December 2022

Attachment for submission to UK authorities for the

CHEMICAL SAFETY REPORT

Legal name of applicant(s):	Boeing Distribution (UK) Inc. Indestructible Paint Ltd		
Submitted by:	**Boeing Distribution (UK) Inc.**		
Substances:	Chromium trioxide (CT) (includes "Acids generated from chromium trioxide and their oligomers", when used in aqueous solutions)	EC 215-607-8	CAS 1333-82-0
Uses applied for:	Use 1: Slurry coating using chromium trioxide in aerospace and defence industry and its supply chains		

Contents

List of Tables

Preliminary Remark

This Chemical Safety Report (CSR) has been prepared on behalf of the applicants by the Aerospace and Defence Chromates Reauthorisation (ADCR) Consortium

1 UK-specific information

1.1 Preliminary remarks

The chemical safety report submitted to ECHA as part of the respective review report describes the conditions of use for the use "Slurry coating using chromium trioxide in the aerospace and defence industry and its supply chains", together with the exposure and risk characterisation.

This attachment to the CSR for the EU review report specifies the situation of companies in the United Kingdom (UK). It explains where differences exist and highlights characteristics of the situation of UK companies for this use.

1.2 Companies and tonnages

Of the sites covered by the ADCR consortium and performing this use, a larger proportion is located in the UK. Among the 14 sites that contributed information to this CSR, six are in the UK, which account for approximately 43%.

Similar amounts used per site are assumed for the UK and for the EEA. The amount of Cr(VI) used by UK sites for slurry coating (up to 10 kg) per year and site is in the lower range of the tonnage band specified in the EU dossier (up to 35 kg per year and site).

1.3 UK-specific conditions

1.3.1 Health and safety measures required by UK authorities

According to the Control of Substances Hazardous to Health Regulations (COSHH) Regulations of the Health and Safety Executive (HSE), exposure to hazardous substances is to be prevented or where prevention is not reasonably practicable exposure must be adequately controlled. Adequate control of a carcinogen can be achieved by reducing exposure to as low a level as is reasonably practicable (ALLARP) below the present Workplace Exposure Limit (WEL) (HSE, 1999; 2013). The present WEL for hexavalent chromium (Cr(VI)) is 0.01 mg/m^3 (8 h TWA as chromium) (HSE, 2020), which is identical to the transitional binding occupational exposure limit value (BOELV) in the EU (0.010 mg/m^3) and by factor two higher than the BOELV applicable in the EU from 2025 onwards (0.005 mg/m^3)[1]. Before 2020 the WEL was 0.05 mg/m^3 (8 h TWA as chromium).

In the area of occupational health and safety, the HSE publish an engineering sheet that primarily address companies carrying out application of chromate primer paints, but is also relevant for other chromate-containing paint applications (i.e. slurry coating with chromium trioxide) (HSE, 1999).

As chromates are classified as carcinogens, it is required under COSHH that employers prevent exposure, apply specific measures to control exposure, and perform an assessment of health risks from work activities. If carcinogens cannot be substituted, adequate control of exposure to chromate-containing dust, mist, or spray must be achieved by combining engineering and process control measures as well as use of personal protective equipment (PPE), as appropriate (HSE, 1999). The

[1] Binding occupational exposure limit values (OELs) of the European https://www.dguv.de/ifa/fachinfos/occupational-exposure-limit-values/verbindliche-arbeitsplatzgrenzwerte-der-eu-kommission/index.jsp

measures taken to reduce exposure and to demonstrate that exposure is well below the WEL may vary from site to site. Further specific measures, which the employer shall apply are given in Regulation 7[2] of COSHH, include amongst others:

- *reducing, to the minimum required for the work concerned - the number of employees subject to exposure*
- *cleaning floors, walls and other surfaces at regular intervals and whenever necessary*
- *designating those areas and installations which may be contaminated by carcinogens and using suitable and sufficient warning signs*.

When complete enclosure is not practically feasible, local exhaust ventilation shall be used. In order to minimise exposure to Cr(VI)-containing spray, the used extraction system is depending on the size of the part to be painted, whereas small parts can be sprayed in an extracted enclosure and larger parts in an appropriate dimensioned spray booths. Additionally, the extraction system shall always ensure to remove spray from the worker's breathing zone (HSE, 1999).

COSHH Regulation 9 specifies that control measures shall always be '*maintained in an efficient state, in efficient working order, in good repair and in a clean condition*', where relevant. The same applies for engineering controls, e.g., a thorough examination and testing of LEV is performed at least every 14 months as required by the Regulation 9(2)[3] of COSHH.

