CHEMICAL SAFETY REPORT

Part B section 9 and 10

Legal name of applicant(s): AB Connectors Ltd.

Submitted by: AB Connectors Ltd.

Date: 30th March 2025

Substance: Hexavalent Chromium

Use title: Industrial application of a mixture with hexavalent chromium compounds (chromium trioxide) for the surface treatment of mechanical parts, electrical connectors and associated components meeting the relevant standards and requirements for challenging environments and / or high safety applications.

Use Number: Use 1

Contents

9. Exposure Assessment (and related risk characterisation)

9.1 Introduction

AB Connectors Ltd. is a downstream user of #1 and #2 which contain Hexavalent Chromium. Through the process the substance name changes based on its situation. For clarity, as a raw material it may be referred to as chromium trioxide, if it is diluted in water, it may be referred to as chromic acid and if it is mixed with additional substances, it may be referred to as hexavalent chromium.

This substance is used in conversion coating and passivation of circular and rectangular connectors manufactured at AB Connectors Ltd. site in Abercynon, South Wales. The process is carried out at room temperature that is not electrolytic and does not produce hydrogen or mists. Therefor the likelihood of inhalation is low meaning the exposure risk is very low.

The environmental exposure assessment and risk characterisation has been performed in accordance with the relevant guidance for the production of a Chemical Safety Report (CSR) under the REACH Regulation considering the specific aspects relating to the use of the substance.

Surveillance programs of the processes, including maintenance operations, are performed at the Abercynon site. Emergency procedures are in place in case of accidental release, malfunctioning of ventilation or other accidental events.

Workers involved in the activities using this substance are specifically trained and made aware of the specific hazards. Health surveillance programs are in place in order to ensure the complete safety of each worker. The vats containing hexavalent chromium is located in a restricted area where only qualified workers are allowed.

9.1.1 Overview of uses and exposure scenarios

AB Connectors Ltd.'s Authorisation and the Exposure Scenario described covers the activities at the Abercynon site.

Identified Use ID	Identified Use Description	Exposure Scenario
Use 1	Industrial application of a mixture with hexavalent chromium compounds (chromium trioxide) for the surface treatment of mechanical parts, electrical connectors and associated components meeting the relevant standards and requirements for challenging environments and/or high safety applications.	ES1: Industrial use of hexavalent chromium in bath for the surface treatment of connectors

Table 1: Identified Uses and Exposure Scenarios

9.1.1.1 Process Explanation

This Chemical Safety Report (CSR) discusses the use of hexavalent chromium in a vat for the surface treatment of connectors.

Parts for electroplating are cleaned of oil in an automated aqueous wash system in the Machining area, before being passed to the Plating Department.

The "Electroplating Processes" referenced in the above, refer to the Nickel Plating and Zinc Cobalt plating applied to the aluminium base parts prior to the passivation process.

The Chromium Trioxide based passivation is a Non-Electrolytic process, which forms a complex zinc/chromate compound on the surface of the zinc plated layer to provide the colour (e.g. black, olive green) and to enhance the corrosion protection of the zinc and nickel plating.

There is no Chrome Electroplating carried out at AB Connectors Ltd.

We only use Chromium Trioxide for the passivation of connectors.

Each batch of components will have a "Batch Card" which will identify the component, and the plating finish required

Figure 1: Components prepared for plating

There is no direct inhalation exposure to hexavalent chromium during this task.

- ***Wiring***

To prepare the parts for plating they are wired onto frames (jigs) using copper wire. The number of components per frame is determined by the surface area of the parts to maintain a standard load for the plating process. The wired jigs are placed on a trolley awaiting plating.

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 10 (WCS 10).

- ***Plating***

The plating line consists of approximately 33 vats containing various chemicals used as part of the plating process.

Pretreatment – Alkaline cleaners and Acids

Plating Tanks

Post Treatment – Passivates

It is a fully automated process consisting of a computer processor which controls the movement of 3 robotic transporter arms which carry the parts for plating between the various process tanks.

