# CHEMICAL SAFETY REPORT

| | |
|---|---|
| Legal name of applicant: | ACF Howell |
| Submitted by: | ACF Howell |
| Date: | 29th December 2024 |
| Substance: | Chromium trioxide<br>EC : 215-607-8<br>CAS : 1333-82-0 |
| Use title: | Use of chromium trioxide for the electroplating of legacy components such as for classic/vintage cars & motorcycles with the purpose of creating a coating to match the original specification and provide specific performance characteristics. |
| 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 legacy components such as for vintage and classic cars and motorcycles has the purpose of creating a coating to match the original specification and provide specific performance characteristics.

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

Functional chrome plating with decorative character represents the surface treatment of metal or other surfaces 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) *
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)

* It is noted that the current binding Occupational Exposure Limit (OEL) set under the EU Directive 2004/37/EC is 10 µg/$m^3$ as an 8-hour time-weighted average (TWA) until January 17, 2025. After that date, the OEL will be reduced to 5 µg/$m^3$ as an 8-hour TWA.

# 2. COMPANY BACKGROUND

A.C.F. Howell is a micro business and specialises primarily in the refurbishment and restoration of chromed parts for vintage and classic cars and motorcycles, together with small batch work of new parts.

Founded by Adam Howell in 1986, the company is located in Victorian workshops in Walsall and employs a small team of versatile metal workers and long serving staff, experienced in the metal finishing business. 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 specialist component restoration.

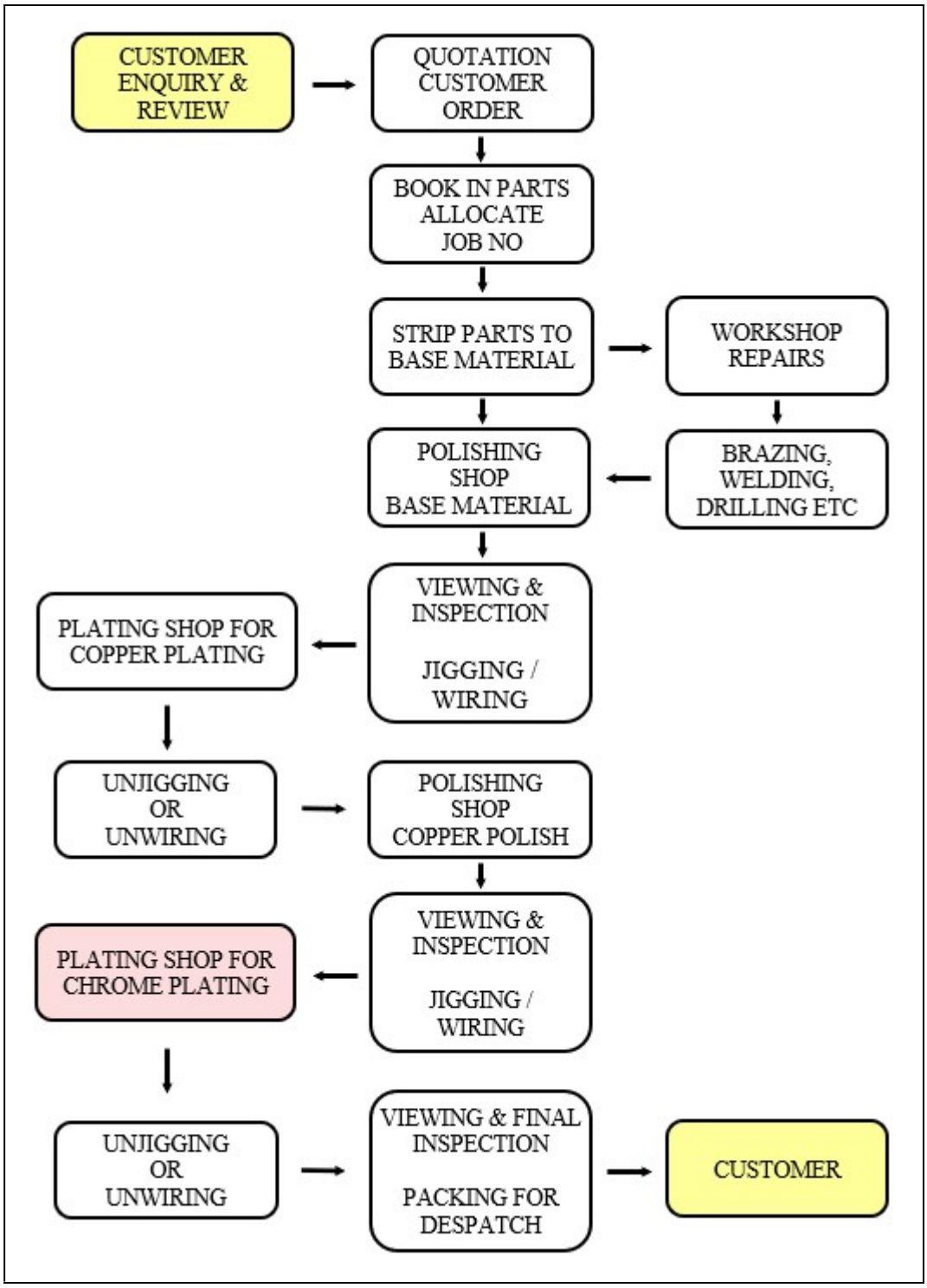
The company has a loyal customer base, made up of enthusiasts, prestigious restoration businesses, spares dealers and general engineering companies. Before the UK withdrew from the EU, the company had many customers in Europe but has still been able to retain its business in the United States.