In case adequate control of exposure to Cr(VI) is not practicable or achieved by control measures (e.g., enclosure or LEV), the use of respiratory protective equipment (RPE) is necessary. While spraying Cr(VI)-containing paints RPE shall be worn, except spraying is performed in a '*very well designed extracted spray booths*' (HSE, 1999). Furthermore, wearing RPE '*may also be necessary for certain cleaning or maintenance work*' (HSE, 1999). The practical guide '*Respiratory protective equipment at work*' provides an overview on selecting RPE, which other types of RPE may also be suitable if workers are adequately protected, and information on RPE fit testing (HSE, 1999). Fit testing of RPE is particularly important as it ensures that the selected RPE is protecting the worker from Cr(VI) exposure sufficiently. According to the HSE *Guidance on respiratory protective equipment (RPE) fit testing*[4] suitable methods for fit testing of RPE are the 'Qualitative Taste Test' and the 'Particle Counting Device', which results shall be recorded for 5 years. Regular maintenance of RPE shall be performed as indicated by manufacturer's instructions (HSE, 1999). Workers shall wear other PPE such as protective clothing, gloves, footwear, and eye protection during all activities where skin exposure to Cr(VI) cannot be excluded (HSE, 1999).

[2] The Control of Substances Hazardous to Health Regulations 2002 – Regulation 7; https://www.legislation.gov.uk/uksi/2002/2677/regulation/7/made; assessed in May 2022

[3] The Control of Substances Hazardous to Health Regulations 2002 – Regulation 9; https://www.legislation.gov.uk/uksi/2002/2677/regulation/9/made; assessed in June 2022

[4] Health and Safety Executive (HSE) "Guidance on respiratory protective equipment (RPE) fit testing", March 2019; https://www.hse.gov.uk/pubns/indg479.htm; accessed in August 2022

COSHH Regulation 10[5] requires that monitoring is performed to demonstrate proper use and maintenance of control measures and to confirm that workers' health is protected sufficiently from exposure to Cr(VI). It is described in the Engineering sheet 32 *Chromate primer paints* (HSE, 1999) that employers may be required to monitor workers' exposure to Cr(VI) through

- Biological monitoring (in urine samples) and/or

- Air sampling (static and/or personal)

Air sampling involves sampling in the breathing zone of workers by means of personal sampling equipment and/or sampling of Cr(VI) in the air in or adjacent to the spray booth. It is useful for the assessment of health risks, which may be caused by handling/application of Cr(VI)-containing slurry products. If the measured exposure value is below the WEL, adequate control of inhalation exposure is considered to be achieved.

However, exposure may also occur via different routes (e.g., skin or eye), which are not covered by air sampling. Thus it may be appropriate to also perform biological monitoring in order to consider Cr(VI) exposure by all routes (HSE, 1999).

For biological monitoring, the sampling frequency should typically be once per year for workers exposed to chromium (including, e.g., spray operators and maintenance workers). The UK Biological Monitoring Guidance Value (UK BMGV) for Cr(VI) is 10 µmol/mol creatinine (HSE, 2022). Workers with no workplace exposure are expected to have monitoring values below 3 µmol Cr/mol creatinine (levels found in the general population) (SEA, 2018).

According to the Engineering sheet 32 *Chromate primer paints*, biological monitoring shall not be the sole method for monitoring workers' exposure to Cr(VI) (HSE, 1999). In order to comply with COSHH, sites performed regular personal air sampling as well as biological monitoring.

Please note that, as explained in section 9.1.2.5.2 of the CSR, chromium concentrations measured in urine cannot easily be related to Cr(VI) inhalation exposure concentrations. Therefore, biomonitoring results cannot be linked to the exposure-risk relationship proposed by RAC and used for risk characterisation. For characterising health risks of workers at UK sites we compare air concentrations reported by UK sites with air concentrations measured at workplaces in the EEA.

1.3.2 Environmental contributing scenario

1.3.2.1 Conditions of use

Description of the situation – differences to exposure scenario in EU dossier

The use conditions of the UK sites do not differ from the use conditions described in the EU dossier.

1.3.2.2 Releases

All six UK sites contributing information to this CSR provided emission data (Sites 1, 3, 6, 8, 9, and 10 in the EU dossier). The sites use 0.1-6.10 kg Cr(VI)/year and their releases to air range from the minimum (6.76E-05) to the maximum (1.50E-01) of all values given in the EU dossier. Only one site

[5] The Control of Substances Hazardous to Health Regulations 2002 – Regulation 10 - Monitoring exposure at the workplace; https://www.legislation.gov.uk/uksi/2002/2677/regulation/10; assessed in May 2022

(Site 3) has a release to water, whereas the other UK sites have no water emissions as either do not produce wastewater or all their wastewater is gathered and sent to an external company certified for disposing of liquid hazardous waste. Site 3 had a minimal release to water (1.39E-04) compared to the EEA site, which had a release of 0.155 kg/year. For all six UK sites, the calculated risks for humans via the environment are at the lower to middle range described in the EU dossier.

In the following, air and water emissions are quantified and exposure of humans via the environment is calculated for the six UK sites. The exposure assessment is performed as described in chapter 9.1 of the EU dossier.

Table 1-1 shows ranges of release fractions and total emissions from the UK sites. These release fractions served as input for EUSES modelling of human exposure via the environment. Note that the calculated release fractions to wastewater refer to the emissions after the on-site reduction step.