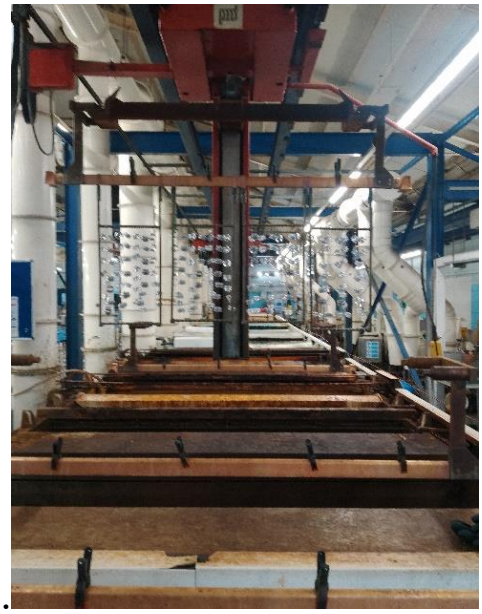


Figure 2: Automated plating process

The processor contains specific chemical process sequences which determine the tanks used and the immersion times for each process (as well as solution temperatures, dwell times over tanks etc)

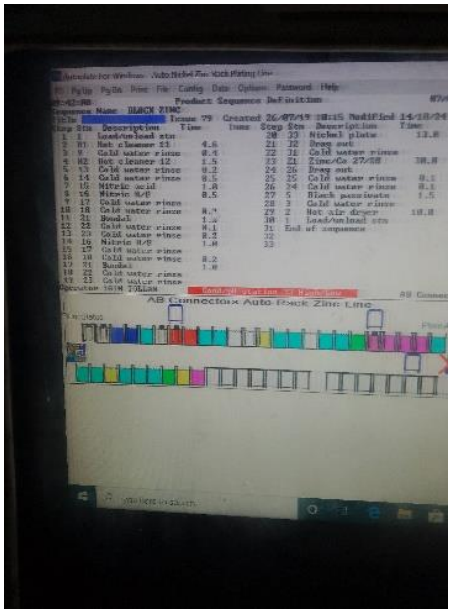


Figure 3: Automated plating processor

The operator loads up to four jigs onto a flight bar then inputs a “process sequence name” into the computer.

The transporter then lifts the bar from the “load / unload” station and takes it through various chemical processes as determined by the process sequence. When the plating process is complete the transporter returns back towards the “load / unload station” where excess water is removed from the components using an air gun before they are placed in an oven to dry at 60C. When the drying is complete the parts are lowered into the load station where the jigs are removed and placed on a trolley ready to transfer to the unwiring stage. The flight bar is now ready to load with more jigs.

All process tanks are fitted with local exhaust ventilation. The closest Operator’s workstation is situated approx. 3 metres from the plating tanks

Figure 3: Process tank

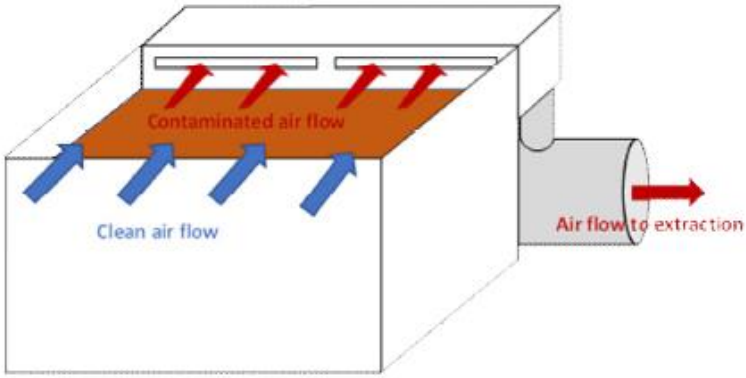


Figure 4: Air flow on extracted bath

Figure 5: Operator's workstation

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 2, 7 & 8 (WCS 2, 7 & 8).

- ***Unwiring***

The plated parts are removed from the jigs by an operator and placed into bins. The passivation process reduces the Chrome 6 to Chrome 3 as the passivate forms a hydrated gel which hardens on drying. This hydrated gel contains a small amount of hexavalent chrome in its matrix.

The components are then placed in an oven ay 130C for 30 minutes to test the adhesion of the plating to the base material. This process dries out the passivate slightly, which improves the shell continuity (which is required) and reduces the hexavalent Chrome to ensure the parts meet the requirements of RoHS.

