

CHEMICAL SAFETY REPORT

Sections 9 & 10

Legal name of applicant: SCA Ceramic Coatings Ltd

Submitted by: SCA Ceramic Coatings Ltd

Substance: Chromium Trioxide

EC: 215-607-8
CAS: 1333-82-0

Use title: Use of chromium trioxide in a binding/sealing process applied to porous/semi-porous coatings to achieve a wear and corrosion resistant technical ceramic surface to meet specific performance characteristics

Use number: 1

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LIST OF ABBREVIATIONS

AfA	Application for Authorisation
APF	Assigned Protection Factor
BMGV	Biological Monitoring Guidance Value
COSHH	Control of Substances Hazardous to Health
CSR	Chemical Safety Report
DNEL	Derived No Effect Limit
ECS	Exposure Contributing Scenarios
ES	Exposure Scenario
HVOF	High Velocity Oxy-Fuel (Thermal Spray Coating)
PAPF/PAPR	Powered Air Purifying Filter/Powered Air Purifying Respirator
PPE	Personal Protective Equipment
RAC	Risk Assessment Committee (EU)
RMM	Risk Management Measure
RPE	Respiratory Protective Equipment
SEA	Socio-Economic Analysis
TWA	Time-Weighted Average
WCS	Worker Contributing Scenario
WEL	Workplace Exposure Limit
w/w	Weight per weight

9. EXPOSURE ASSESSMENT (and related risk characterisation)

9.1 Introduction

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

Volume usage information:

The total used by the Applicant is between [REDACTED] per annum. The Applicant is a micro sized business for the purpose of REACH authorisation applications and full details of company size are included with this application for authorisation. The Applicant is located in the UK.

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 coating of engineering	

		components with the purpose of creating a coating to provide specific performance characteristics	
WCS 1	PROC 1	Receipt & storage of chromium trioxide	1
WCS 2	PROC 8a	Decanting & weighing of solids	1
WCS 3	PROC 5, PROC 9	Mixing coating solutions	1
WCS 4	PROC 13	■ applying Slurry coat	3
WCS 5	PROC 10	■ applying sealing solution	3
WCS 6	PROC 28	Removing excess solution	3
WCS 7	PROC 28	Maintenance activities	1
WCS 8	PROC 28	Waste consolidation	3

Please note that the majority of these tasks will be undertaken by the same workers.

Further details on each activity are as follows:

WCS 1- Receipt, transfer and storage of Chromium Trioxide

The chromium trioxide to be used in the coatings arrives in the company in hermetically sealed steel drums of 25 kg each, and the chromium trioxide has the appearance of dark red flakes. Upon receipt, checks are conducted 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 secure, raw material storage unit. Access to this area is controlled and only approved employees are allowed access.



Raw material store

WCS 2 – Decanting & weighing of solids.

Solid chromium trioxide (flake) is decanted into a sealable container from the bulk container (drum) in the raw material store before transferring into the workshop area. It is then further decanted and weighed into a glass beaker. This process takes only a few minutes and appropriate PPE is worn – including a PAPF mask.

WCS 3 – Mixing Coating Solutions

The Slurry coat solution is prepared using volumetric glass beakers, funnel and weigh scales. Each constituent is weighed separately and added to a [REDACTED] Jar. Chromium trioxide flake is added to the mixture and the beaker rinsed with the remainder of de-ionised water and added to the [REDACTED] Jar. The [REDACTED] Jar is placed on the [REDACTED].

. The final mixture is decanted into a glass beaker [REDACTED]. Appropriate PPE is worn throughout.

Sealing solution is made up in a glass beaker, at room temperature, using de-ionised water and Chromium trioxide. The beaker is first placed into a Fume Cupboard where the water and chromium trioxide are added. A mechanical stirrer is used until the chromium trioxide is completely dissolved. Appropriate PPE is worn.

WCS 4 – Applying Slurry Coat

[REDACTED] Slurry mixture is positioned within a [REDACTED] rig. The component is held [REDACTED] above the slurry mix. [REDACTED] immerse the component to a pre-determined position then [REDACTED] lift the component out of solution.