We point out that **these results represent the overall releases of the sites, among which in each case only a certain share is generated by slurry coating**. The calculation of the share of exposure from slurry coating is performed after the EUSES calculation. Site-specific information on releases, on wastewater (application of sewage sludge to agricultural soil/grassland, dilution in the treatment plant and in the receiving water) and on the share of slurry coating of the overall emission are given in Annex III of the EU dossier.

Table 1-1: Local releases to the environment

Release route	Release fraction [a]	Release [kg/year] [a]	Explanation/Justification
Air [b]	6.76E-05 – 1.50E-01 90th percentile: n.a.	0.0002061 – 0.0168 90th percentile: n.a.	Measured release (site-specific data of representative sites)
Water [b]	0 – 2.27E-05 90th percentile: n.a.	0 – 0.000139 90th percentile: n.a.	Measured release (site-specific data of representative sites)
Soil [b]	0	0	No release to soil is possible

[a] The indicated ranges of release fractions to wastewater, air and soil are based on recent release data and tonnages provided by sites that are representative to cover the whole release spectrum relevant for this use.

[b] For values <LOQ a value corresponding to LOQ/2 was used, as described in ECHA´s Guidance on Information Requirements and Chemical Safety Assessment. Chapter R.16: Environmental exposure assessment (ECHA, 2016). For wastewater emissions this is very likely an overestimation, since the upstream redox process leads to the almost complete conversion of Cr(VI) into Cr(III).

n.a. = not assessed; the statistical parameter was only determined if at least three (for AM) or ten (for SD, Median and 90th percentile) values were available.

Releases to waste

Solid wastes are disposed of as described above by certified companies specialised in hazardous waste disposal. No emissions from solid wastes are expected.

Release fraction to waste from the process: 0

Slurry coating CT

1.3.2.3 Exposure and risks for the environment and humans via the environment

The calculated exposure concentrations for humans via the environment (on a local scale) per site are shown in Annex III of the EU dossier. The EUSES modelling protocols can be provided upon request. The calculation of the share of exposure and risk specifically for the individual use is performed after the EUSES calculation.

The calculation of the share of exposure and risk from slurry coating is shown below in Table 1-2. Sites 1, 3, 6, 8, 9, and 10 are UK sites and listed as separate entries. For comparison, the statistical descriptors for the total data basis (from EEA and UK countries, as reported in the EU dossier) are also shown.

Note that even for sites without emission to wastewater EUSES calculates oral exposure via deposition from air.

Table 1-2: Excess cancer risk estimates for humans via the environment (general population, local assessment) attributed to slurry coating

		Inhalation			Oral			
Data basis	**Site**	**Local Cr(VI) PEC in air [µg/m³]**	**Excess lung cancer risk [1/(µg/m³)] [a]**	**Inhalation risk**	**Oral exposure (water and fish) [µg Cr(VI)/kg x d]**	**Excess cancer risk for tumours of the small intestine [1/(µg/kg bw/day)] [b]**	**Oral risk**	**Combined risk**
UK	Site 1	1.57E-07	2.90E-02	4.55E-09	1.32E-07	8.00E-04	1.06E-10	4.66E-09
	Site 3	1.28E-05	2.90E-02	3.71E-07	1.11E-06	8.00E-04	8.91E-10	3.72E-07
	Site 6	3.17E-06	2.90E-02	9.19E-08	1.32E-07	8.00E-04	1.06E-10	9.20E-08
	Site 8	3.65E-07	2.90E-02	1.06E-08	1.32E-07	8.00E-04	1.06E-10	1.07E-08
	Site 9	7.67E-06	2.90E-02	2.22E-07	1.97E-07	8.00E-04	1.57E-10	2.23E-07
	Site 10	6.38E-07	2.90E-02	1.85E-08	1.32E-07	8.00E-04	1.06E-10	1.86E-08
	MIN	1.57E-07		4.55E-09	1.32E-07		7.16E-10	4.66E-09
	MAX	1.28E-05		3.71E-07	1.11E-06		8.91E-10	3.72E-07
Total (EEA + UK) n = 11	MIN	1.57E-07		4.55E-09	1.32E-07		1.06E-10	4.66E-09
	MAX	3.30E-04		9.57E-06	8.85E-04		7.08E-07	9.58E-06
	Median	7.67E-06		2.22E-07	2.51E-07		2.01E-10	2.87E-07
	90th percentile	**1.45E-04**		**4.20E-06**	**8.19E-06**		**6.55E-09**	**4.21E-06**

[a] RAC dose-response relationship based on excess lifetime lung cancer risk (ECHA, 2013): Exposure to 1 µg/m³ Cr(VI) relates to an excess risk of 2.9×10^{-2} for the general population, based on 70 years of exposure; 24h/day.

[b] RAC dose-response relationship based on excess cancer risk for tumours of the small intestine (ECHA, 2013): Exposure to 1 µg/kg bw/day Cr(VI) relates to an excess risk of 8×10^{-4} for the general population, based on 70 years of exposure; daily exposure.