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 10 (WCS 10).

- ***Sampling Passivate vat for analysis***

A small amount of the passivate solution is taken from the main vat in order to check the concentration of the constituents or check the Ph.

The analysis is carried out in the onsite laboratory which is situated adjacent to the Plating shop. Appropriate PPE is worn during this activity. Exposure to chemicals is limited. Operation is carried out once per day.

From this analysis additions to the process solution are calculated.

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 3 & 4 (WCS 3 & 4).

- ***Decanting chemicals for additions***

Chemicals are supplied in 25 Litre containers. In order to accurately make the additions to the process solution it is necessary to decant chemicals from the 25 Litre container into a smaller measuring jug (2 Litres). This operation is carried out once per day by one operator wearing appropriate personal protective equipment (PPE).

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 5 (WCS 5).

- ***Addition of chemicals to main vat***

Once the correct amount of chemicals has been measured out, they are added directly to the vat by the operator (Typically 1 Litre per day), whilst carrying out this task appropriate PPE is worn.

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 6 (WCS 6).

- ***Make up of new solution***

The tank is filled half full of DI Water using a pump. The required quantities of chemicals needed to make up the passivate are added in specific order (according to the Technical Data Sheet for the process), using a drum pump.

Smaller quantities are decanted into a bucket and added directly to the tank by the operator. The tank is then topped up to working level with DI Water. During this process the operator is wearing appropriate PPE whilst situated near to the process tank for approximately 30 minutes.

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 1 (WCS 1).

- ***Discarding used solution***

Heater is turned off and the solution is allowed to cool. The solution is then pumped using a drum pump into a clean IBC. The lid is secured tightly back on to the IBC and it is moved to storage prior to collection by a licensed hazardous waste disposal company.

During this process the operator is wearing appropriate PPE whilst located near to the vat for approximately 15 minutes.

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 9 (WCS 9).

- ***Waste Water Treatment Plant***

The rinse water streams are segregated into Acid / Chrome and Alkali / Cyanide before running into the effluent treatment plant for processing.

Chrome reduction, Cyanide oxidation, Neutralisation (ph9.00), Flocculation and Settlement are carried out before the waste stream is discharged to sewer.

The metal hydroxide sludge collected through settlement is passed through a filter press for dewatering. The water passes back through the effluent plant. The sludge, compacted into "cake" is collected before being taken off site by a licensed hazardous waste disposal company.

Operating parameters are recorded daily. Samples of the discharge to sewer are taken daily and tested in the on-site lab for metals. Utilities company (Dwr Cymru) take a formal sample at least monthly. All results are reported to NRW annually in line with the requirements of our operating permit (BV7443IP).

Concentrated solutions are transferred into IBC's and taken off site for treatment and disposal by a licensed hazardous waste disposal company.

This task is considered in the estimation of exposure to hexavalent chromium. It is treated in this CSR in the Worker Contributing Scenario 10 (WCS 10).

9.1.1.2 Tonnage Information / Number of Workers exposed:

Tonnage Information

Assessed tonnage:

#3 [redacted] (Olive Drab), 150 litres (50% Chromic Acid content), 75 Kg Chromic Acid

#4 [redacted] (Black Passivate), 550 litres (43% Chromic Acid), 240 Kg Chromic Acid

#5 [redacted] (Yellow Passivate), 25 litres, 7 Kg of Chromium Trioxide

Chromic Acid Flake 50 Kg (100% Chromic Acid), 50 Kg Chromic Acid

Total= 0.372 tons

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Quantity (Tonnes)	Forecast	1.00	0.950	0.850	0.850	0.750	0.700	0.700	0.650	0.650	0.600
	Actual	0.800	0.925	0.675	0.825	0.575	0.550	0.600	0.425		

Table 2: Past and future estimated consumption on the Abercynon site

The number of workers within the Plating Shop carrying out plating activities is 7. There is also 1 Plating Shop Manager who frequently enters the room for sample taking, monitoring, and making additions.

Annual health screening of employees within the area and ancillary staff, such as maintenance engineers, is performed.

An external company carries out Local Exhaust Ventilation (LEV) testing throughout the site including the plating tank extraction and laboratory fume cabinets. This is to ensure that the extraction systems are functioning correctly and extracting at the correct air velocities and volumes. See Annex III for test results of plating tank extraction.

