CHEMICAL SAFETY REPORT

Sections 9 & 10

Legal name of applicant(s):	Cannock Chemicals Ltd
Submitted by:	Surface Engineering Association Chromium Trioxide Authorisation Consortium
Substance:	Chromium Trioxide EC: 215-607-8 CAS: 1333-82-0
Use title:	Use of chromium trioxide for the formulation of surface treatment process solutions – specifically producing chromic acid from chromium trioxide by the addition of water.
Use number:	1

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Abbreviations

BAT	Best Available Techniques
BMGV	Biological Monitoring Guidance Value
CSR	Chemical Safety Report
DF	Dilution Factor
DNEL	Derived No Effect Level
DWF	Dry Weather Flow
ETP	Effluent Treatment Plant
IBC	Intermediate Bulk Container
LEV	Local Exhaust Ventilation
PPE	Personal Protective Equipment
RMM	Risk Management Measures
TWA	Time-weighted Average
WCS	Worker Contributing Scenario
WEL	Workplace Exposure Limit
WWTW	Wastewater Treatment Works

9. EXPOSURE ASSESSMENT (and related risk characterisation)

9.1 Introduction

This exposure assessment is part of the applications for authorisation for the continued use of chromium trioxide (CAS 1333-82- 0, EC: 215-607-8) to formulate chromic acid by the addition of water. This report has been compiled by the Surface Engineering Association Chromium Trioxide Authorisation Consortium (SEACTAC) on behalf of and in conjunction with the applicant. According to Article 62 (4) (d) of the REACH Regulation, CSR in AfA should cover the risks to human health and / or the environment arising from the intrinsic properties specified in Annex XIV, therefore this CSR focuses on carcinogenicity and mutagenicity endpoints.

In particular, the risk assessment performed by SEACTAC took into account the information and the dose-response relationship provided by the risk assessment committee (RAC) in the document "Application for Authorization: Establishing a reference dose response relationship for carcinogenicity of hexavalent chromium "(RAC / 27/2013/06 Rev. 1 Final)[1].

In this document, RAC confirmed that it is not possible to determine a "derived no-effect level" for the carcinogenic properties of chromium trioxide and therefore Chromium Trioxide should be considered as non-threshold substance for the purposes of Article 60 (3) (a) of the REACH Regulation, as a result, according to Article 60 (4) of the REACH Regulation, demonstrating adequate control is not possible and the SEA route is applicable.

This assessment is focused mainly on the Annex XIV properties (Carcinogenic (category 1A) Mutagenic (category 1B)) but an assessment of environmental exposure and consequent assessment of man via the environment has also been carried out to establish any potential exposure levels to the general population.

9.1.1. Overview of uses and Exposure Scenarios

Tonnage information:

The total tonnage used by the member of this application is around 5 tonnes per annum. The company also distributes chromium trioxide flake in sealed containers and this amounts to around 45 tonnes per annum but distribution is specifically excluded from the REACH Regulations. The member is a small sized business for the purpose of REACH authorisation applications and full details of company size is included with this application for authorisation. The member is located in the UK and is a member of the Surface Engineering Association

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

Table 1 Overview of Contributing Scenarios

Contributing scenario	ERC / PROC	Name of the contributing scenario	Size of the exposed population
ES 1:			
ECS1		Use at an Industrial Site - Use of chromium trioxide for the formulation	All Local

		of surface treatment processes, namely chromic acid.	
WCS 1	PROC 1	Receipt & storage of chromium trioxide	1
WCS 2	PROC 8b	Decanting & weighing of solids	3
WCS 3	PROC 8a/8b	Transfer to vessel – aqueous solution	3
WCS 4	PROC 8b	Transfer to vessel – solids	3
WCS 5	PROC 2-5	Mixing by dilution	3
WCS 6	PROC 8b	Transfer to storage container	3
WCS 7	PROC 9	Transfer to small containers	3
WCS 8	PROC 8b	Cleaning of equipment	3
WCS 9	PROC 8a	Maintenance of equipment	3
WCS 10	PROC 1	Storage of formulation	3
WCS 11	PROC 15	Quality Control (sampling & lab analysis)	1
WCS 12	PROC 8b	Waste management	3

