

Exposure Scenario provided in accordance with EU Directive 2004/37/EC, Regulation (EC) No 1907/2006 Annex I and the terms of the REACH authorisation No. REACH/19/32/2

1. TITLE SECTION

Substance	Sodium chromate (CAS number 7775-11-3, EC number 231-889-5)
ES/use name	<p>Sealing after anodizing, chemical conversion coating, pickling and etching applications by the aerospace sector¹, where any of the following key functionalities or properties is necessary for the intended use: for the pickling/etching process - etch rate, intergranular attack/end grain pitting, surface contamination, fatigue testing, tensile testing, surface roughness, impact to shot peen compressive layer; and for the chemical conversion coating and sealing after anodising process - corrosion resistance, active corrosion inhibition, adhesion promotion, chemical resistance, layer thickness, electrical properties.</p> <p>Sodium chromate may only be used for sealing after anodizing, chemical conversion coating, pickling and etching applications by the aerospace sector.</p> <p><u>Important note:</u> The authorisation for the use of sodium chromate is not granted for applications by the aerospace sector where none of the key functionalities listed in the use is necessary for the intended use.</p>

1.1. Scope

ENVIRONMENT (Environment Contributing Scenario – ECS)

ECS 1: Use of sodium chromate for sealing after anodizing, chemical conversion coating, pickling and etching applications by aerospace companies and their suppliers.	ERC 6b
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WORKER (Worker Contributing Scenario – WCS)

WCS 1: Delivery and storage of raw material	PROC 1
WCS 2: Decanting – liquids	PROC 8b
WCS 3: Decanting and weighing of solids	PROC 8b
WCS 4: Mixing – solids	PROC 5
WCS 5: Re-filling of baths for adjustment of concentration – liquids	PROC 8b
WCS 6: Re-filling of baths for adjustment of concentration – solids	PROC 8b
WCS 7: Use of sodium chromate for chemical conversion coating applications by aerospace companies and their suppliers	PROC 13
WCS 8: Sealing after anodizing with sodium chromate in baths	PROC 13
WCS 9: Pickling and Etching	PROC 13
WCS 10: Surface treatment by brushing (small sized areas)	PROC 10
WCS 11: Maintenance of equipment	PROC 8a
WCS 12: Sampling	PROC 8b
WCS 13: Machining operations on small to medium sized parts containing Cr(VI) on an extracted bench/extraction booth including cleaning	PROC 21, 24
WCS 14: Machining operations in large work areas on parts containing Cr(VI) including cleaning	PROC 21, 24
WCS 15: Machining operations on parts containing Cr(VI) in small work areas including cleaning	PROC 21, 24
WCS 16: Storage of articles	PROC 1

¹ Aerospace sector includes companies principally engaged in carrying out the design, development, manufacture, maintenance, modification, overhaul, repair, or support of civil or military aerospace and defence equipment, systems, or structures.

WCS 17: Waste management	PROC 8b
WCS 18: End of Life	PROC 8a

This ES includes relevant information provided in the Boeing Distribution, Inc. (formerly Avial Services Inc) Chemical Safety Report (CSR) for Sodium chromate (see [AFA No. 0099-02](#)), in accordance with ECHA's illustrative example of an exposure scenario, and follows ECHA's guidance on extracting the relevant information from the comprehensive exposure scenarios in the CSR.

1.2. Explanation on the approach taken for the ES

All worker exposure estimates are given in terms of Cr(VI) and are expressed as 8-hour Time Weighted Average (TWA).

The frequency of a specific activity in the worker sub-scenarios is expressed as daily activity unless otherwise stated. *As long-term exposure is the relevant period for long-term health effects, the duration of exposure per day as set out in the ES is expressed as average duration per day over a longer period (e.g. 2 hours each day are equal to 4 hours every second day). Therefore, the duration of exposure per day is not the same as the maximum allowed duration in any one day.*

Occupational exposure estimates are based on measured data and/or on modelled data, using the exposure model 'Advanced REACH Tool 1.5' or 'ART'². ART is a second-tier model calibrated to assess exposure to inhalable dust, vapours, and mists; this Exposure Scenario is within the scope of ART. Additional parameters used for the purpose of modelling are provided in the CSR for the relevant worker contributing scenarios (WCS).

Where the sample size and sampling strategy is adequate (i.e. personal sampling data), the risk characterisation relies on the measured exposure values. The results of exposure modelling were used for the risk characterisation when adequate measurement data were not available.

2. CONDITIONS OF USE AFFECTING EXPOSURE

This section includes the Operational Conditions (OCs) and Risk Management Measures (RMMs) for each contributing scenario.