An external company also carries out air monitoring throughout the site, including the plating and effluent treatment rooms using static and personal sampling. Table 3 below shows most recent results regarding chromium (January 2025). We considered biological monitoring but concluded that it wasn't required, due to the low levels of detection during the air monitoring study and Advance Reach Tool (ART) modelling.

Static Sampling

Sample Ref	Media ID	Start Time	End Time	Activity / Location	Sample Duration (mins)	Flow Rate ($L\ min^{-1}$)	Sampled Volume (L)	Analyte	Mass of Analyte (mg)	Concentration in Air ($mg.m^{-3}$)
7	Cr2	08:54	13:12	Opposite to the olive drab passivate tank 8 on the Zinc Line	258	2.00	516	Hexavalent Chromium (CrVI)	0.00015	0.00029

Personal Sampling

Sample Ref	Media ID	Start Time	End Time	Operator	Activity/ Location	Shift Length (hrs)	Sample Duration (mins)	Flow Rate ($L\ min^{-1}$)	Sampled Volume (L)	Analyte	Mass of Analyte (mg)	Concentration in Air ($mg.m^{-3}$) 8-Hr TWA		WEL or Guidance Limit	% of WEL or Guidance Limit
1	Cr1	08:29	13:25	#6	Zinc Line	8	296	2.00	591	Hexavalent Chromium (CrVI)	0.0001	0.00024	0.00024	0.01	2

ALARP (or broadly equates to ALARP), and in the absence of a WEL or alternative guidance value

Results **equal or exceed** the WEL/guidance value

Results **equal or exceed 25%** of the WEL/guidance value (EEUK Group Ltd consider this significant)

Results **between 10% and 25%** of the WEL/guidance value (EEUK Group Ltd consider compliance is likely)

Results **< 10%** of the WEL/guidance value (EEUK Group Ltd consider compliance is demonstrated)

Sample Ref.	Operator Name / Sample Location	Analyte	Average Sampling Rate (L/Min)	Sample Time (Mins)	Sample Volume (l)	Amount Detected (mg)	Conc'n (mg.m-3)	8 Hr TWA (mg.m-3)	% of Limit
ECL/21/5158	#7 Plating Plating Line	Chromium	2.0	06:17 – 13:15 (418)	836	0.0006	0.0007	0.0007	<1.0
ECL/21/5161	#8 Plating Unwiring	Chromium	2.0	415	830	0.0013	0.0016	0.0014	<1.0
ECL/21/5164	Static Plating Gold Line	Chromium	2.0	06:23 – 13:15 (412)	824	<0.0005	<0.0006	---	<1.0
ECL/21/5167	Static Plating Wiring	Chromium	2.0	06:26 – 13:15 (409)	818	<0.0005	<0.0006	---	<1.0
ECL/21/5173	#9 Plating Plating Line	Chromium VI	2.0	06:31 – 13:29 (418)	836	<0.0003	<0.0004	<0.0003	<3.3
ECL/21/5174	#10 Plating Unwiring	Chromium VI	2.0	06:32 – 13:30 (418)	836	<0.0003	<0.0004	<0.0003	<3.3
ECL/21/5175	Static Plating Gold Line	Chromium VI	2.0	06:30 – 13:29 (419)	838	<0.0003	<0.0004	---	<3.6

Key: l/min = litres per minute; mg = milligrams
conc'n = concentration; $mg.m^{-3}$ = milligrams per cubic metre
TWA = Time Weighted Average (for personal samples only)
% of WEL = calculated for all samples, though only personal sample collection should be directly compared to any listed limit value