[REDACTED] Slurry is wiped off external surfaces using a damp paper towel, leaving the desired, internal surface coated. Low temperature heat is then applied to initiate the drying process and “set” the remaining slurry coating.

The component is transferred to a segmented wire basket.

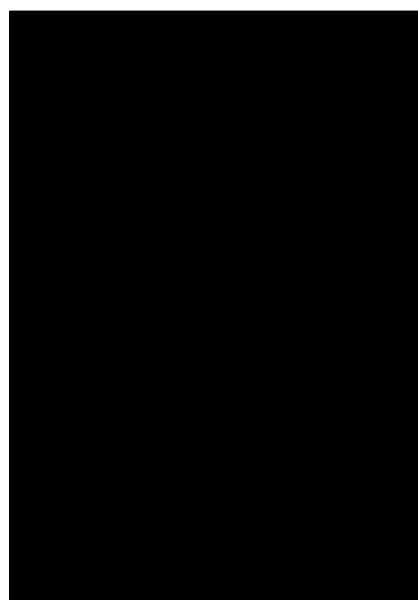
This process is repeated until the basket is filled or the batch is complete.

Each full basket is placed in a sealed oven and cured [REDACTED]

Appropriate PPE is worn. Waste towels are placed in the allocated bin.



[REDACTED]



Slurry coated components

WCS 5 – Applying Sealing solution.

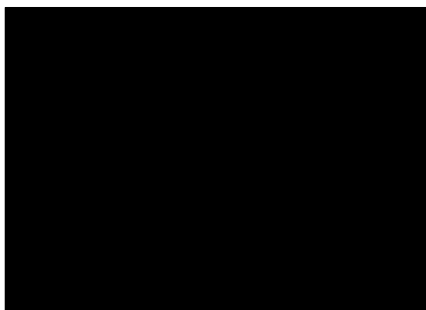
The 'cured' Slurry Coating is extremely friable and porous.

A Sealing solution is applied [REDACTED] the coated surface. [REDACTED]
[REDACTED] oven for further curing.

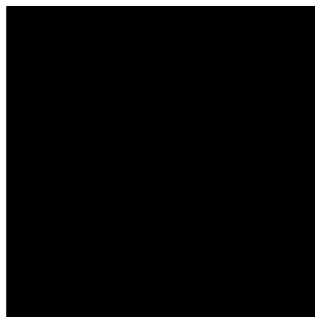
This process is repeated several times. Components are then either sent for [REDACTED]
[REDACTED]

Sealing solution is also applied to large Rolls that are received "as coated" with a Thermal Spray applied Carbide coating. This is required due to the inherent porosity present within the Thermal Spray coating.

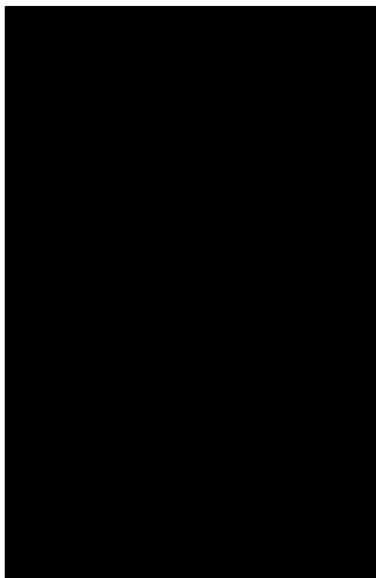
Appropriate PPE is worn.