Typical components include bumpers, overriders, bonnet and boot catches, light surrounds, door and window trims, exhaust systems and handlebars.

# 3. DESCRIPTION OF ACTIVITIES

Figure 3.1 is a schematic diagram of the tasks involved in the refurbishment process of a component probably taken off a classic car or motorcycle. It highlights where chrome plating takes place and the work involved in preparing a component which will meet the customer's expectations and performance requirements.

**Figure 3.1**




# 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, colour and shine stability, surface consistency and smoothness.

Figure 4.1 is a layout of the plating shop where the process that uses chromium trioxide is located. The plating shop is totally segregated from the rest of the factory and only the main plater and support plater are allowed to work in this unit. As can be seen in the diagram, a

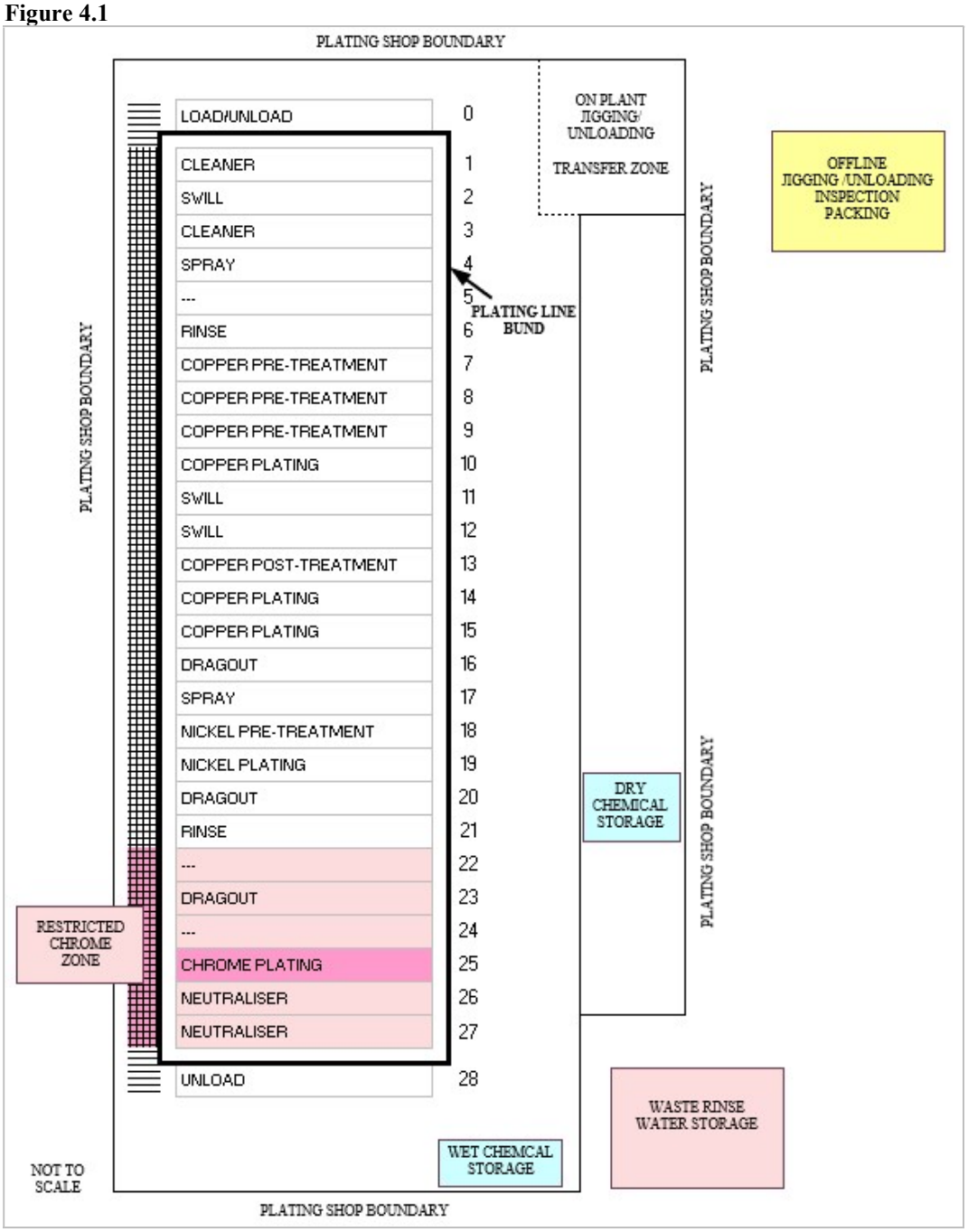
restricted chrome zone has been identified (2 metres either side of the chrome plating tank) and time spent in this zone is kept to the absolute minimum needed to perform the task.

The plating line is a manually operated in-line rack plating line containing a total of 27 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. The platers will either:

- Process components to the copper stage and then unload jigs/frames back at the loading station 0 or
- Process components to the final chrome stage and unload at the unload station 28.

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 the main plater and support plater 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 27 process stations, which in total contain approximately 30,800 litres of various rinses & process chemicals. Approximately 23,800 litres is the total of active process chemicals, with remaining volume being rinses & swills. The whole plating line sits inside a large bund of approximately 27 cu m (27,000 litres).

Waste rinse water from the plating processes, which will contain trace amounts of chromium trioxide (4 mg/l), is stored and contained on-site. This waste is sent for disposal as hazardous waste using a registered waste contractor when appropriate.

**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 misting testing and surface tension monitoring takes place.

**General Ventilation**

The plating shop has two independent ventilation systems. One system serves the cleaner stage process area and the other system serves the central process area. Each have recently been tested demonstrating airflows of 282.4 $m^3$/min and 323.4 $m^3$/min respectively.

**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 B (CAT III) 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**

  These are suitably located around the site. One station is located close to load/unload station 0 on the plating line.

- **Respiratory Protective Equipment (RPE)**

  For various tasks in the plating shop, RPE is worn. As standard, FFP3 (JSP M632 EN149:2001) 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 line personnel take their overalls home

**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
- Emptying A Chrome Tank

**Regular maintenance**

The good working order of the plating plant 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 mist testing has been taking place for many years and provides strong viable data to assess workshop exposure. Records are available back to 22nd January 2002.