>50% Limit
10% - 50% Limit
<10% Limit

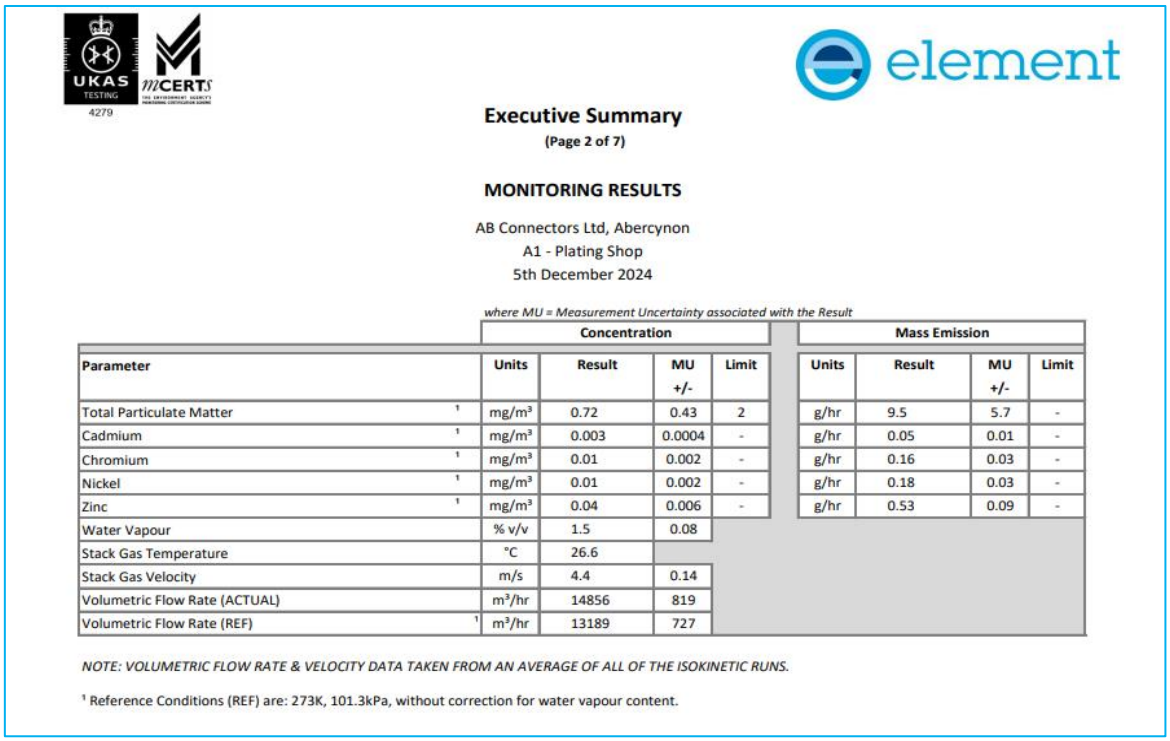
Table 3: Static and personal chromium monitoring results

Sampling of extracted air is carried out annually for various metals including chromium. Tables 4, 5, 6, & 7 is an extract of results showing chromium data.