Further details on each activity are as follows:

Overview

The formulation of the chromium trioxide solution (chromic acid) is performed in a purpose-built self-contained area and is away from other activities. Chromic acid production is planned to be performed in single batches every one to two months and customer requirements will be satisfied from the stock produced. Stock levels are monitored, and a further batch will be made when stock has reduced to a minimum level. Production is restricted to a single working day whenever possible. Raw material is received on wrapped pallets of 25kg sealed metal containers and stored in a designated area of the warehouse. Health & Safety awareness training has been given to van drivers, fork truck drivers and warehouse personnel. The production area is bunded in line with Best Practice. The mixing vessel is an enclosed IBC type container. Any waste that is generated is disposed off-site through the use of registered hazardous waste contractors. Operating procedures are maintained in line with Best Practice

WCS 1- Receipt and storage of Chromium Trioxide

The chromium trioxide to be used in the formulation process arrives in the company in hermetically sealed steel drums of 25 kg or 50kg each, and the chromium trioxide has the appearance of dark red flakes. Upon receipt, checks are carried out to ensure the goods are in accordance with the purchase order but the drums are not opened. Upon successful completion of the checks, the drums are moved by a worker to a dedicated area in the raw material storage area. Access to this area is controlled and only approved employees are allowed access.

WCS 2 – Decanting and weighing of solids

Solid chromium trioxide is decanted and weighed before being transferred to the mixing vessel. This process only takes a few minutes and appropriate PPE is worn.

WCS3 – Transfer to vessel – aqueous solution

If solid chromium trioxide is not available (unlikely scenario), a chromium trioxide solution would be added to the mixing vessel and appropriate PPE would be worn.

WCS4 – Transfer to vessel - solids

The decanted and weighed chromium trioxide from WCS 1 is transferred into the mixing vessel and this is a manual process. Appropriate PPE is worn.

WCS5 – Mixing by dilution

Water is added to the mixing vessel to produce the correct formulation requirements.

WCS6 – Transfer to storage container

Once the mixing is complete and the formulation requirements have been satisfied, the chromium trioxide solution is transferred into a large storage vessel.

WCS7 – Transfer to small containers

When stocks are running low, the chromium trioxide solution is transferred into smaller containers and suitable PPE is worn. These smaller containers then go into the stores for subsequent despatch to customers.

WCS8 – Cleaning of equipment

Production equipment will be cleaned after each production batch (once every 1 to 2 months depending on sales volumes), appropriate PPE is worn, and any waste is collected and disposed of off-site by registered hazardous waste companies.

WCS9 – Maintenance of equipment

Following the cleaning of the equipment after production batch, any required maintenance will be carried out and suitable PPE will be worn.

WCS10 – Storage of formulation

The formulation is either stored in a large storage vessel or in smaller containers ready for shipment to customer.

WCS11 – Quality control (sampling & lab analysis)

Samples of the chromium trioxide solution will be taken at various points during the process and then analysed in the laboratory to ensure compliance with the required specification.

WCS12 – Waste Management

Any waste following the production process is collected and disposed off-site by registered hazardous waste companies.