2.1. ENVIRONMENT CONTRIBUTING SCENARIO: Use of sodium chromate for sealing after anodizing, chemical conversion coating, pickling and etching applications by aerospace companies and their suppliers. (ECS 1) (ERC 6b)

<i>Amount used, frequency and duration of use (or from service life)</i>	
▪ Daily use at site:	<= 2E-04 tonnes/day [as Cr(VI)]
▪ Annual use at a site:	<= 0.05 tonnes/year [as Cr(VI)]
▪ Percentage of tonnage used at regional scale:	= 33 %
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> ▪ Air emission abatement: at least 99% efficiency. For operations where exposure potential is low [i.e. operations are infrequent using only small quantities of Cr(VI)] air emission abatement may not be necessary. ▪ Negligible discharge of Cr(VI) in wastewater from the site. ▪ All solid and any liquid waste is collected and either the collected waste is directly forwarded to an external waste management company, or Cr(VI) in wastewater is reduced to Cr(III) on-site, or treated by vacuum evaporation. The treated wastewater is discharged to municipal sewage system. Any solid or slurry 	

² The use of ART for workers exposure assessment under REACH is described in ECHA's updated Guidance on Information Requirements and chemical safety assessment R.14, Vers. 2, May 2010. Background information for ART are provided in: Fransman W., Cherrie J., van Tongeren M., Schneider T., Tischer M., Schinkel J., Marquart H., Warren, N.D., Spankie S., Kromhout H., Tielemans E. Development of a mechanistic model for the Advanced REACH Tool (ART). Version 1.5, January 2013.

waste is either recycled or forwarded to an external waste management company (licenced contractor) for disposal as hazardous waste.
Conditions and measures related to sewage treatment plant
<ul style="list-style-type: none"> ▪ Not applicable – negligible discharge of Cr(VI) in wastewater from the site.
Conditions and measures related to treatment of waste (including article waste)
<ul style="list-style-type: none"> ▪ Collection of all solid and liquid waste, elimination of Cr(VI) from waste water, reuse disposal as hazardous waste by an external waste management company (licenced contractor).
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> ▪ When needed, exhaust air from LEV is passed through dry filters and/or wet scrubbers according to best available technique (see air emission abatement above).

2.1.1. Specific Conditions of REACH authorisation [C\(2019\) 7447](#) (Article 2, points 11(b), 12, 14 and 15)

- Implement at least annual monitoring programmes for chromium (VI) emissions to wastewater and air from local exhaust ventilation. Those programmes shall be based on relevant standard methodologies or protocols and be representative of the operational conditions and risk management measures (such as wastewater treatment systems, gaseous emission abatement techniques) used at the individual sites where measurements are carried out.
- The information gathered via the measurements and related contextual information shall be used by the authorisation holder and by its downstream users to regularly review the effectiveness of the risk management measures and operational conditions in place and to introduce measures to further reduce exposure and emissions.
- The results of those measurements as well as of any action taken following the review shall be documented and be made available by the authorisation holder and their downstream users, upon request, to the competent authorities of the Member State where the authorised uses take place.
- The downstream users shall make available to the Agency the information from the monitoring programme, including the contextual information associated to each set of measurements, for the first time by 24 October 2020, for transmission to the authorisation holder for the purpose of validating the exposure scenarios and afterwards for the preparation of the review report according to Article 61(1) of Regulation (EC) No 1907/2006. That information shall also be maintained and be made available by the authorisation holder and downstream users, upon request, to the competent authority of the Member State where the authorised use takes place.
- Continuation of monitoring requirements
 - Downstream users may reduce the frequency of measurements once they can clearly demonstrate to the competent authority of the Member State where the use takes place that exposure to humans and releases to the environment have been reduced to as low a level as technically and practically possible and that the risk management measures and operational conditions correspond to the exposure scenarios and function appropriately.

2.2. WORKER CONTRIBUTING SCENARIOS 1 - 19

<i>WCS 1: Delivery and Storage of raw material (PROC 1) in sealed containers</i>	
Product (Article) characteristics	
<ul style="list-style-type: none"> ▪ Substance type 	Substance as such/in a mixture
<ul style="list-style-type: none"> ▪ Concentration of Cr(VI) 	< 33%
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> ▪ Duration of activity 	< 1 hour
<ul style="list-style-type: none"> ▪ Frequency of activity 	Infrequent

WCS 1: Delivery and Storage of raw material (PROC 1) in sealed containers	
Technical and organisational conditions and measures	
▪ General ventilation	Basic general ventilation (1-3 air changes per hour)
▪ Containment	Closed system (minimal contact during routine operations)
▪ Local exhaust ventilation	No localized controls
▪ Occupational Health and Safety Management System	Advanced ³
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ PPE	Not required
Other conditions affecting workers exposure	
▪ Place of use	Indoor
▪ Temperature	Room temperature
Exposure Concentration	
Inhalation, local, long-term	0 µg/m ³ – no potential for worker exposure