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 2021 to November 2024 is shown in Table 6.1

**Table 6.1**

| No of tests | Highest Reading mg/m³ as Cr | Geometric Mean mg/m³ as Cr | 90th Percentile mg/m³ as Cr |
|---|---|---|---|
| 33 | 0.03 | 0.0115 | 0.020 |

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 3 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 |
|---|---|---|---|---|---|
| [redacted] | [redacted] | [redacted] | Marchwood | 259 | 0.927 |

| | | | | | |
|---|---|---|---|---|---|
| [redacted] | [redacted] | [redacted] | Marchwood | 301 | 0.101 |
| Static Position | [redacted] | Sampling unit permanently positioned within 1 metre of the chrome plating tank | Marchwood | 345 | 0.129 |

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] | RPS | 1.56 |
| [redacted] | [redacted] | RPS | 1.68 |

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 both platers 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 support plater 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 |
|---|---|
| 23/10/2024 | 36 |
| 29/11/2024 | 34 |

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 micro 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 in a pre-made solution at a concentration of approximately 50% and the weight of CT is deduced from the total volume of solution used.

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 at an Industrial Site - Use of chromium trioxide for the electroplating of legacy components such as for classic/vintage cars & motorcycles with the purpose of creating a coating to match the original specification and provide specific performance characteristics. | Local |
| WCS 1 | PROC 1 | Receipt, transfer and storage of Chromium Trioxide solution | Support Plater |
| WCS 2 | PROC 4 | Offline jigging / unloading / inspection of components | One operative |
| WCS 3 | PROC 13 | Working in the Plating Shop<br>Activity 1 : Working outside Chrome Zone<br>Activity 2 : Working inside Chrome Zone<br>Activity 3 : Working with contaminated components after plating | Main plater *<br>Support plater |
| WCS 4 | PROC 8b | Sampling the chrome tank | Support plater |
| WCS 5 | PROC 8b | Concentration adjustment of the chrome tank (Making additions)<br>Activity 1 : Working outside Chrome Zone<br>Activity 2 : Working inside Chrome Zone | Support plater |
| WCS 6 | PROC 28 | Maintenance activities | Main plater *<br>Support plater |

| | | | |
|---|---|---|---|
| WCS 7 | PROC 28 | Wastewater management & disposal | Support plater |

*Please note that the tasks listed in Table 9.1 can be performed together, shared or performed individually.

Further details on each WCS activity are as follows:

WCS 1- Receipt, transfer and storage of Chromium Trioxide solution

The chromium trioxide, which is purchased for the purpose of concentration adjustment of the chrome plating tank, arrives at the company in 25L heavy duty plastic containers as a pre-made up solution. Upon receipt, checks are carried out to ensure the goods are in good condition and undamaged. The containers remain unopened and are moved by the support plater to a dedicated area in plating shop. Access to this area is controlled and only approved employees are allowed access.

WCS 2 – Offline jigging / unloading / inspection of components

Before components can be processed on the plating line, they have to be either:

A. Loaded onto specially designed jigs or
B. Attached by copper wire to specially designed frames or
C. Loaded directly onto the flight bar using copper wire and special attachments.

Operations A and B can be performed by one operative outside the plating shop which is included in this scenario, but no exposure to chromium trioxide is possible.

Operations A, B and C can be performed by either plater in the plating shop and is included in WCS 3.

On completion of the plating process:

D. The jigs/frames are unloaded from the plating line and then
E. Components are removed from jigs/frames and then
F. Components are inspected and packed.

Operation D is performed by either plater, only in the plating shop and is included in WCS 3.

Operation E can be performed by one operative outside the plating shop which is included in this scenario and by either plater in the plating shop and is included in WCS 3.

Operation F is only performed by one operative outside the plating shop which is include in this scenario.

WCS 3 – Working in the Plating Shop

The plating shop is totally segregated from the rest of the factory and only the main plater and support plater are allowed to work in this unit. 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 plant is a manually operated in-line rack plating line containing a total of 27 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 platers have the opportunity to assess quality and performance of processes and monitor the condition of the tanks, solution levels, pumps, pipes and heaters. The platers will either:

- Process components to the copper stage and then unload jigs/frames back at the loading station 0 or

- Process components to the final chrome stage and unload at the unload station 28.

In addition to operating the plating line, the platers can perform operations A, B and C (see above). Operation D (see above) is performed by either plater and only in the plating shop. Operation E (see above) can be performed by either plater whilst in the plating shop.

This scenario represents a full shift for both platers and includes estimates of the time spent on a typical range of tasks during a typical shift.