The following table summarises the frequency and duration of each of the contributing scenarios in this particular application for authorisation:

Table 2 – Frequency & duration of tasks

WCS	Frequency / duration of task	8-hour Shift equivalent (232 working days/year) hours
WCS1 (1 employee)	24 per year/1 hour	0.103
WCS2 (3 employees)	12 per year/1.5 hours	0.233
WCS3 (3 employees)	12 per year/1 hour	0.155
WCS4 (3 employees)	12 per year/2 hours	0.310
WCS5 (3 employees)	12 per year/1.5 hours	0.233
WCS6 (3 employees)	12 per year/0.5 hours	0.078
WCS7 (3 employees)	3 per year/3.5 hours	0.136
WCS8 (3 employees)	12 per year/2 hours	0.310
WCS9 (3 employees)	12 per year/0.5 hours	0.078
WCS10 (3 employees)	12 per year/0.5 hours	0.078
WCS11 (1 employee)	12 per year/1 hour	0.052
WCS12 (3 employees)	12 per year/1 hour	0.155
Total (averaged) hours exposure per 8 hr (TWA)		**= 1.92**

9.1.1.1 Risk Management Measures and Operational Controls

There have been regulations in place in the UK regarding the use of chromium trioxide since 1931. These were amended in 1973 and then revoked by the issue of the Control of Hazardous Substances regulations in 1988. There has also been joint Health & Safety Executive and Surface Engineering Association guidance on best practice in place for many years and these will be revised following the conclusion of the application for authorisation.

Many educational events have taken place, again over many years, such as the 2005 National Health Awareness Day for the UK Chromium Plating Industry and the Disease Reduction Programme focussing on workplace cancers which began in 2008.

The UK has been at the forefront of the control of the potential risks during chromium electroplating from the use of chromium trioxide. The UK's approach of risk management rather than complete risk removal (leading to processes being carried in countries with less stringent or even no real controls) means that chromium trioxide can be used safely in electroplating processes with exposures similar to background levels.

Here is a list of the risk management measures and operational controls that are in operation at the site that is covered by this particular application.

1 – Workplace & Employee Exposure

2 – Training

3 – Suitable PPE

4 – Waste disposal

5 – Regular maintenance

6 – Management Systems

These are all detailed in the RMM document that accompanies this application for authorisation.

9.1.2. Introduction to the assessment

9.1.2.1. Environment

The quantity of chromium trioxide used is approximately 50 tonnes per annum. There are no releases to atmosphere from the site as there is LEV (extraction) in use and there are no releases to watercourses. All chromium trioxide waste is sent for treatment off-site using registered waste contractors. The only potential exposures to chromium trioxide are within the factory, so there is no risk to the general public.

Scope and type of assessment:

As there are no emissions to atmosphere and any waste if treated off-site by registered waste contractors, there is no need for an assessment.

9.1.2.2. Human via environment

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

9.1.2.3. Workers

Scope and type of assessment:

The worker exposure via inhalation for all WCS are assessed using the results of the regular personal air sampling and biological monitoring of the workers. The air sampling is carried out by specialist companies and analysed off site, as is the analysis of the biological monitoring.

Air-monitoring samples were collected by drawing a measured volume of air through prepared filter media in accordance with the requirement of MDHS 52/4[2] and using the WEL's detailed in EH 40/2005:2020[3].

For the personal air samples, the sampling head is positioned within the workers breathing zone.

Table 3: Chromium trioxide concentration measured during formulation process

There is no exposure during the formulation process as it is carried out in an enclosed process vessel.

Table 4: Chromium in Workers' Breathing zone (TWA) – "worst case" results

Employee	Sample Type	Airborne level of chromium trioxide (µg/m³ 8hr TWA)	TWA values corrected for frequency (µg/m³ 8hr TWA)
Employee 7	Personal Air	[redacted]	[redacted]

Note: Air monitoring in the area where the chromium trioxide is used showed airborne levels below [redacted] 8hr TWA.

Table 5: Biological monitoring (chrome in urine). Results assumed as 100% chromium trioxide.

Company (site)	Sample Type	Chromium in Urine (µmol/mol creatinine)*
Employee 1	Biological Monitoring	[redacted]
Employee 2	Biological Monitoring	[redacted]
Employee 3	Biological Monitoring	[redacted]
Employee 4	Biological Monitoring	[redacted]
Employee 5	Biological Monitoring	[redacted]
Employee 6	Biological Monitoring	[redacted]

Notes:

*UK Biological Monitoring Guidance Value (BMGV) is 10µmol/mol (creatinine) with unexposed level being 2.9µmol/mol (creatinine). All employees had chromium levels below the unexposed levels, clearly indicating no occupational exposure.