WCS 2: Decanting of liquids (PROC 8b) (e.g. before re-filling of baths)	
Product (Article) characteristics	
▪ Substance product type	Liquid
▪ Concentration of Cr(VI) in mixture	Small (1 - 5%)
▪ Vapour pressure of substance	< 0.01 Pa
▪ Viscosity	Low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 30 min
▪ Frequency of activity	1 time/week (reduction factor of 0.2 applied)
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	No localized controls
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Other PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Process temperature	Room temperature
▪ Work area	Indoors
▪ Room size	Any size workroom
▪ Process fully enclosed?	No

³ Such systems are consistent with the duty of care set out through general Health and Safety at Work legislation, as well as via more specific legislation, such as the Carcinogens Directive (2004/37/EC) and the Chemical Agents at Work Directive (98/24/EC) and include, for example: areas using Cr(VI) are restricted to essential workers with appropriate PPE; workers are informed of temporary, planned higher exposure and how to minimise exposure; appropriate hygienic procedures are in place; appropriate training is provided on potential risks to health, exposure prevention, hygiene requirements, PPE, etc.; appropriate warning and hazard labelling is provided; workers are informed on abnormal exposures as quickly as possible, etc.

WCS 2: Decanting of liquids (PROC 8b) (e.g. before re-filling of baths)	
▪ Effective housekeeping practices in place?	Yes
Exposure Concentration	
Inhalation, local, long-term	0.31 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency)	0.062 µg/m³ (modelled with ART 1.5)
WCS 3: Decanting and weighing of solids (PROC 8b) (e.g. before re-filling of baths)	
Product (Article) characteristics	
▪ Substance product type	Powders, granules or pelletised material
▪ Concentration of Cr(VI) in mixture	< Substantial (10 – 50%)
▪ Dustiness	Low (inhalable fraction: ≤ 100 mg/kg)
▪ Moisture content	Dry product (<5 % moisture content)
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 30 min
▪ Frequency of activity	1 time/week (reduction factor of 0.2 applied)
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	No localized controls <i>In most cases, this activity is conducted under LEV. However, this has not been considered in this exposure assessment.</i>
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Respiratory Protection	Yes, at least half mask with P3 filter
▪ Other PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Work area	Indoors
▪ Room size	Any size workroom
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
Specific Condition(s) imposed by the granted authorisation	
▪ Closed systems and automation shall, where possible, be used for tasks involving decanting and weighing of solids.	
▪ The area in which activities with solid chromates are conducted shall be restricted either physically by means of barriers or through strict procedure during the activity and for a specified time after the operation.	
▪ Effective cleaning practices shall be implemented to prevent surface contamination where solid chromates are handled.	

WCS 3: Decanting and weighing of solids (PROC 8b) (e.g. before re-filling of baths)	
Exposure Concentration	
Inhalation, local, long-term	2.2 µg/m ³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency)	0.44 µg/m ³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency and RPE ⁴)	1.47E-02 µg/m ³ (modelled with ART 1.5)

WCS 4: Mixing – solids (PROC 5) (e.g. before re-filling of baths for adjustment of concentration)	
Product (Article) characteristics	
▪ Substance product type	Powders, granules or pelletised material
▪ Powder weight fraction Cr(VI)	< Substantial (10 – 50%)
▪ Dustiness	Low (inhalable fraction: ≤ 100 mg/kg)
▪ Moisture content	Dry product (<5 % moisture content)
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 30 min
▪ Frequency of activity	1 time/week (reduction factor of 0.2 applied)
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	No localized controls
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Respiratory Protection	Yes, at least half mask with P3 filter
▪ Other PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Work area	Indoors
▪ Room size	Any size workroom
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
Specific Condition(s) imposed by the granted authorisation	
▪ The area in which activities with solid chromates are conducted shall be restricted either physically by means of barriers or through strict procedure during the activity and for a specified time after the operation.	
▪ Effective cleaning practices shall be implemented to prevent surface contamination where solid chromates are handled.	