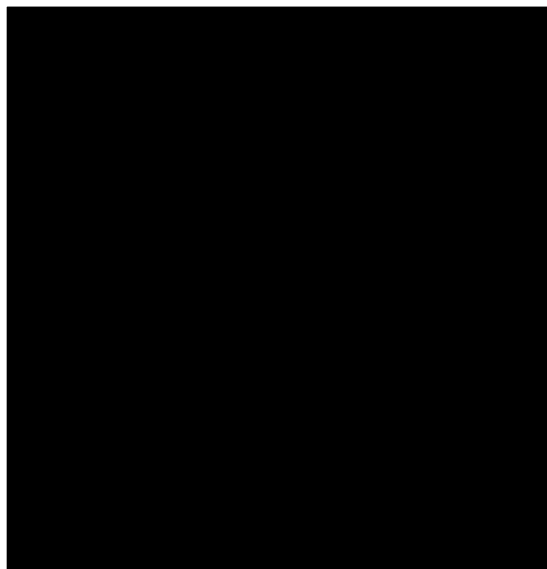
Applying sealing solution



Sealing solutions for use



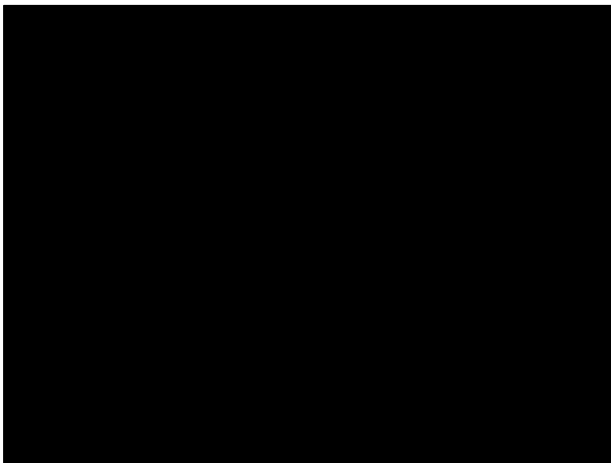
Hand Polishing (note. Backpack. Personal Air Monitoring survey in progress).



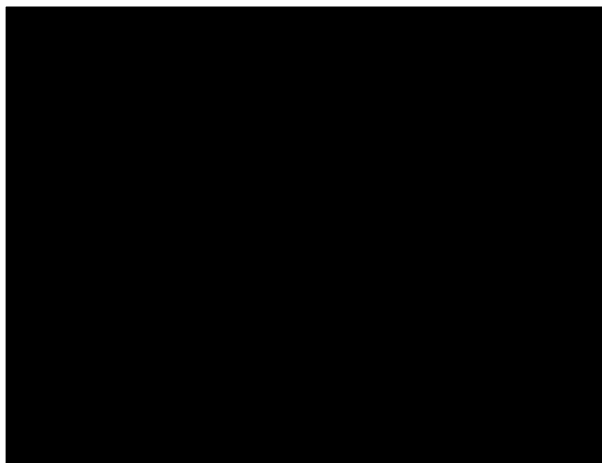
Note. Dust Extractor nozzle (bottom centre)

Following Grinding or Polishing, the Sealing process is carried out an additional [REDACTED] cycles.

All coated surfaces are finally hand polished to finish. Appropriate PPE is worn.



application to HVOF coating



Removing excess Sealer

WCS 6 – Removing excess solution.

Sealing solution

. Contaminated
wipes are placed into waste bins under the workbench. Appropriate PPE is worn.



WCS 7 – Maintenance

Minimal maintenance is required and is unlikely to entail contact with Chromium trioxide. As the equipment used in the coating/sealing process is hand-held, maintenance is by replacement with new after disposing defective equipment into the waste bin. Appropriate PPE is worn.

WCS8 – Waste consolidation

All waste materials (paper towels, brushes, PPE, and 'dried' solutions) are collected in open topped bins in the working area. When full, or at the end of shift, bins are decanted into "blue," clip-top waste barrels. Materials are compressed and the lid replaced. When Barrels are full, collection is made by Licensed Waste Carrier for treatment and disposal.



Clip-top Waste Barrels in storage unit.



Waste Barrel awaiting collection & disposal.

9.1.1.1 Risk Management Measures and Operational Controls

There have been sector-specific regulations in place in the UK regarding the use of chromium trioxide in chromium electroplating operations since 1931. These were amended in 1973 and then revoked by the issue of the Control of Hazardous Substances regulations in 1988. The COSHH Regulations place strict controls on the use of chromium trioxide detailing both Health & Safety Hazards and specific Control Measures and Monitoring.