Since this scenario represents a typical shift in the plating shop, WCS4 (Sampling) and WCS5 (Making additions) will, in fact, be included in the scenario for the support plater on the day these activities take place. No allowance has been made for this situation, maintaining the worst case scenario methodology.

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 support plater will make the addition of chromium trioxide to ensure that the optimal concentration of the electroplating solution is maintained.

WCS 6 – Maintenance activities

Periodic maintenance activities are carried out and include:

- Every 3 months - Checking condition of anodes and cleaning plating rails
- Every 3 years or Emergency - Emptying and replenishing chrome tank

WCS 7 – Wastewater management & disposal

Waste rinse water from the plating processes, which will contain trace amounts of chromium trioxide (4 mg/l), is stored and contained on-site. This waste is sent for disposal as hazardous waste using a registered waste contractor when appropriate.

## 9.1.2 Introduction to the assessment

## 9.1.2.1 Environment

The chromium trioxide is purchased in a pre-made solution at a concentration of approximately 50% and the used weight of solid is deduced as 50-75 kg per annum.
There are no releases to atmosphere from the site as there is no Local Exhaust Ventilation (LEV) in use and there are no releases to watercourses.
All chromium trioxide waste is stored and contained on-site. No plating related substances are disposed of via sewer (Severn Trent Water). Once the 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.

## 9.1.2.2 Human via environment

There are no quantifiable releases of chromium trioxide to the environment as there is no LEV in use, therefore operations involving chromium trioxide make no contribution to this potential route of human exposure.

**Scope and type of assessment:**

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 (4 mg/l), is stored and contained on-site. This waste is sent for disposal as hazardous waste using a registered waste contractor when appropriate.

### 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. Arborne mist testing has been taking place for many 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 no 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 | 300 m³ * | 300 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 | 10 air changes per hour (ACH) ** | 10 air changes per hour (ACH) ** |

* Actual work area volume is estimated at 450 m³

** A conservative estimate of actual ACH is well in excess of 25

Note:
Work area volume and ACH used in WCS2 adjusted for offline activity
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, transfer and storage of Chromium Trioxide solution | Method |
|---|---|
| **Product (article) characteristics** | |
| ▪ Sealed container containing chromium trioxide solution @ approximately 50% concentration. | |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| ▪ 2x 25L containers. Every 3 months. No exposure as sealed container.<br>▪ Duration of activity : 30 minutes<br>▪ Number of workers: Support Plater only | |
| **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.<br>▪ 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.<br>▪ 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)<br>▪ Duration of activity : Daily (Typically 1 hour exposure to plated components)<br>▪ Number of workers: One worker outside 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.<br>▪ Components allowed to dry before being removed from the plating line | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| ▪ Wear chemically resistant gloves, overalls, eye protection<br>▪ Training - Working with Chromium - Standard Operating Procedure in place<br>▪ 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): 480 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 | |
| *Dispersion* | | |
| Work area | Indoors | |
| Room size | 100 m³ | |
| *Risk Management Measures* | | |
| *Dispersion* | | |
| Ventilation rate | No restriction on general ventilation characteristics | |

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/m³) | Modelled Exposure value (8h TWA, µg/m³) * | Exposure value corrected for frequency (µg/m³) ** |
|---|---|---|---|
| Inhalation | 0.00000053 | 0.00053 | 0.00053 |

*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 in the Plating Shop | **Method** |
|---|---|
| **Product (article) characteristics** | |
| ▪ Chromium trioxide solution containing approximately 23% 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).<br>▪ One operator enters 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 28.<br>▪ Maximum time in Chrome Zone: 5 minutes total per load<br>▪ Number of workers: Main Plater or Support Plater individually | |
| **Technical and organisational conditions and measures** | |
| ▪ Suppressant used to reduce surface tension and reduce/prevent mist evolution.<br>▪ Good ventilation | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| ▪ Wear chemically resistant gloves, overalls, eye protection<br>▪ Task specific Standard Operating Procedure in place<br>▪ Training - Working with Chromium - Standard Operating Procedure in place<br>▪ Good hygiene practices - Standard Operating Procedure in place | |
| **Other conditions affecting workers exposure** | |
| ▪ Far field exposure applies for platers while not of 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 three 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 in the Plating Shop