Of the six UK sites, the maximum local PEC in air is 1.28E-05 µg/m^3 and the maximum inhalation risk is 3.71E-07. The maximum oral exposure is 1.11E-06 µg Cr(VI)/kg per day and the maximum oral risk is 8.91E-10. The maximum combined risk of humans via inhalation and oral exposure is 3.72E-07. The maximum combined risk is low, which is to be expected as only a small fraction of a small amount of substance is released to air and water (Site 3 only; other sites have no water emissions).

Due to the small number of sites in the UK for which emission data for this use are available, we consider the emission data from all sites (in the EEA and the UK, eleven sites in total) as an extended data basis for the risk assessment. The combined risks calculated for the six UK sites are lower than the maximum combined risk from all sites (EEA and UK; 9.58E-06).

Note that the modelling of local air concentrations with EUSES is generally acknowledged as being overly conservative, as described in detail in section 9.1.2.4.2 in the EU dossier.

1.3.3 Worker contributing scenario 1 – Spray operators

This SEG performs the same main and secondary tasks at UK sites as described in the EU dossier.

1.3.3.1 Conditions of use

Description of the situation – differences to exposure scenario in EU dossier

HSE allows under certain conditions that RPE is not worn as *'RPE is essential for all spraying of chromate paints, unless the spraying operation is enclosed within very well designed extracted spray booths'*. Information obtained from UK companies performing slurry coating indicates that RPE is worn during spraying activities.

The use conditions of the UK sites are comparable to the situation described in the EU dossier apart from:

- The requirements for glove material to be used in the UK for handling chromates are slightly different from those in the EU. For tasks where "dexterity is required (e.g., unjigging and unmasking) a single use splash resistant nitrile glove (BS EN 374) are suitable. These gloves should be replaced every time they are removed" (SEA, 2018c).
- Biomonitoring of chromium concentrations in urine is considered a key exposure control means by UK authorities (see section 1.3.1)

1.3.3.2 Exposure and risks for workers

1.3.3.2.1 Inhalation exposure

Measured inhalation exposure concentration

In total, 30 personal long-term (≥2h)[6] measurements covering exposure from slurry coating are available for this SEG from UK sites. The personal monitoring data come from four sites in the UK. Thirteen values are <LOQ and 17 values are >LOQ. The 30 UK personal long-term measurements

[6] All long-term measurements (≥2h) are considered as shift-representative measurements and used as such as 8h TWA exposure values; no recalculation has been performed. Measurements <2h were not used to calculate 8h TWA exposure values.

account for 44% of the total personal long-term measurements (68 measurements) provided by EEA and UK sites, excluding measurements from a site from 2018 and 2019, which implemented corrective actions, resulting in substantial decrease in exposure levels.

Table 1-3 shows the summary statistics of workplace measurements for spray operators at UK sites compared to the total dataset (EEA + UK) excluding measurements from a specific EU site from 2018/2019. For values <LOQ, half of the LOQ (LOQ/2) was considered for statistical evaluation. All measurements of the UK sites are from the period 2017-2021. The arithmetic mean (AM) over the UK long-term measurements is 2.42 µg/m^3 and the 90th percentile is 6.01 µg/m^3. All measurements were taken from spray operators working in the paint area. The AM and 90th percentile of the UK data are lower than the AM (3.30 µg/m^3) and 90th percentile (9.93 µg/m^3) of the total database.

Table 1-3: Summary statistics of inhalation exposure measurements for WCS 1 – Spray operators

Personal – long-term						
	N	**% of total**	**AM [µg/m^3]**	**SD [µg/m^3]**	**Median [µg/m^3]**	**90th Perc. [µg/m^3]**
Total without specific EU site 2018/2019 (2015-2021)	68	100	3.30	3.93	1.43	9.93
UK (2019-2021)	30	44	2.42	3.03	1.00	6.01

All exposure values rounded to three significant figures for presentation, but unrounded values used for calculation of exposure.

The measured values shown in Table 1-3 are without taking RPE into consideration. As indicated in the conditions of use in the CSR (see section 9.2.3.2.1) it is required to wear a full mask with P3 filter during exposure relevant activities (e.g., manual spraying), corresponding to an Assigned Protection Factor (APF) of 20 for a P3 combination filter or APF 40 for a P3 particle filter in the UK.

1.3.3.2.2 Biomonitoring

Biomonitoring data available for this use are described in the appendix. Three sites provided data for workers possibly exposed to Cr(VI) during slurry coating. In total, 45 measurements are available, taken in the years 2017-2019 and in 2021. All except one value are assignable to a SEG. Most exposure values (41/45) are below the UK BMGV of 10 µmol Cr/mol creatinine. Four values (11.0, 13.0, 20.0, and 41.0 µmol/mol creatinine) were above the UK BMGV.