⁴ A factor of 30 was applied, based on an APF 30 assigned for this RPE according to the German BG rule 190

WCS 4: Mixing – solids (PROC 5) (e.g. before re-filling of baths for adjustment of concentration)	
Exposure Concentration	
Inhalation, local, long-term	7.4 µg/m ³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency)	1.48 µg/m ³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency and RPE ⁴)	0.049 µg/m ³ (modelled with ART 1.5)

WCS 5: Re-filling of baths for adjustment of concentration – liquids (PROC 8b)⁵	
Product (article) characteristics	
▪ Substance product type	Liquid
▪ Concentration of Cr(VI) in mixture	Small (1 - 5%)
▪ Vapour pressure of substance	< 0.01 Pa
▪ Viscosity	Low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 10 min
▪ Frequency of activity	1 time/week (reduction factor of 0.2 applied)
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	Fixed capturing hood ⁶ (90.00 % reduction)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Process temperature	Room temperature
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Any size workroom
Specific Condition(s) imposed by the granted authorisation	
▪ Effective cleaning practices shall be implemented to prevent surface contamination around treatment baths and other equipment.	
Exposure Concentration	
Inhalation, local, long-term	0.11 µg/m ³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency)	0.022 µg/m ³ (modelled with ART 1.5)

⁵ This scenario covers as worst-case similar activities in which the adjustment is done automatically; or in which a complete emptying and re-filling of a bath is conducted.

⁶ Or equivalent LEV to achieve the specified percent reduction.

WCS 6: Re-filling of baths for adjustment of concentration – solids (PROC 8b)⁵	
Product (Article) characteristics	
▪ Substance product type	Powders, granules or pelletised material
▪ Powder weight fraction Cr(VI)	< Substantial (10 – 50%)
▪ Dustiness	Low (inhalable fraction: ≤ 100 mg/kg)
▪ Moisture content	Dry product (<5 % moisture content)
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 10 min
▪ Frequency of activity	1 time/week (reduction factor of 0.2 applied)
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	Fixed capturing hood ⁶ (90.00 % reduction)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Respiratory Protection	Yes, at least half mask with P3 filter
▪ Other PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Work area	Indoors
▪ Room size	Any size workroom
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
Specific Condition(s) imposed by the granted authorisation	
<ul style="list-style-type: none"> ▪ The area in which activities with solid chromates are conducted shall be restricted either physically by means of barriers or through strict procedure during the activity and for a specified time after the operation. ▪ Effective cleaning practices shall be implemented to prevent surface contamination where solid chromates are handled. 	
Exposure Concentration	
Inhalation, local, long-term	0.74 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency)	0.148 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency and RPE ⁴)	4.93E-03 µg/m³ (modelled with ART 1.5)

WCS 7: Use of sodium chromate for chemical conversion coating applications (PROC 13) (e.g. within one or more tanks in a surface treatment process)⁷	
Product (article) characteristics	
▪ Substance product type	Liquid

⁷Cleaning of equipment is not a separate task but conducted by those employees working in the bath area as part of their normal working procedure.

WCS 7: Use of sodium chromate for chemical conversion coating applications (PROC 13) (e.g. within one or more tanks in a surface treatment process) ⁷	
▪ Concentration of Cr(VI) in mixture	Very small (0.5 - 1%)
▪ Vapour pressure of substance	< 0.01 Pa
▪ Viscosity	Low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 1 h
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	Fixed capturing hood ⁶ (90.00 % reduction)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Process temperature	Above room temperature
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Any size workroom
Specific Condition(s) imposed by the granted authorisation	
▪ Effective cleaning practices shall be implemented to prevent surface contamination around treatment baths.	
Exposure Concentration	
Inhalation, local, long-term	5.8E-03 µg/m³ (modelled with ART 1.5)

WCS 8: Sealing after anodizing with sodium chromate in baths (PROC 13)⁷	
Product (article) characteristics	
▪ Substance product type	Liquid
▪ Concentration of Cr(VI) in mixture	Very small (0.5 - 1%)
▪ Vapour pressure of substance	< 0.01 Pa
▪ Viscosity	Low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 1 h
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	Fixed capturing hood ⁶ (90.00 % reduction)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.

WCS 8: Sealing after anodizing with sodium chromate in baths (PROC 13)⁷	
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Process temperature	Hot processes (below 100°C)
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Any size workroom
Specific Condition(s) imposed by the granted authorisation	
▪ Effective cleaning practices shall be implemented to prevent surface contamination around treatment baths.	
Exposure Concentration	
Inhalation, local, long-term	5.8E-03 µg/m³ (modelled with ART 1.5)

WCS 9: Pickling and Etching (PROC 13)⁷ (e.g. within a bath)	
Product (article) characteristics	
▪ Substance product type	Liquid
▪ Concentration of Cr(VI) in mixture	Small (1 - 5%)
▪ Vapour pressure of substance	< 0.01 Pa
▪ Viscosity	Low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 30 min
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	Fixed capturing hood ⁶ (90.00 % reduction)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Process temperature	Hot processes (below 100°C) (See specific conditions below)
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Any size workroom
Specific Condition(s) imposed by the granted authorisation	
▪ Measures shall be taken to ensure that pickling and etching baths remain below boiling point at all times.	
▪ Effective cleaning practices shall be implemented to prevent surface contamination around treatment baths.	