| Activity 1 : Working outside Chrome Zone | | |
|---|---|---|
| Variable Parameters used in ART tool | Total duration (mins): 315 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 | 23% |
| 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 | --- |

| Activity 2 : Working inside Chrome Zone | | |
|---|---|---|
| Variable Parameters used in ART tool | Total duration (mins): 45 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 | 23% | |
| Viscosity | Low | |
| *Activity emission potential* | | |
| Activity class | Activities with relatively undisturbed surfaces (no aerosol formation) | |
| Situation | Open surface 0.3 - 1 m² | |
| Containment level | --- | |
| Activity 3 : Working with contaminated components after plating | | |
| Variable Parameters used in ART tool | Total duration (mins): 30 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 | 23% |
| 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 0.3-1 m²) | Open surface 0.3 - 1 m² |
| Containment level | Contamination < 10 % surface | --- |

Exposure and risks for workers

The exposure concentration estimated using the ART 1.5 model for a full shift of three 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 : Two workers

**Table 9.7 Exposure concentrations and risks for workers (WCS3)**

| 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 | 0.0012 | 1.2 | 1.2 |

*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 23% chromium trioxide. | |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| ▪ 100ml typically once per month.<br>▪ Maximum time in Chrome Zone: 10 minutes total<br>▪ Number of workers: Support Plater only | |
| **Technical and organisational conditions and measures** | |
| ▪ Submerge sample container into chrome trioxide solution using long handled tongs.<br>▪ Seal sample container and thoroughly neutralise and rinse before removing from the plating line.<br>▪ Good ventilation | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| ▪ Wear chemically resistant gloves, overalls, eye protection<br>▪ Task specific Standard Operating Procedure in place<br>▪ Training - Working with Chromium - Standard Operating Procedure in place<br>▪ 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<br>▪ 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 | 23% | |
| 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.

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/m$^3$) | Modelled Exposure value (8h TWA, µg/m$^3$) * | Exposure value corrected for frequency (µg/m$^3$) ** |
|---|---|---|---|
| Inhalation | 0.00014 | 0.14 | 0.007 |

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

## 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 20 minutes per month.

**9.2.5.1 Conditions of use**

| WCS 5 – Making Additions | **Method** |
|---|---|
| **Product (article) characteristics** | |
| ▪ Chromium Trioxide solution containing 50% Chromium Trioxide | |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| ▪ 50L typically every 3 months<br>▪ Average 20 mins per month (Total activity duration)<br>▪ Maximum time in Chrome Zone: 5 mins<br>▪ Number of workers: Support Plater only | |
| **Technical and organisational conditions and measures** | |
| ▪ Good ventilation<br>▪ 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<br>▪ Wear FFP3 filter mask<br>▪ Task specific Standard Operating Procedure in place<br>▪ Training - Working with Chromium - Standard Operating Procedure in place<br>▪ Good hygiene practices - Standard Operating Procedure in place | |
| **Other conditions affecting workers exposure** | |
| ▪ Far field exposure applies for platers | |
| **Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply** | |
| ▪ Neutralise and rinse taps & jugs<br>▪ 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): 15 | |
| *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 | 50% | 23% |
| 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 10-90 % of surface | --- |
| 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 (Not Applicable) |
| *Substance emission potential* | | |
| Substance product type | Liquids | --- |
| Process temperature | Room temperature | |
| Vapour pressure | 0.01 Pa | |
| Liquid weight fraction | 50% | |
| Viscosity | Low | |
| *Activity emission potential* | | |
| Activity class | Falling liquids | |
| Situation | Transfer of liquid product with flow of 1 - 10 l/minute | |
| Containment level | Open process | |
| Loading type | Splash loading, where the liquid dispenser remains at the top of the reservoir and the liquid splashes freely | |

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): 460
Exposure duration: 20 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 | 0.0016 | 1.6 | 0.08 |

*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.