Of the three sites, a total of 25 values are assignable to spray operators. Thereof, three values (11.0, 20.0, and 41.0 µmol/mol creatinine) are above the UK BMGV. One spray operator (20.0 µmol/mol creatinine) placed the part incorrectly so the flow of the spray drift to the dry filters was hindered. The part's orientation was adjusted, which allowed the extraction to pull the paint away from the operator and lowered the exposure of the operator below the limit. The two other high values were due to workers not correctly following industrial hygiene procedures at that time. A re-briefing on the hazards, risk controls, hygiene, correct PPE usage, and care was performed and additionally all PPE provided was reviewed and re-confirmed to be suitable and sufficient. All other values are below the UK BMGV.

Slurry coating CT

1.3.3.2.3 Risk characterisation

The risk characterisation for the UK does not differ from the description in the EU dossier.

1.3.4 Worker contributing scenario 2 – Maintenance and/or cleaning workers

This SEG performs the same main and secondary tasks at UK sites as described in the EU dossier.

1.3.4.1 Conditions of use

Description of the situation – differences to exposure scenario in EU dossier

The use conditions for this SEG in the UK do not differ from the use conditions described in the EU dossier.

1.3.4.2 Exposure and risks for workers

1.3.4.2.1 Inhalation exposure

Measured inhalation exposure concentration

For the assessment of inhalation exposure of maintenance and/or cleaning workers, pooled monitoring data available for different galvanic Cr(VI) uses (i.e., the galvanic Cr(VI) uses covered by ADCR) are used for the reasons stated in the EU dossier.

In total, six personal long-term (≥2h)[7] measurements are available for this SEG from UK sites. One personal measurement was excluded from further analysis because it was below an unreasonably high LOQ (i.e., <2 µg/m^3). Of the remaining five personal monitoring data, none is related to slurry coating. For slurry coating nine measurements, which were either short-term (<2h) or had an unreasonably high LOQ were reported but could not be considered in the exposure assessment. The five long-term UK measurement come from three sites in the UK. Of these five values are two values <LOQ and three values are >LOQ. The five UK personal long-term measurements account for 29% of the total personal long-term measurements provided by EEA and UK sites in total (17 measurements).

Table 1-4 shows the summary statistics of workplace measurements for maintenance and/or cleaning workers at UK sites compared to the total dataset (EEA + UK). For values <LOQ, half of the LOQ (LOQ/2) was considered for statistical evaluation. All measurements are from the period 2018-2021. The arithmetic mean (AM) over the UK long-term measurements is 0.461 µg/m^3 and the 90th percentile is 1.00 µg/m^3 (individual values: 0.0355, 0.02, 0.25, 1.0, 1.0 µg/m^3).

The AM of the UK data is approximately by a factor 1.7 lower than the AM (0.800 µg/m^3) of the total database. The 90th percentile of the UK data is by a factor 3 lower than the 90th percentile (3.06 µg/m^3) of the total database. However, given the small data base for the UK and due to the comparable conditions of use between the EU and the UK for the relevant activities, it cannot be concluded that inhalation exposure at UK sites is lower than at EEA sites as this observation may be by chance.

[7] All long-term measurements (≥2h) are considered as shift-representative measurements and used as such as 8h TWA exposure values; no recalculation has been performed. Measurements <2h were not used to calculate 8h TWA exposure values

Table 1-4: Summary statistics of inhalation exposure measurements for WCS 2 – Maintenance and/or cleaning workers

Personal – long-term (related to any Cr(VI) use)						
	N	**% of total**	**AM [µg/m³]**	**SD [µg/m³]**	**Median [µg/m³]**	**90th Perc. [µg/m³]**
Total (2017-2021)	19	100	0.800	1.32	0.240	3.06
UK (2018-2021)	5	26	0.461	0.50	0.250	1.00

All exposure values rounded to three significant figures for presentation, but unrounded values used for calculation of exposure.

As maintenance workers are typically only spending a small part (1%) of their working time on activities related to Cr(VI) exposure in relation to slurry coating exposure to Cr(VI) is considered to be lower than shown in Table 1-4. For the risk characterisation, no APF was considered as RPE is only worn during specific activities (for details see section 9.2.3.3.2.1 of the CSR).

1.3.4.2.2 Biomonitoring

Biomonitoring data available for this use are described in the appendix. Three sites provided data for workers possibly exposed to Cr(VI) during slurry coating. In total, 45 measurements are available, taken in the years 2017-2019 and in 2021. All except one value are assignable to a SEG. Most exposure values (41/45) are below the UK BMGV of 10 µmol Cr/mol creatinine. Four values (11.0, 13.0, 20.0, and 41.0 µmol/mol creatinine) were above the UK BMGV.

Of the three sites, two values are assignable to maintenance and/or cleaning workers. Both values were below the LOQ and UK BMVG.

1.3.4.2.3 Risk characterisation

The risk characterisation for the UK does not differ from the description in the EU dossier.

1.3.5 Worker contributing scenario 3 – Incidentally exposed workers

This SEG performs the same main and secondary tasks at UK sites as described in the EU dossier.