WCS 9: Pickling and Etching (PROC 13)⁷ (e.g. within a bath)	
Exposure Concentration	
Inhalation, local, long-term	0.012 µg/m³ (modelled with ART 1.5)

WCS 10: Surface treatment by brushing (small sized areas) (PROC 10) (e.g. on surfaces with or without electrical current)	
Product (article) characteristics	
▪ Substance product type	Liquid
▪ Concentration of Cr(VI) in mixture	Very small (0.5 - 1%)
▪ Vapour pressure of substance	< 0.01 Pa
▪ Viscosity	Low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 60 min
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	No localized controls
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
▪ Process temperature	Room temperature
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Any size workroom
Exposure Concentration	
Inhalation, local, long-term	0.057 µg/m³ (modelled with ART 1.5)

WCS 11: Maintenance of equipment (PROC 8a) (e.g. baths and related equipment)⁸	
Product (article) characteristics	
▪ Substance product type	Liquid
▪ Concentration of Cr(VI) in mixture	Small (1 - 5%)
▪ Vapour pressure of substance	< 0.01 Pa
▪ Viscosity	Low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 60 min

⁸ This scenario also covers infrequent maintenance activities with longer duration and depending on the exposure potential, RPE is worn additionally.

WCS 11: Maintenance of equipment (PROC 8a) (e.g. baths and related equipment)⁸	
▪ Frequency of activity	1 time/2 weeks (reduction factor of 0.1 applied)
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	No localized controls
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting worker exposure	
▪ Process temperature	Room temperature
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Any size workroom
Exposure Concentration	
Inhalation, local, long-term	0.012 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for duration and frequency):	2.4E-03 µg/m³ (modelled with ART 1.5)

WCS 12: Sampling (PROC 8b)	
Product (article) characteristics	
▪ Substance product type	Liquid
▪ Concentration of Cr(VI) in mixture	Small (1 - 5%)
▪ Vapour pressure of substance	< 0.01 Pa
▪ Viscosity	Low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 15 min
▪ Frequency of activity	1 time/week (reduction factor of 0.2 applied)
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	Fixed capturing hood ⁶ (90.00 % reduction)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	

WCS 12: Sampling (PROC 8b)	
Other conditions affecting workers exposure	
▪ Process temperature	Room temperature
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Any size workroom
Exposure Concentration	
Inhalation, local, long-term	5.7E-03 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency):	1.14E-03 µg/m³ (modelled with ART 1.5)

WCS 13: Machining operations on small to medium sized parts containing Cr(VI) on an extracted bench/extraction booth including cleaning (PROC 21, 24)	
Product (article) characteristics	
▪ Substance product type	Solid object
▪ Solid weight fraction	< 0.1 % ⁹
▪ Moisture content	Dry product (<5 % moisture content)
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity:	< 60 min
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	Fixed capturing hood /Vacuum cleaner ⁶ (HEPA filter with at least 99.00 % reduction)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Respiratory Protection	Yes, at least half mask with P3 filter <i>At least half mask with P3 filter is worn if workplace monitoring data do not confirm negligible exposure clearly below 1 µg/m³ (e.g. < 0.1 µg/m³)</i>
▪ Other PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
Other conditions affecting workers exposure	
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Equipment level	Any size workroom
Specific Condition(s) imposed by the granted authorisation	
▪ Effective cleaning practices shall be implemented to prevent surface contamination in the vicinity where machining activities take place.	

⁹ The Cr(VI) weight fraction of the part is assumed to be < 0.1 %. In case of lower or higher Cr(VI) content, estimated exposure would be reduced or increased in a linear way. If needed, OCs and RMMs could be adjusted for that different situation.

WCS 13: Machining operations on small to medium sized parts containing Cr(VI) on an extracted bench/extraction booth including cleaning (PROC 21, 24)	
Exposure Concentration	
Inhalation, local, long-term	0.38 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for RPE ⁴)	0.013 µg/m³ (modelled with ART 1.5)