### 9.2.6.1 Conditions of use

| WCS 6 – Maintenance activities | **Method** |
|---|---|
| **Product (article) characteristics** | |
| ▪ Chromium trioxide solution containing approximately 23% chromium trioxide. | |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| ▪ Typical time spent in Chrome Zone: 60 mins<br>▪ Frequency : Every 3 months<br>▪ Number of workers: Main Plater and Support Plater together | |
| **Technical and organisational conditions and measures** | |
| ▪ Plating process must be stopped before any maintenance commences.<br>▪ Good ventilation | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| ▪ Wear chemically resistant gloves, overalls, eye protection<br>▪ Appropriate task specific PPE & RPE is required<br>▪ Task specific Standard Operating Procedures in place<br>▪ Training - Working with Chromium - Standard Operating Procedure in place<br>▪ 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**

| Variable Parameters used in ART tool | Total duration (mins): 480 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 | 23% | |
| 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 % of surface | |

Exposure and risks for workers

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

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/m³) | Modelled Exposure value (8h TWA, µg/m³) * | Exposure value corrected for frequency (µg/m³) ** |
|---|---|---|---|
| Inhalation | 0.00085 | 0.85 | 0.014167 |

*Conversion x1000 **Frequency correction Once every 3 months 1/60

## 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 emanating from the process rinses and the disposal of this waste using a registered waste contractor.

### 9.2.7.1 Conditions of use

| WCS 7 – Wastewater management & disposal | **Method** |
|---|---|
| **Product (article) characteristics** | |
| ▪ Chromium Trioxide solution containing traces of Chromium Trioxide (4 mg/l) | |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| ▪ Waste disposal takes place infrequently. Typically 10,000 litres every 2-3 years<br>▪ Typical activity time : 60 mins<br>▪ Number of workers: Support Plater only | |
| **Technical and organisational conditions and measures** | |
| ▪ Waste rinse water from the plating processes is stored and contained on-site.<br>▪ Waste disposal takes place when appropriate.<br>▪ 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.<br>▪ 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 management & disposal**

| Variable Parameters used in ART tool | Total duration (mins): 480 Nonexposure 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 | 0.4% | |
| Viscosity | Low | |
| *Activity emission potential* | | |
| Activity class | Bottom loading | |
| Situation | Transfer of liquid product with flow of 100 - 1000 l/minute | |
| Containment level | --- | |
| *Dispersion* | | |
| Work area | Indoors (Outdoor courtyard) | |
| Room size | 3000 m³ (Open air) | |
| *Risk Management Measures* | | |
| *Dispersion* | | |
| Ventilation rate | No restriction on general ventilation characteristics | |

Exposure and risks for workers

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

Exposure duration: 60 min : 90th percentile full-shift exposure : Two workers

**Table 9.15 Exposure concentrations and risks for workers (WCS7)**

| 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 | 0.000014 | 0.014 | 0.000019 |

*Conversion x1000 **Frequency correction Once every 3 years 1/(240*3)

# 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 in the Plating Shop | Inhalation | 1.2 | 0.00480 | |
| | **WCS 6** Maintenance activities | Inhalation | 0.014167 | 0.00006 | |
| | | | Main Plater | Total Risk | 0.00486 |
| Support Plater | **WCS 1** Receipt, transfer and storage | Inhalation | 0 | 0.00000 | |
| | **WCS 3** Working in the Plating Shop | Inhalation | 1.2 | 0.00480 | |
| | **WCS 4** Sampling the chrome tank | Inhalation | 0.007 | 0.00003 | |
| | **WCS 5** Making Additions | Inhalation | 0.08 | 0.00032 | |
| | **WCS 6** Maintenance activities | Inhalation | 0.014167 | 0.00006 | |
| | **WCS 7** Wastewater management & disposal | Inhalation | 0.000019 | 0.00000 | |
| | | | Support Plater | Total Risk | 0.00521 |

| | | | | | |
|---|---|---|---|---|---|
| Offline Worker | **WCS 2** Offline jigging / unloading / inspection of components | Inhalation | 0.00053 | 0.00000 | |
| | | | 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 no 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 no emissions to air from the site as there is no Local Exhaust Ventilation (LEV) in use.

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

There are no emissions to Surface Water.

All waste solution and waste rinse water from the plating processes are stored and contained on-site. Disposal of this waste is made using a registered waste contractor. Typically 10,000 litres every 2-3 years.

# 11. REFERENCES

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