1.3.5.1 Conditions of use

Description of the situation – differences to exposure scenario in EU dossier

The use conditions for this SEG in the UK do not differ from the use conditions described in the EU dossier.

1.3.5.2 Exposure and risks for workers

1.3.5.2.1 Inhalation exposure

Measured inhalation exposure concentration

From UK sites, 29 personal long-term (≥2h)[8] measurements are available for this SEG. Two personal long-term measurements were excluded from further analysis due to unreasonably high LOQs (i.e., above 2 µg/m³). Additionally, four personal long-term measurements were excluded as these values were unreasonably high (2.0 (2), 7.0, and 14.0 µg/m³) and measurements, which were performed at the same site six months later were all below LOQ. The reason for these higher measurements is unknown. All remaining 23 personal monitoring data are relevant to slurry coating. The 23 values come from one site in the UK. Of these measurements 22 are <LOQ and one measurement is >LOQ. The 23 UK personal long-term measurements account for 96% of the total personal long-term measurements provided by EEA and UK sites in total (24 measurements).

Table 1-5 shows the shows the summary statistics of workplace measurements for incidentally exposed workers at UK sites compared to the total dataset (EEA + UK). For values <LOQ, half of the LOQ (LOQ/2) was considered for statistical evaluation. All measurements are from the period 2017, 2019-2021. The arithmetic mean (AM) over the UK long-term measurements is 0.163 µg/m³ and the 90th percentile is 0.081 µg/m³.

The datasets for UK and EEA sites only differ in one value (0.2 µg/m³). Therefore, the AMs are similar and the 90th percentile of the total database (0.164 µg/m³) is higher.

Table 1-5: Summary statistics of inhalation exposure measurements for WCS 3 – Incidentally exposed workers

Personal – long-term						
	N	**% of total**	**AM [µg/m³]**	**SD [µg/m³]**	**Median [µg/m³]**	**90th Perc. [µg/m³]**
Total (2017, 2019-2021)	24	100	0.165	0.381	0.067	0.164
UK (2017, 2019-2021)	23	96	0.163	0.390	0.067	0.081

All exposure values rounded to three significant figures for presentation, but unrounded values used for calculation of exposure.

1.3.5.2.2 Biomonitoring

Biomonitoring data available for this use are described in the appendix. Three sites provided data for workers possibly exposed to Cr(VI) during slurry coating. In total, 45 measurements are available, taken in the years 2017-219 and in 2021. All except one value are assignable to a SEG. Most exposure values

[8] All long-term measurements (≥2h) are considered as shift-representative measurements and used as such as 8h TWA exposure values; no recalculation has been performed. Measurements <2h were not used to calculate 8h TWA exposure values

(41/45) are below the UK BMGV of 10 µmol Cr/mol creatinine. Four values (11.0, 13.0, 20.0, and 41.0 µmol/mol creatinine) were above the UK BMGV.

Of the three sites, a total of 17 values are assignable to incidentally exposed workers. Thereof, one value (13.0 µmol/mol creatinine) is above the UK BMGV and the remaining 16 below the UK BMGV. The incidentally exposed worker has performed spraying operations on the days preceding the monitoring day and did not correctly follow the industrial hygiene procedures at that time (see section 2.1 for details). A re-briefing on the hazards, risk controls, hygiene, correct PPE usage and care was performed and additionally all PPE provided was reviewed and re-confirmed to be suitable and sufficient.

1.3.5.2.3 Risk characterisation

The risk characterisation for the UK does not differ from the description in the EU dossier.

1.3.6 Conclusions

Regarding the risks for humans via the environment UK sites are at the lower range of all sites (EEA + UK). The risks for workers are comparable between UK and the EEA. Sites measure worker exposure via air monitoring and biomonitoring. Of the available biomonitoring data most values are below the UK BMGV of 10 µmol Cr/mol creatinine. The conditions of use are comparable for spray operators at UK sites compared to EEA sites; for the other SEGs we have no information on differing conditions of use. In conclusion, the EU risk assessment is applicable for UK sites.

2 Appendix

2.1 Biomonitoring data

The available biomonitoring data of UK sites performing this use are described below. Generally (with very few exceptions), no information is available on the Cr(VI) uses a worker was involved in the days before the sampling the worker belongs. Consequently, it is not always evident from the individual measurements as to whether the worker was actually exposed to the use in question in the days preceding the measurement. Furthermore, it should be noted that the measured workers may have been exposed to other Cr(VI) uses at the site during their working time the days before the sampling (at sites where more than one Cr(VI) use is carried out), and therefore the measured exposure cannot be exclusively assigned to the use in question.

Three UK sites provided biomonitoring data for workers possibly exposed to slurry coating. In total, 45 measurements are available, taken in the years 2017-2019 and in 2021. At two of the three UK sites, workers may have also been exposed to Cr(VI) by primer and/or chemical conversion coating application.