Comments on assessment approach related to toxicological hazard:

The assessment approach uses measured data from the site, the low frequency and low volume of chromium trioxide additions and the relative proximity of the Worker to the

formulation process tanks during operation; the only viable data to assess exposure is the mist test and personal air sample results.

This site also collects biological monitoring data in order to assess exposure via all potential routes i.e., inhalation, ingestion and dermal contact absorption. This measure indicates "total chrome" but cannot distinguish between the valent states and is, therefore, an indicator only of control measure efficacy.

Comments on assessment approach related to physicochemical hazard:

Chromium Trioxide is classified as a Category 1 carcinogen (R45: 'May cause cancer') and, as such, does not have any Derived No Effect Limit (DNEL). Therefore, WEL and BMGV values (where available) are used as benchmarks for controls.

General information on risk management related to toxicological hazard:

The conditions of use detailed within this CSR (sections 9.2.1 to 9.2.12.) specify that all handling of the substance by the Worker should be done while wearing appropriate PPE relative to the task.

General information on risk management related to physicochemical hazard:

The conditions of storage, use & handling of the substance are detailed within this CSR under sections 9.2.1 to 9.2.12 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 the site therefore the process operations involving chromium trioxide make no contribution to this potential route of human exposure.

9.2. Exposure scenario 1 for workers

9.2.1. Worker contributing scenario 1

This contributing scenario covers potential exposure during receipt of bulk raw materials and transfer to secure storage area.

9.2.1.1. Conditions of use

	Method
Product (article) characteristics	
▪ Sealed container containing dry flake/granule form comprising >99.8% Chromium Trioxide.	
Technical and organisational conditions and measures	
▪ Keep sealed in original container. Transfer to store location.	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in case of accidental spillage.	

	Method
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.	

9.2.2. Worker contributing scenario 2

This contributing scenario covers the decanting of solid chromium trioxide from the original containers into the mixing vessel.

9.2.2.1. Conditions of use

	Method
Product (article) characteristics	
▪ Dry flake/granule form comprising >99.8% Chromium Trioxide	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ Bunded area ▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training. ▪ Wear appropriate respiratory protection	
Other conditions affecting workers exposure	
▪ Use indoors	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.3. Worker contributing scenario 3

This contributing scenario covers the transfer of liquid chromium trioxide into the mixing vessel when solid chromium trioxide is unavailable (unlikely occurrence).

9.2.3.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid containing approximately 50% chromium trioxide.	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ Area is bunded	

	Method
▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training.	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.4. Worker contributing scenario 4

This contributing scenario covers when the decanted and weighed chromium trioxide from WCS 1 is transferred into the mixing vessel and this is a manual process

9.2.4.1. Conditions of use

	Method
Product (article) characteristics	
▪ Dry flake/granule form comprising >99.8% Chromium Trioxide	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ Area is bunded ▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training. ▪ Wear appropriate respiratory protection	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.5. Worker contributing scenario 5.

This contributing scenario covers the adding of water to the mixing vessel to produce the correct formulation requirements. This is carried out in an enclosed vessel.

9.2.5.1. Conditions of use

	Method
Product (article) characteristics	

	Method
▪ Solution containing around 50% chromium trioxide	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ Area is bunded ▪ Operating procedures ▪ Operation carried out in enclosed vessel	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall and eye protection in combination with specific employee training.	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.6. Worker contributing scenario 6.

This contributing scenario covers the transfer of the formulated product in the large storage vessel.

9.2.6.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (25% chromium trioxide)	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ Area is bunded ▪ Operating procedures ▪ Operation carried out in enclosed vessel	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training.	
Other conditions affecting workers exposure	
n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.7. Worker contributing scenario 7.