Metals checked to EN14385

Particulate checked to EN13284-1

Oxides of Nitrogen as NO2 checked to EN14792



Executive Summary

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MONITORING RESULTS

AB Connectors Ltd, Abercynon
A1 - Plating Shop
5th December 2024

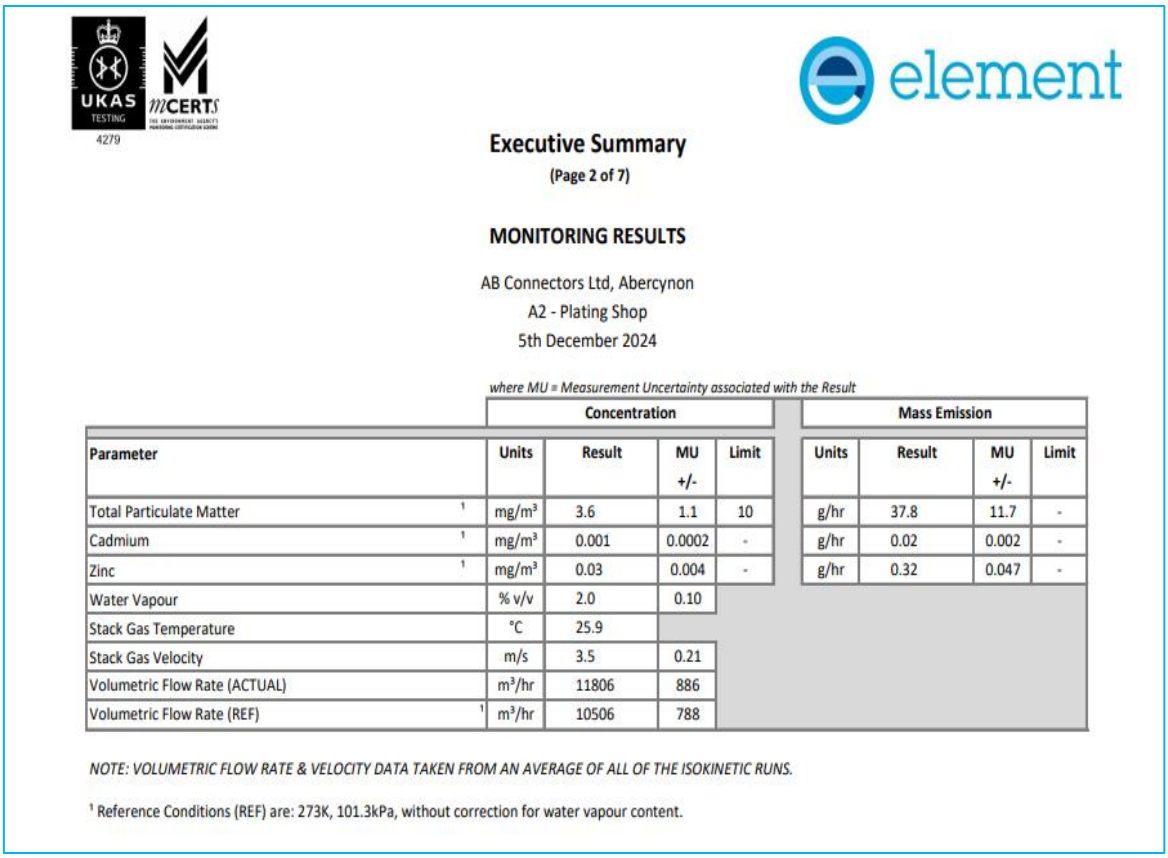
where MU = Measurement Uncertainty associated with the Result

	Concentration				Mass Emission			
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Total Particulate Matter [1]	mg/m³	0.72	0.43	2	g/hr	9.5	5.7	-
Cadmium [1]	mg/m³	0.003	0.0004	-	g/hr	0.05	0.01	-
Chromium [1]	mg/m³	0.01	0.002	-	g/hr	0.16	0.03	-
Nickel [1]	mg/m³	0.01	0.002	-	g/hr	0.18	0.03	-
Zinc [1]	mg/m³	0.04	0.006	-	g/hr	0.53	0.09	-
Water Vapour	% v/v	1.5	0.08					
Stack Gas Temperature	°C	26.6						
Stack Gas Velocity	m/s	4.4	0.14					
Volumetric Flow Rate (ACTUAL)	m³/hr	14856	819					
Volumetric Flow Rate (REF) [1]	m³/hr	13189	727					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

[1] Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

Table 4: Extracted air sample data – A1



Executive Summary

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MONITORING RESULTS

AB Connectors Ltd, Abercynon
A2 - Plating Shop
5th December 2024

where MU = Measurement Uncertainty associated with the Result

	Concentration				Mass Emission			
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Total Particulate Matter [1]	mg/m³	3.6	1.1	10	g/hr	37.8	11.7	-
Cadmium [1]	mg/m³	0.001	0.0002	-	g/hr	0.02	0.002	-
Zinc [1]	mg/m³	0.03	0.004	-	g/hr	0.32	0.047	-
Water Vapour	% v/v	2.0	0.10					
Stack Gas Temperature	°C	25.9						
Stack Gas Velocity	m/s	3.5	0.21					
Volumetric Flow Rate (ACTUAL)	m³/hr	11806	886					
Volumetric Flow Rate (REF) [1]	m³/hr	10506	788					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

