specific PPE & RPE is required ▪ Task specific Standard Operating Procedures in place ▪ Training - Working with Chromium - Standard Operating Procedure in place ▪ Good hygiene practices - Standard Operating Procedure in place	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Regular refresher training - Working with Chromium	

Exposure assessment

In the absence of specific task based exposure data, personal exposure was modelled using ART 1.5 tool. The input values are summarised in table 9.12.

Table 9.12 Inhalation Exposure modelling for WCS 6 – Maintenance activities

Activity 1 : Working outside Chrome Zone : Weekly cleaner & rinse maintenance		
Variable Parameters used in ART tool	Total duration (mins): 240	
Operational Conditions	Near-field exposure	Far-field exposure
Substance emission potential		
Substance product type	Liquids	Liquids
Process temperature	Room temperature	Room temperature
Vapour pressure	0.01 Pa	0.01 Pa
Liquid weight fraction	Minute	25%
Viscosity	Low	Low
Activity emission potential		
Activity class	Handling of contaminated objects	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Activities with treated/contaminated objects (surface 0.1-0.3 m²)	Open surface 0.3 - 1 m²
Containment level	Contamination < 10 % surface	n/a
Activity 2 : Working inside Chrome Zone : Checking anodes		
Variable Parameters used in ART tool	Total duration (mins): 60	
Operational Conditions	Near-field exposure	Far-field exposure (Not Applicable)
Substance emission potential		
Substance product type	Liquids	---
Process temperature	Room temperature	
Vapour pressure	0.01 Pa	
Liquid weight fraction	25%	
Viscosity	Low	
Activity emission potential		
Activity class	Handling of contaminated objects	
Situation	Activities with treated/contaminated objects (surface 0.1-0.3 m²)	

Containment level	Contamination > 90 % surface	

Exposure and risks for workers

The exposure concentration estimated using the ART 1.5 model is reported in Table 9.13.

Activity 1
Total duration (mins): 480 Non-exposure period (mins): 240
Exposure duration: 240 min : 90th percentile full-shift exposure : Two workers

Activity 2
Total duration (mins): 480 Non-exposure period (mins): 420
Exposure duration: 60 min : 90th percentile full-shift exposure : Two workers

Table 9.13 Exposure concentrations and risks for workers (WCS6)

Route of exposure	Modelled Exposure value (8h TWA, mg/m^3)	Modelled Exposure value (8h TWA, µg/m^3) *	Exposure value corrected for frequency (µg/m^3) **
Inhalation	0.00114	1.14	0.059333

*Conversion x1000
**Activity 1 Frequency correction Once every 1 week 1/5
**Activity 2 Frequency correction Once every 6 months 1/120

9.2.7 Worker contributing scenario 7 – WCS 7

This contributing scenario covers the potential exposure to chromium trioxide while performing tasks related to contaminated wastewater flowing to the effluent treatment plant and cleaning out the filter press.

9.2.7.1 Conditions of use

WCS 7 – Wastewater / effluent treatment	**Method**
Product (article) characteristics	
▪ Wastewater containing traces of Chromium Trioxide (Qualitative 4 mg/l) ▪ Chromium hydroxide solid containing traces of Chromium Trioxide (<0.1 mg/kg)	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Solid waste is removed from the filter press and dispensed into the holding skip ▪ Frequency : Once per month ▪ Typical activity time : 15 mins ▪ Number of workers: One of three trained operatives	
Technical and organisational conditions and measures	
▪ Waste rinse water is processed through the effluent plant. ▪ Solid waste disposal to registered handler takes place when appropriate. ▪ Activity performed outdoors but within a courtyard. Out of range of the plating line.	
Conditions and measures related to personal protection, hygiene and health evaluation	

▪ Wear chemically resistant gloves, overall, eye protection in case of accidental spillage. ▪ Training - Working with Chromium - Standard Operating Procedure in place	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Regular refresher training - Working with Chromium	

Exposure assessment

In the absence of specific task based exposure data, personal exposure was modelled using ART 1.5 tool. The input values are summarised in table 9.14.