WCS 14: Machining operations in large work areas on parts containing Cr(VI) including cleaning (PROC 21, 24)	
Product (article) characteristics	
▪ Substance product type	Solid object
▪ Solid weight fraction	< 0.1 % ⁹
▪ Moisture content	Dry product (<5 % moisture content)
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 30 min
Technical and organisational conditions and measures	
▪ General ventilation	10 air changes per hour (ACH)
▪ Local exhaust ventilation	Wetting at the point of release/on-tool extraction/vacuum cleaning ⁶ (90.00 % reduction)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Respiratory Protection	Yes, at least half mask with P3 filter <i>At least half mask with P3 filter is worn if workplace monitoring data do not confirm negligible exposure clearly below 1 µg/m³ (e.g. < 0.1 µg/m³)</i>
▪ Other PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
Other conditions affecting workers exposure	
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Large workrooms only
Specific Condition(s) imposed by the granted authorisation	
▪ Effective cleaning practices shall be implemented to prevent surface contamination in the vicinity where machining activities take place.	
Exposure Concentration	
Inhalation, local, long-term:	0.83 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for RPE ⁴)	0.028 µg/m³ (modelled with ART 1.5)

WCS 15: Machining operations on parts containing Cr(VI) in small work areas including cleaning (PROC 21, 24)	
Product (article) characteristics	
▪ Substance product type	Solid object

WCS 15: Machining operations on parts containing Cr(VI) in small work areas including cleaning (PROC 21, 24)	
▪ Solid weight fraction	< 0.1 % ⁹
▪ Moisture content	Dry product (< 5 % moisture content)
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 30 min
Technical and organisational conditions and measures	
▪ General ventilation	Good natural ventilation (0 – 2 air changes per hour)
▪ Local exhaust ventilation	No localized controls (See specific conditions below)
Conditions and measures related to personal protection, hygiene and health evaluation	
▪ Respiratory Protection	Yes, Full face mask with P3 filter <i>Full face mask with P3 filter is worn if workplace monitoring data do not confirm negligible exposure clearly below 1 µg/m³ (e.g. < 0.1 µg/m³)</i>
▪ Other PPE	Protective clothing; chemical-resistant, impermeable gloves; goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
Other conditions affecting workers exposure	
▪ Process fully enclosed?	No
▪ Effective housekeeping practices in place?	Yes
▪ Work area	Indoors
▪ Room size	Small workrooms only
Specific Condition(s) imposed by the granted authorisation	
▪ Mechanical ventilation shall be used for machining activities in small work areas, unless this would introduce risks or is technically and practically not possible.	
▪ Effective cleaning practices shall be implemented to prevent surface contamination in the vicinity where machining activities take place.	
Exposure Concentration	
Inhalation, local, long-term:	32 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for RPE ¹⁰):	0.08 µg/m³ (modelled with ART 1.5)

WCS 16: Storage of articles (PROC 1)	
Product (article) characteristics	
▪ Concentration of substance Cr(VI) in article	Non detectable or very low
Amount used (or contained in articles), frequency and duration of use/exposure	
▪ Duration of activity	< 8 hours
Technical and organisational conditions and measures	
▪ General ventilation	Basic general ventilation (1-3 air changes per hour)
▪ Local exhaust ventilation	No localized controls

¹⁰ A factor of 400 was applied, based on an APF 400 assigned for this RPE according to the German BG rule 190

WCS 16: Storage of articles (PROC 1)	
Occupational Health and Safety Management System	Advanced ³
Conditions and measures related to personal protection, hygiene and health evaluation	
PPE	Not required
Other conditions affecting workers exposure	
Place of use	Indoor/outdoors
Process temperature (for solids)	Ambient
Exposure Concentration	
Inhalation, local, long-term	0 µg/m ³ – no potential for worker exposure

WCS 17: Waste management (PROC 8b) (e.g. transfer of solid waste (e.g. empty containers, canisters, pencils, masking material) to the waste storage area)	
Product (article) characteristics	
Substance product type	Powders, granules or pelletised material
Powder weight fraction [Cr(VI)]	Substantial (10 – 50%)
Dustiness	Firm granules, flakes or pellets
Moisture content	Dry product (< 5 % moisture content)
Amount used (or contained in articles), frequency and duration of use/exposure	
Duration of activity	< 15 min
Frequency of activity	1 time/week (reduction factor of 0.2 applied)
Technical and organisational conditions and measures	
General ventilation	Good natural ventilation (0 – 2 air changes per hour)
Primary	No localized controls
Conditions and measures related to personal protection, hygiene and health evaluation	
PPE	Protective clothing; chemical-resistant, impermeable gloves; and goggles. Section 8 of the applicable SDS contains supplier advice to inform PPE selection for this task, which may include additional considerations.
<i>The RMM and OC specified above represent good industry practice for this task. DUs may adapt or improve RMM and OC selection in order to most appropriately and efficiently control worker exposure and maintain compliance with national regulations.</i>	
Other conditions affecting workers exposure	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Work area	Indoors
Room size	Any size workroom
Specific Condition(s) imposed by the granted authorisation	
Where technically and practically possible, waste management activities shall be conducted under LEV.	
The area in which activities with solid chromates are conducted shall be restricted either physically by means of barriers or through strict procedure during the activity and for a specified time after the operation.	
Effective cleaning practices shall be implemented to prevent surface contamination where solid chromates are handled.	