This contributing scenario covers the potential exposure to chromic acid when transferring the solution from the large storage vessel into smaller containers.

9.2.7.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (up to 25% chromium trioxide).	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ Area is bunded ▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training.	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.8. Worker contributing scenario 8.

This contributing scenario covers the potential exposure to chromic acid when cleaning the mixing vessel after use.

9.2.8.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (up to 25% chromium trioxide).	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ Area is bunded ▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training. ▪ Wear appropriate respiratory protection	

	Method
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.9. Worker contributing scenario 9.

This contributing scenario covers the potential exposure to chromic acid during maintenance operations.

9.2.9.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (up to 25% chromium trioxide).	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ Area is bunded ▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training. ▪ Wear appropriate respiratory protection	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.10. Worker contributing scenario 10.

This contributing scenario covers the potential exposure to chromic acid during the storage of the formulated product

9.2.10.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (up to 25% chromium trioxide).	
Technical and organisational conditions and measures	
▪ Stored in closed containers ▪ Stored in self-contained area ▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training.	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.11. Worker contributing scenario 11.

This contributing scenario covers the potential exposure to chromic acid during the sampling and quality control of the formulation.

9.2.11.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (up to 25% chromium trioxide).	
Technical and organisational conditions and measures	
▪ General ventilation ▪ In self-contained area ▪ In laboratory environment ▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training.	
Other conditions affecting workers exposure	
▪ Indoors	

	Method
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.2.12. Worker contributing scenario 12.

This contributing scenario covers the potential exposure to chromic acid through the management of waste

9.2.12.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (up to 25% chromium trioxide).	
Technical and organisational conditions and measures	
▪ Process waste stored and disposed by registered waste company ▪ Operating procedures	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training.	
Other conditions affecting workers exposure	
▪ n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply	
▪ Specific training when working with chromium trioxide.	

9.3 Combined exposure for all WCS

It is assumed that there is potential for exposure to chromium trioxide from all 12 worker contributing scenarios, although it is extremely unlikely for some of the WCS where they are carried out in enclosed vessel or are simple storage operations.

Chromium trioxide is bio-accumulative and exposure potential is via inhalation, ingestion and/or dermal absorption. Results from the regulated monitoring methods of mist testing and personal air sampling all show that the RMM's are effective in maintaining exposures to levels below the WEL for chromium trioxide from both the process generated and TWA measures.

Biological monitoring results also demonstrate that the RMM's are effective and that all of the results are below the "un-exposed" level of 2.9µmol/mol (creatinine).

10. RISK CHARACTERISATION RELATED TO COMBINED EXPOSURE

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

10.1.1. Workers

Table 6: Combined exposure and risk characterisation

Contributing scenario	Route of exposure	8h TWA exposure values, corrected for PPE and frequency	WEL (EH40/2005 - 4th Edition 2020) (8-hr TWA reference period)	Excess risk factor (from CSR)
*WCS 1-12	Inhalation	0.5µg/m^{3**}	0.025mg/m^3 (25µg/m^3)	0.002

* WCSs that may be performed by the same worker/s within one shift

**** Detailed in Table 4**

10.1.2. Consumers

Exposure and risk characterisation

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 the site 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 as the site does not use LEV on their formulation tanks.

There are no emissions to ground as all Group Companies facilities are effectively maintained and bunded.

There are no emissions to Surface Water.

All waste solutions from the process are collected by licensed waste treatment contractors.

There are no liquid discharges to foul sewer.

11. REFERENCES

1. Application for Authorisation: Establishing a reference dose response relationship for the carcinogenicity of hexavalent chromium. Published by the Risk Assessment Committee of the European Chemicals Agency – RAC/27/2013/06 Rev. Final
2. MDHS 52/4 – Hexavalent chromium in chromium plating mists. Published by the Health & Safety Executive 11/2014
3. EH40/2005 – Workplace Exposure Limits (Fourth edition). Published by The Stationery Office ISBN 978 0 7176 6733 8