Site A

From site A 38 values were provided and information is given as to which SEG the measured workers belong to, except for one measurement. 18 values are from spray operators, two from maintenance and/or cleaning workers, and 17 from incidentally exposed workers. The measurements were performed by means of ICP-MS or ICP-MS with collision cell technology (BMOP01) Creatinine. The LOQs of the measurement methods are 0.5 nmol/L or 1 nmol/L, which corresponds to 0.000001 or 0.00128 µmol Cr/mol creatinine, assuming a molecular concentration of 15 mmol creatinine/L urine[9, 10]. Of the 38 values 25 were below the LOQ and 13 above the LOQ. For values <LOQ we used a value corresponding to LOQ/2.

The 25 values below the LOQ were only given in µg Cr/L urine. The remaining 13 values were stated by the site in µmol Cr/mol creatinine. For a comparable presentation with the measurements reported by the other sites, we transformed the 25 values into µmol Cr/mol creatinine, assuming a molecular concentration of 15 mmol creatinine/L urine.

[9] Considering 15 mmol/L as an average molecular concentration of creatinine in urine for adults in analogy to the creatinine concentration used in the *Regulation of the Slovak Republic No. 356/2006 Coll. on the protection of the health of employees against risks related to exposure to carcinogenic and mutagenic factors at as amended by Slovak Government Regulation No. 301/2007 Coll.* https://www.slov-lex.sk/static/pdf/2015/83/ZZ_2015_83_20150501.pdf; assessed in August 2022

[10] The normal ranges of molecular creatinine concentrations in urine for adults are 3.5 - 23 mmol/L for men and 2.5 - 19 mmol/L for women; https://unitslab.com/node/44#; assessed in August 2022

Slurry coating CT

The measured and transformed values are in the range of 0.64-41 µmol Cr/mol creatinine (Table 2-1). All values except four are below the UK BMGV of 10 µmol Cr/mol creatinine. Two values (11 and 13 µmol Cr/mol creatinine) are just above the UK BMGV. These values are from workers declared to be a spray operator and incidentally exposed worker, respectively. Due to additional information received from the company the worker declared to be an incidentally exposed worker performed spraying operations on the days preceding the monitoring day (the job assignment information provided by the company refers to the activity performed on the day the samples were taken, not considering that biomonitoring values are influenced by preceding days as well). On review it was found that both individuals did not correctly follow industrial hygiene procedures at that time. A re-briefing on the hazards, risk controls, hygiene, correct PPE usage and care was performed and additionally all PPE provided was reviewed and re-confirmed to be suitable and sufficient. Furthermore, two values (20 and 41 µmol Cr/mol creatinine) from spray operators were above the UK BMGV. In one instance (20 µmol Cr/mol creatinine) the reason has been that the part was placed incorrectly so the flow of the spray drift to the dry filters was hindered. The part's orientation was adjusted, which allowed the extraction to pull the paint away from the operator and lowered the exposure of the operator below the limit. This observation was included in the Job Safety Observation and posted at the workplace as an instruction. The worker with the high value of 41.0 µmol Cr/mol creatinine was observed to have not correctly followed the industrial hygiene procedures. Therefore, a re-briefing on hygiene measures was performed and the worker is included in future monitoring campaigns.

Most exposure values (28/38) are below or close to 3 µmol Cr/mol creatinine. Biomonitoring values below 3 µmol Cr/mol creatinine (levels found in the general population) are to be expected for workers without workplace exposure (SEA, 2018), as described above in section 1.3.1. In each SEG occasional values above the background exposure are reported, altogether exposure values are comparable between the SEGs.

Table 2-1: Biomonitoring data – Site A

No.	SEG	Year	Cr exposure value as measured [µg/L]	Cr exposure value as measured or transformed [µmol/mol creatinine] (considering 15 mmol creatinine/L urine)
1	Spray operator	2017	<1.0	0.64
2	Spray operator	2017	<1.0	0.64
3	Spray operator	2017	<1.0	0.64
4	Spray operator	2017	not provided	20.0
5	Spray operator	2017	not provided	11.0
6	Spray operator	2017	<1.0	0.64
7	Spray operator	2017	not provided	5.9

8	Spray operator	2017	<1.0	0.64
9	Spray operator	2017	<1.0	0.64
10	Spray operator	2017	<1.0	0.64
11	Spray operator	2017	<1.0	0.64
12	Spray operator	2017	<1.0	0.64
13	Spray operator	2018	<1.0	0.64
14	Spray operator	2018	<1.0	0.64
15	Spray operator	2019	<1.0	0.64
16	Spray operator	2019	<1.0	0.64
17	Spray operator	2021	not provided	0.90
18	Spray operator	2021	not provided	41.0
19	Maintenance and/or cleaning worker	2017	<1.0	0.64
20	Maintenance and/or cleaning worker	2017	<1.0	0.64
21	Incidentally exposed worker	2017	<1.0	0.64
22	Incidentally exposed worker	2017	not provided	5.40
23	Incidentally exposed worker	2017	not provided	4.00
24	Incidentally exposed worker	2017	not provided	5.90
25	Incidentally exposed worker	2017	not provided	3.30
26	Incidentally exposed worker	2017	not provided	13.0
27	Incidentally exposed worker	2017	<1.0	0.64
28	Incidentally exposed worker	2017	<1.0	0.64
29	Incidentally exposed worker	2017	<1.0	0.64
30	Incidentally exposed worker	2017	<1.0	0.64