WCS 17: Waste management (PROC 8b) (e.g. transfer of solid waste (e.g. empty containers, canisters, pencils, masking material) to the waste storage area)

Exposure Concentration

Inhalation, local, long-term	0.37 µg/m³ (modelled with ART 1.5)
Inhalation, local, long-term (adjusted for frequency)	0.074 µg/m³ (modelled with ART 1.5)

2.2.1. Risk characterization related to combined exposure

Workers in the process of use of sodium chromate for sealing after anodizing, chemical conversion coating, pickling and etching applications by aerospace companies and their suppliers could conduct some combinations of tasks (sub-scenarios). The core activities will be the sequential process steps of the application in baths.

A possible combination of sub-scenarios is the combination of WCS 2-9 and 12, activities in relation to the various bath applications. The combined exposure estimate (as the 90th percentile value of model-based exposure distribution) of these activities would be 0.18 µg/m³.

A further possible combination of activities would be the machining activities (WCS 13-15). The combined exposure estimate (as the 90th percentile value of model-based exposure distribution) of these activities would be 0.12 µg/m³.

2.2.2. Other Specific Conditions of REACH authorisation [C\(2019\) 7447](#) (Article 2, points 8, 11(a), 12, 14 and 15)

- Downstream users shall implement best practices to reduce workplace exposure to sodium chromate and its emissions to the environment to as low a level as technically and practically feasible, including by using closed systems and automation, when possible. Where use of closed systems and automation is not possible, downstream users shall use appropriately designed and installed local exhaust ventilation (LEV) systems that are dimensioned, located and maintained so as to capture and remove sodium chromate. Where closed systems and automation are not used downstream users shall be permitted not to use LEV only exceptionally, where its use is technically impossible. Information on LEV systems put in place in the installations where the authorised uses take place, as well as of their maintenance, shall be made available to the competent authorities of Member States.
- Where respiratory protective equipment (RPE) is needed to control exposure to sodium chromate, downstream users shall use it in accordance with standard procedures for use and maintenance, including procedures for fit testing of RPE masks, applied in accordance with relevant standards.
- Implement at least annual air monitoring programmes on occupational exposure to chromium (VI) in accordance with Article 5(5)(e) of Directive 2004/37/EC. The first measurements shall be performed without delay and at the latest by 24 April 2020. Those programmes shall be based on relevant standard methodologies or protocols and be representative of:
 - the range of tasks undertaken where exposure to chromium (VI) is possible, including tasks involving process and maintenance workers;
 - the operational conditions and risk management measures typical for each of these tasks;
 - the number of workers potentially exposed
- The information gathered via the measurements and related contextual information shall be used by the authorisation holder and by its downstream users to regularly review the effectiveness of the risk management measures and operational conditions in place and to introduce measures to further reduce exposure and emissions.
- The results of those measurements as well as of any action taken following the review shall be documented and be made available by the authorisation holder and their downstream users, upon request, to the competent authorities of the Member State where the authorised uses take place.

- The downstream users shall make available to the Agency the information from the monitoring programme, including the contextual information associated to each set of measurements, for the first time by 24 October 2020, for transmission to the authorisation holder for the purpose of validating the exposure scenarios and afterwards for the preparation of the review report according to Article 61(1) of Regulation (EC) No 1907/2006. That information shall also be maintained and be made available by the authorisation holder and downstream users, upon request, to the competent authority of the Member State where the authorised use takes place.
- Continuation of monitoring requirements
 - Downstream users may reduce the frequency of measurements once they can clearly demonstrate to the competent authority of the Member State where the use takes place that exposure to humans and releases to the environment have been reduced to as low a level as technically and practically possible and that the risk management measures and operational conditions correspond to the exposure scenarios and function appropriately.

2.3. Exposure estimation and reference to its source

2.3.1. Environmental release and exposure

Local releases to the environment

Release	Release factor estimation method	Explanation / Justification
Air	Release factor	Initial release factor: 0.1% Final release factor: 0.001% Local release rate: 2E-6 kg/day

Exposure and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk characterisation
Freshwater	Not relevant	-
Sediment (freshwater)	Not relevant	-
Marine water	Not relevant	-
Sediment (marine water)	Not relevant	-
Predator (freshwater)	Not relevant	-
Predator (marine water)	Not relevant	-
Top predator (marine water)	Not relevant	-
Sewage treatment plant	Not relevant	-
Air	Local PEC: 3.808E-10 mg/m ³	-
Agricultural soil	Not relevant	-
Predator (terrestrial)	Not relevant	-
Man via Environment – Inhalation	Local PEC: 3.808E-10 mg/m ³	Based on the dose-response relationship derived by the RAC, considering a 70-year exposure time (24h/day, 7d/week), the following excess lifetime risk up to age 89 is derived for the general population based on the estimated exposure: 1.1E-05 per 1000 exposed
Man via Environment - Oral	Not relevant	-