There has also been Health & Safety Executive Guidance on best practice in place for many years.

The UK's approach of risk management rather than complete risk removal (leading to processes being carried out in countries with less stringent or even no real controls) means that chromium trioxide can be used safely 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 covered by this application.

- 1 – Workplace & Employee Exposure
- 2 – Training
- 3 – Suitable PPE
- 4 – Waste disposal
- 5 – Maintenance
- 6 – Management Systems

9.1.2. Introduction to the assessment

9.1.2.1. Environment

The quantity of chromium trioxide used by the company in this application is [REDACTED] per annum. There are no releases to atmosphere and there are no releases to watercourses. All chromium trioxide waste is disposed for treatment off-site using

registered waste contractors. Once the components have been coated and oven cured, 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

As there are no extraction systems that discharge outside of the workplace, there is no potential of exposure to the local population.

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 worker. The air sampling is conducted according to BS ISO 16740:2005, by a specialist company and analysed at an approved Laboratory.

Table 2: Chromium in Workers' Breathing zone (TWA) – "worst case" results.

Employee	Sample Type	Airborne level of chromium trioxide ($\mu\text{g}/\text{m}^3$ 8hr TWA) *highest reported value	TWA values corrected for frequency ($\mu\text{g}/\text{m}^3$ 8hr TWA)
■	Personal Air Monitoring	1.46	No correction
■	Personal Air Monitoring	<0.185	No correction
■	Personal Air Monitoring	0.5	No correction

Notes:

UK Workplace Exposure Limit (WEL) is $10\mu\text{g}/\text{m}^3$ 8hr TWA

Confidential spreadsheet attached detailing SEG test data along with Geometric Mean and 90th percentile calculations (using Expostats - tool 1).

Table 3: Biological monitoring (chrome in urine).

Employee	Sample Type	Chromium in Urine ($\mu\text{mol}/\text{mol}$ creatinine) * (highest results)
■	Biological Monitoring	■
■		■
■		■
■		■
■		■

Notes:

*UK Biological Monitoring Guidance Value (BMGV) is $10\mu\text{mol}/\text{mol}$ (creatinine) with unexposed level being $2.9\mu\text{mol}/\text{mol}$ (creatinine).

**Measurements below the unexposed (general public) level

Comments on assessment approach related to toxicological hazard:

The assessment approach uses measured data from the site but, the low frequency of operations and low volume of chromium trioxide used means that the only viable data to assess exposure is the personal air sample results and Biological Monitoring results.

Biological monitoring data is used 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 9.2.8.) 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 9.2.8 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.	
Amount used (or contained in articles), frequency and duration of use/exposure	
25Kg container. Average 1x per annum. No exposure as sealed container.	
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.	
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 potential exposure to chromic acid during the decanting and weighing of solid chromium trioxide from the original containers into transfer container and then into mixing vessel (beaker). Mixing is done in a recirculating-air fume cupboard.

9.2.2.1. Conditions of use

	Method
Product (article) characteristics	
• Dry flake/granule form comprising >99.8% Chromium Trioxide	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Very small amount (unquantified)	
Technical and organisational conditions and measures	
▪ General ventilation ▪ Secure raw material store ▪ Fume Cupboard ▪ 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 potential exposure to chromic acid during the addition to water in the mixing vessel to produce the correct concentration requirements. This is carried out inside a recirculating-air fume cupboard.

9.2.3.1 Conditions of use

	Method
Product (article) characteristics	
Chromic acid containing approximately [REDACTED] chromium trioxide.	
Amount used (or contained in articles), frequency and duration of use/exposure	
Very small amount [REDACTED] once weekly, 40 weeks per annum.	
Technical and organisational conditions and measures	
- General ventilation - Operating procedures - Fume cupboard	
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	
Specific training when working with chromium trioxide.	do not apply

9.2.4. Worker contributing scenario 4

This contributing scenario covers the potential exposure to chromic acid while applying slurry coating solution [REDACTED].