31	Incidentally exposed worker	2017	<1.0	0.64
32	Incidentally exposed worker	2017	<1.0	0.64
33	Incidentally exposed worker	2017	<1.0	0.64
34	Incidentally exposed worker	2017	<1.0	0.64
35	Incidentally exposed worker	2018	<1.0	0.64
36	Incidentally exposed worker	2021	not provided	2.2
37	Incidentally exposed worker	2021	not provided	1.2
38	unknow	2017	not provided	8.7

Site B

Four values from site B are available, which are all assignable to spray operators (Table 2-2). The measurements were performed by means of ICP-MS or ICP-MS with collision cell technology (BMOP01) Creatinine. The LOQs of the measurement methods are 0.5 nmol/L or 1 nmol/L, which corresponds to 0.000001 or 0.00128 µmol Cr/mol creatinine (assuming a concentration of 15 mmol creatinine/L urine).

One measurement is below the LOQ. For values <LOQ we used a value corresponding to LOQ/2. The one value below the LOQ was only given in µg Cr/L urine and transformed into µmol Cr/mol creatinine (assuming a molecular concentration of 15 mmol creatinine/L urine) for better comparison with other measurements reported from this and other sites. The measured or transformed values are in the range of 0.64-1.00 µmol Cr/mol creatinine. All values are below the UK BMGV of 10 µmol Cr/mol creatinine and below 3 µmol Cr/mol creatinine.

Table 2-2: Biomonitoring data – Site B

No.	**SEG**	**Year**	**Cr exposure value as measured [µg/L]**	**Cr exposure value as measured or transformed [µmol/mol creatinine] (considering 15 mmol creatinine/L urine)**
1	Spray operator	2019	<1.0	0.64
2	Spray operator	2021	not provided	0.70
3	Spray operator	2021	not provided	0.30
4	Spray operator	2021	not provided	1.00

Slurry coating CT

Site C

Three values from site C are available, which are all assignable to spray operators (Table 2-3). No information is given on the applied analysis method. The LOQ is 1 nmol/L, which corresponds to 0.00128 µmol Cr/mol creatinine (assuming a concentration of 15 mmol creatinine/L urine).

All measurements are below the LOQ. For values <LOQ we used a value corresponding to LOQ/2. These values were only given in µg Cr/L urine and transformed into µmol Cr/mol creatinine (assuming a molecular concentration of 15 mmol creatinine/L urine) for better comparison with other measurements reported from other sites. Thus, all values are 0.64 µmol Cr/mol creatinine and are below the UK BMGV of 10 µmol Cr/mol creatinine as well as below 3 µmol Cr/mol creatinine.

Table 2-3: Biomonitoring data – Site C

No.	SEG	Year	Cr exposure value as measured [µg/L]	Cr exposure value as measured or transformed [µmol/mol creatinine] (considering 15 mmol creatinine/L urine)
1	Spray operator	2019	<1.0	0.64
2	Spray operator	2019	<1.0	0.64
3	Spray operator	2019	<1.0	0.64

Slurry coating CT

3 REFERENCES

ECHA, European Chemicals Agency (2013)

Application for Authorisation: Establishing a Reference Dose Response Relationship for Carcinogenicity of Hexavalent Chromium

Helsinki, 04 December 2013. RAC/27/2013/06 Rev.1. (Agreed at RAC-27). http://echa.europa.eu/documents/10162/13579/rac_carcinogenicity_dose_response_crvi_en.pdf

ECHA, European Chemicals Agency (2016)

Guidance on Information Requirements and Chemical Safety Assessment. Chapter R.16: Environmental exposure assessment. Version 3.0, February 2016

Helsinki, Finland. https://echa.europa.eu/guidance-documents/guidance-on-information-requirements-and-chemical-safety-assessment

HSE, Health & Safety Executive (1999)

Chromate Primer Paints. Engineering Sheet No 32.

Suffolk, United Kingdom. https://www.hse.gov.uk/pubns/eis32.pdf

HSE, Health & Safety Executive (2013)

Control of substances hazardous to health. Sixth edition

Suffolk, United Kingdom. https://www.hse.gov.uk/pubns/priced/l5.pdf

HSE, Health & Safety Executive (2022)

Biological Monitoring Guidance Values. Guidance sheet for: Chromium in urine

https://www.hsl.gov.uk/internal/search?search=Chromium+in+urine

HSE, Health and Safety Executive (2020)

EH40/2005 Workplace exposure limits, EH40 (Fourth edition 2020)

https://www.hse.gov.uk/pubns/books/eh40.htm

SEA, Surface Engineering Association (2018)

Hexavalent chromium in electroplating: Monitoring for exposure

https://www.sea.org.uk/wp-content/uploads/2018/12/monitoring_for_exposure.pdf