[1] Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

Table 5: Extracted air sample data – A2

UKAS TESTING 4279 MCERTS element

Executive Summary

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MONITORING RESULTS

AB Connectors Ltd, Abercynon
A3 - Plating Shop
5th December 2024

where MU = Measurement Uncertainty associated with the Result

		Concentration			Mass Emission			
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Total Particulate Matter [1]	mg/m³	0.91	0.56	2	g/hr	8.8	5.4	-
Chromium [1]	mg/m³	0.007	0.001	-	g/hr	0.07	0.01	-
Zinc [1]	mg/m³	0.03	0.004	-	g/hr	0.27	0.04	-
Water Vapour	% v/v	2.3	0.12					
Stack Gas Temperature	°C	23.3						
Stack Gas Velocity	m/s	3.2	0.20					
Volumetric Flow Rate (ACTUAL)	m³/hr	10689	825					
Volumetric Flow Rate (REF) [1]	m³/hr	9597	740					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

[1] Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

Table 6: Extracted air sample data – A3

UKAS TESTING 4279 MCERTS element

Executive Summary

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MONITORING RESULTS

AB Connectors Ltd, Abercynon
A4 - Wet Scrubber
4th December 2024

where MU = Measurement Uncertainty associated with the Result

		Concentration			Mass Emission			
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Total Particulate Matter [1]	mg/m³	0.77	0.32	2	g/hr	16.9	7.1	-
Cadmium [1]	mg/m³	0.007	0.001	-	g/hr	0.14	0.02	-
Copper [1]	mg/m³	0.02	0.003	-	g/hr	0.36	0.06	-
Zinc [1]	mg/m³	0.04	0.006	-	g/hr	0.81	0.13	-
Total Oxides of Nitrogen [1]	mg/m³	< 3.9	1.83	-	g/hr	< 85.9	40.2	-
Oxides of Nitrogen (as NO_2) [1]	mg/m³	2.4	0.88	1.5	g/hr	53.2	19.5	-
Water Vapour	% v/v	1.5	0.41					
Stack Gas Temperature	°C	18.0						
Stack Gas Velocity	m/s	7.0	0.12					
Volumetric Flow Rate (ACTUAL)	m³/hr	23674	1143					
Volumetric Flow Rate (REF) [1]	m³/hr	21879	1056					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

[1] Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

Table 7: Extracted air sample data – A4

9.1.1.3 Overview of Exposure Scenarios

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

Identifiers*)	Market Sector	Titles of exposure scenarios	Tonnage (tonnes per year)
ES 1:		Industrial use of hexavalent chromium in bath for the surface treatment of connectors	0.750
***) Manufacture: M-#, Formulation: F-#, Industrial end use at site: IW-#, Professional end use: PW-#, Consumer end use: C-#, Service life (by workers in industrial site): SL-IW-#, Service life (by professional workers): SL-PW-#, Service life (by consumers): SL-C-#.)**			

Table 8: Overview of exposure scenarios

Contributing scenario	ERC / PROC	Name of the contributing scenario	Size of the exposed population
ES 1: Industrial use of hexavalent chromium in bath for the surface treatment of connectors			
ECS 1	**ERC5**	Industrial use resulting in inclusion into or onto a matrix	**Regional:** **Local:**
WCS 1	PROC8b	Initial Make Up of Solution	1
WCS 2	PROC2	Dipping Connector Parts into Passivate	1
WCS 3	PROC8a	Sampling Vat for Analysis	1
WCS 4	PROC15	Lab Analysis	1
WCS 5	PROC8b	Decanting of Chemical	1
WCS 6	PROC8b	Making Additions to Vat Based on Analysis (Maintenance)	1
WCS 7	PROC2	Dipping Parts into Rinse Water After Passivation	1
WCS 8	PROC7	Drying of Components	1
WCS 9	PROC8b	Discharge of Waste Solution	1

WCS 10	PROC0	Operators in Work Area Not Associated with Chrome Passivate Process	7
ES 2: Consumers This section is not relevant since no consumers will use the final manufactured articles (as described in 9.3 below)			

Table 9: Overview of Contributing Scenarios

9.1.2 Introduction to the assessment

9.1.2.1 Environment

Following REACH, Article 62(4)(d), the CSR supporting an Analysis for Alternatives (AfA) needs to cover only those potential risks arising from the intrinsic properties specified in Annex XIV. Accordingly, only the potential human health risks related to the classification of chromium trioxide as a carcinogenic and mutagenic toxicant are considered in the current CSR.

At the end of the process, all waste is managed by a specialised waste management company that also collects all waste (filters, PPE, packaging etc.), except liquid waste which is treated onsite.