Table 9.14 Inhalation Exposure modelling for WCS 7 – Wastewater / effluent treatment

Variable Parameters used in ART tool	Total duration (mins): 480 Non-exposure period (mins): 465	
Operational Conditions	Near-field exposure	Far-field exposure (Not Applicable)
Substance emission potential		
Substance product type	Paste, slurry or clearly (soaked) wet powder (not containing volatile liquid components)	---
Process temperature	Room temperature	
Contaminated with powder	No	
Activity emission potential		
Activity class	Handling of contaminated solid objects or paste	
Type of handling	Careful handling	
Dispersion		
Work area	Outdoors	
Source located close to buildings?	Yes	

Exposure and risks for workers

The exposure concentration estimated using the ART 1.5 model is reported in Table 9.15.

Exposure duration: 15 min : 90th percentile full-shift exposure : One worker

Table 9.15 Exposure concentrations and risks for workers (WCS7)

Route of exposure	Modelled Exposure value (8h TWA, mg/m^3)	Modelled Exposure value (8h TWA, µg/m^3) *	Exposure value corrected for frequency (µg/m^3) **
Inhalation	0	0	0

*Conversion x1000 **Frequency correction Once per month 1/20

10. RISK CHARACTERISATION RELATED TO COMBINED EXPOSURE

10.1 Human health (related to combined, shift-long exposure)

10.1.1 Workers

Excess lifetime risk (ELR) is defined as the additional risk of dying from lung cancer due to exposure of toxic substances incurred over the working lifetime of an individual.

With reference to RAC-27-2013-06 Rev.1, based on a 40 year working life (8h/day, 5 days/week), the following risk estimates are used: An excess lifetime lung cancer mortality risk = 4 x 10^{-3} per µg Cr(VI)/m^3.

Table 10.1 Excess risk to workers calculation

A	Inhalation exposure µg/m^3 (from CSR)	[EXP]
B	Excess risk unit coefficient	0.004 per µg/m^3
C	Excess risk for 40 years (A * B)	[EXP] * 0.004

Table 10.2 Combined exposure and risk characterisation from this CSR

Role	Contributing scenario	Route of exposure	8hr TWA exposure values, corrected for frequency (µg/m^3)	Excess lifetime mortality risk per employee (40 years)	Total ELR per employee (40 years)
Main Plater	**WCS 3** Working on the Plating Line	Inhalation	1.7	0.0068	
	WCS 6 Maintenance activities	Inhalation	0.059333	0.000237332	
			Main Plater	Total Risk	0.00704
Cover Plater	**WCS 2** Offline jigging / unloading / inspection of components	Inhalation	0.00021	0.00000084	
	WCS 6 Maintenance activities	Inhalation	0.059333	0.000237332	
			Cover Plater	Total Risk	0.00024
Supervisor	**WCS 4** Sampling the chrome tank	Inhalation	0.00375	0.000015	
	WCS 5 Making Additions	Inhalation	0.85	0.0034	
			Supervisor	Total Risk	0.00342
Offline Worker	**WCS 1** Receipt, transfer and storage	Inhalation	0	0.00000	
	WCS 7	Inhalation	0	0.00000	

	Wastewater management & disposal				
			Offline Worker	Total Risk	0.00000

10.1.2 Consumers

Exposure and risk characterisation

There is no exposure to consumers from the use of chromium trioxide in accordance with this AfA.

There are negligible releases of chromium trioxide to the environment from the site and therefore the process operations involving chromium trioxide make no contribution to this potential route of human exposure.

10.2 Environment (combined for all emission sources)

There are negligible releases to air from the site.

There are no emissions to ground as the plating line is well bunded and the facilities are effectively maintained.

There are no emissions to Surface Water.

All waste solutions from the process are reduced to the trivalent state (Cr^{+3}) within the onsite effluent treatment plant. The solid waste in the form of cake was analysed on 24/11/23 and shows chromium trioxide traces of <0.1 mg/kg. On the basis that a usual disposal is approximately 6.6 tonnes and represents 9 months of activity, the discharge of chromium trioxide via solid waste is likely to be <0.00088 kg/year (<1g/year).

Liquid discharged to foul sewer is sampled and analysis results show chromium (total) to average 0.53mg/l. See Table 9.1.2.1. This is well below the BAT standard which is typically limited to 3 mg/L chromium (total).
With an average discharge of 30 cu m per day and average concentration of 0.53mg/l, the likely total discharge of total chrome is 8.5 kg per year.
Discharges to foul sewer are further diluted prior to discharge by Surface Water by Severn Trent Water.

11. REFERENCES

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