9.2.4.1. Conditions of use

	Method
Product (article) characteristics	
Chromic acid containing [REDACTED] chromium trioxide	
Amount used (or contained in articles), frequency and duration of use/exposure	
Very small amount (unquantified)	
Technical and organisational conditions and measures	
- Slurry solution container located [REDACTED] - Component secured in [REDACTED] [REDACTED] process, hand controlled - Component removed and located in [REDACTED]	
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	
Specific training when working with chromium trioxide.	do not apply

9.2.5. Worker contributing scenario 5.

This contributing scenario covers the potential exposure to chromium trioxide during the application of sealing solution.

9.2.5.1. Conditions of use

	Method
Product (article) characteristics	
Chromic acid containing chromium trioxide	
Amount used (or contained in articles), frequency and duration of use/exposure	
Very small amount (unquantified)	
Technical and organisational conditions and measures	
apply solution to component surface	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear chemically resistant gloves, coverall, eye protection and appropriate respiratory 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	
Specific training when working with chromium trioxide.	do not apply

9.2.6. Worker contributing scenario 6.

This contributing scenario covers the potential exposure to chromic acid (chromium trioxide) during removal of excess coating.

9.2.6.1. Conditions of use

	Method
Product (article) characteristics	
Slurry or Sealing solution containing chromium trioxide	
Amount used (or contained in articles), frequency and duration of use/exposure	
Very small amounts (unquantified)	
Technical and organisational conditions and measures	
Excess coatings removed using	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training. Appropriate RPE if required.	
Other conditions affecting workers exposure	
n/a	
Additional good practice advice. Obligations according to Article 37(4) of REACH	
- Waste towels disposed correctly in specified containers (bins) - Specific training when working with chromium trioxide.	do not apply

9.2.7. Worker contributing scenario 7.

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

9.2.7.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (>40% (w/w) chromium trioxide)	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Occasional exposure subject to requirements	
Technical and organisational conditions and measures	
▪ Coating process must be stopped before any maintenance commences. ▪ All parts/surfaces (including surrounding) to be wiped with damp paper towels	
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Wear chemically resistant gloves, coverall, eye protection in combination with specific employee training. Appropriate RPE if required.	
Other conditions affecting workers exposure	
▪ Confined spaces	
Additional good practice advice. Obligations according to Article 37(4) of REACH	
do not apply	
▪ Parts replaced should be cleaned prior to disposal. ▪ Specific training when working with chromium trioxide.	

9.2.8. Worker contributing scenario 8.

This contributing scenario covers the potential exposure to chromic acid while consolidating waste materials into Disposal Bins.

9.2.8.1. Conditions of use

	Method
Product (article) characteristics	
▪ Chromic acid (chromium trioxide).	
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ per year, retained on PPE or absorbed in paper towels	
Technical and organisational conditions and measures	
▪ Retained in bins during production and transferred to Waste Bins daily.	
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	
▪ avoid repetitive handling (decanting) to keep exposure to a minimum. ▪ 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 8 worker contributing scenarios.

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

Where biological monitoring is conducted, these results also demonstrate that the RMM's are effective and that most of the results are significantly below the BMGV of $10\mu\text{mol/mol}$ (creatinine) and with a number of these being below the "un-exposed" level of $2.9\mu\text{mol/mol}$ (creatinine).

10. RISK CHARACTERISATION RELATED TO COMBINED EXPOSURE

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

10.1.1. Workers

Table 4: 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 SEA, table 1)
*WCS 1-8	Inhalation	0.715µg/m ³ ** 0.035µg/m ³ ***	0.010mg/m ³ (10µg/m ³)	

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

** Averaged from details in Table 2 (rather than the less conservative geometric mean

*** adjusted for APF 20 by use of PAPR

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.

There are no emissions to ground.

There are no emissions to Surface Water.

All waste from the process is collected by licensed waste treatment contractors to be incinerated.

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. EH40/2005 – Workplace Exposure Limits (Fourth edition). Published by The Stationery Office ISBN 978 0 7176 6733 8