2.3.2. Worker exposure

Exposure concentrations and risks for worker

Worker Contributing Scenario	Route of exposure and type of effects	Exposure Concentration	Risk Characterisation ¹¹
WCS 1: Delivery and storage of raw material	Inhalation, local, long-term (qualitative)	0 µg/m ³ – no worker exposure	Not applicable
WCS 2: Decanting – liquids	Inhalation, local, long-term, further adjusted for frequency (90 th percentile, ART 1.5)	0.062 µg/m ³	0.248 per 1000 exposed workers
WCS 3: Decanting and weighing of solids	Inhalation, local, long-term, further adjusted for frequency and RPE (90 th percentile, ART 1.5)	1.47E-02 µg/m ³	5.88E-02 per 1000 exposed workers
WCS 4: Mixing - solids	Inhalation, local, long-term, further adjusted for frequency and RPE (90 th percentile, ART 1.5)	0.049 µg/m ³	0.196 per 1000 exposed workers
WCS 5: Re-filling of baths for adjustment of concentration - liquids	Inhalation, local, long-term, adjusted for frequency (90 th percentile, ART 1.5)	0.022 µg/m ³	8.8E-02 per 1000 exposed workers
WCS 6: Re-filling of baths for adjustment of concentration - solids	Inhalation, local, long-term, adjusted for frequency and RPE (90 th percentile, ART 1.5)	4.93E-03 µg/m ³	1.97E-02 per 1000 exposed workers
WCS 7: Chemical conversion coating applications	Inhalation, local, long-term (90 th percentile, ART 1.5)	5.8E-03 µg/m ³	0.023 per 1000 exposed workers
WCS 8: Sealing after anodizing with sodium chromate in baths	Inhalation, local, long-term (90 th percentile, ART 1.5)	5.8E-03 µg/m ³	0.023 per 1000 exposed workers
WCS 9: Pickling and Etching	Inhalation, local, long-term (90 th percentile, ART 1.5)	0.012 µg/m ³	0.048 per 1000 exposed workers
WCS 10: Surface treatment by brushing (small sized areas)	Inhalation, local, long-term (90 th percentile, ART 1.5)	0.057 µg/m ³	0.23 per 1000 exposed workers
WCS 11: Maintenance of equipment	Inhalation, local, long-term, further adjusted for duration and frequency (90 th percentile, ART 1.5)	2.4E-03 µg/m ³	9.6E-03 per 1000 exposed workers
WCS 12: Sampling	Inhalation, local, long-term, further adjusted for frequency (90 th percentile, ART 1.5)	1.14E-03 µg/m ³	4.56E-03 per 1000 exposed workers
WCS 13: Machining operations on small to medium sized parts containing Cr(VI) on an extracted bench/extraction booth including cleaning	Inhalation, local, long-term: Inhalation, local, long-term, further adjusted for RPE (90 th percentile, ART 1.5)	0.38 µg/m ³ 0.013 µg/m ³	Not assessed 5.07E-02 per 1000 exposed workers
WCS 14: Machining operations in large work areas on parts containing Cr(VI) including cleaning	Inhalation, local, long-term: Inhalation, local, long-term, further adjusted for RPE (90 th percentile, ART 1.5)	0.83 µg/m ³ 0.028 µg/m ³	Not assessed 0.11 per 1000 exposed workers

¹¹ Based on the dose-response relationship for lung cancer mortality derived by the RAC, considering a 40-year working life (8h/day, 5d/week), the excess lifetime lung cancer mortality risk up to age 89 is derived based on the estimated exposure.

Worker Contributing Scenario	Route of exposure and type of effects	Exposure Concentration	Risk Characterisation ¹¹
WCS 15: Machining operations on parts containing Cr(VI) in small work areas including cleaning	Inhalation, local, long-term:	32 µg/m ³	Not assessed
	Inhalation, local, long-term, further adjusted for RPE (90 th percentile, ART 1.5)	0.08 µg/m ³	0.32 per 1000 exposed workers
WCS 16: Storage of articles	Inhalation, local, long-term (qualitative)	0 µg/m ³ – no worker exposure	Not applicable
WCS 17: Waste management	Inhalation, local, long-term, further adjusted for frequency (90 th percentile, ART 1.5)	0.074 µg/m ³	0.296 per 1000 exposed workers
WCS 18: End of Life	Not applicable	Not applicable	Not applicable