Nevertheless, in the environmental contributing scenarios, we will analyse and discuss the possible release and risk for the general population.

9.1.2.2 Human via Environment

Risk analysis for man via environment will be performed according to the conclusions of the environmental release identified in the environmental contributing scenario.

9.1.2.3 Workers

The excess risk calculation will be based on RAC/27/2013/06 Rev.1 which establishes a reference dose response relationship for carcinogenicity of hexavalent chromium.

Regarding the publication of the RAC, no data clearly indicates that dermal exposure to Cr (VI) compounds presents a risk of cancer to humans. As a consequence, the risk induced via dermal exposure will not be considered in what follows, especially taking into account the dermal protections used when the substance is handled.

Moreover, we will estimate the cancer risk mainly due to volatility of the substance, for lung cancer, and maximize excess of cancer risk by not taking into account the small intestine cancer risk.

Monitoring measurement campaign are planned on site for exposure assessment of the entire process. For the description of each contributing scenario, we will use the ART 1.5 software to calculate an associated value of exposure. In the modelling process, we will use the Long-term value at 90th percentile for the entire contributing scenario. ART modelling reports are given in Annex I. It has to be stressed that, in the ART model, the duration of activity does not impact the results of the raw exposure estimated for one task. Thus, the duration can be adjusted for each member for the estimation of the global exposure (made in section 10 and duration presented in Annex I). The results of the modelling approach will be compared to monitoring measurements. Nevertheless, to calculate the excess risk of cancer (section 10) we will use the estimation value from ART to assess a quantitative analysis.

Considering reprotoxic effects, this Chemical Safety Report focuses on the use of hexavalent chromium for the carcinogenic / mutagenic effects. RMM are in place to reduce the risk as low as possible in the framework of the non-threshold effects (cancer) of the substances. Consequently, it is deemed that these measures also cover the risk due to threshold effects for reproduction. Finally, when threshold effects are adequately controlled, they must not be taken into account in the excess risk calculation.

Thus, exposures and excess risk calculation will be developed considering only carcinogenic effects.

It has to be stressed that the estimated exposures presented for each contributing scenario in the section 9 are based on the worst case according to the description of the site, as presented in Annex I.

9.1.2.4 Consumers

This section is not relevant since no consumer will use the final manufactured articles because they are high technology equipment and they are not intended to be used by consumers.

Only professional workers use the treated connector parts.

9.2 Exposure Scenario 1 for Workers

Sector of use: Industrial use: Uses of substances as such or in preparations at industrial sites **(SU 3)**

Article categories: Metals articles **(AC 7)**

Environment contributing scenario(s): ECS1 - Industrial use resulting in inclusion onto a matrix **(ERC 5)**

Worker / Consumer contributing scenario(s):

WCS 1 – Initial make up of solution **(PROC8b)**

WCS 2 – Dipping connector parts into passivate **(PROC2)**

WCS 3 – Sampling vat for analysis **(PROC8a)**

WCS 4 – Lab Analysis **(PROC15)**

WCS 5 – Decanting of chemical **(PROC8b)**

WCS 6 – Making additions to vat based on analysis **(PROC8b)**

WCS 7 – Dipping parts into rinse water after passivation **(PROC2)**

WCS 8 – Drying of components **(PROC7)**

WCS 9 – Discharge of waste solution **(PROC8b)**

WCS 10 – Operators in work area not associated with chrome passivate process **(PROC0)**

Subsequent service life exposure scenario(s): Not applicable

Exposure scenario(s) of the uses leading to the inclusion of the substance into the article(s): Not applicable

Description of the activities and technical processes covered in the exposure scenario:

The different tasks and various conditions are described within Contributing Scenarios.

Explanation on the approach taken for the ECS:

The exposure scenario concerns the immersion of connector parts into vats for chromium treatment. Only the tasks which lead to exposure of hexavalent chromium, as identified in section 9.1.1 are analysed as Contributing Scenarios. For all the

Contributing Scenarios concerning the exposure at the workplace, detailed conditions of use at the site are presented in Annex I.

Efficiency of respiratory protective equipment

When it is described in the Contributing Scenario, wearing respiratory protective equipment (RPE) is mandatory. Thus, to estimate exposure of workers at the workplace, it is necessary to determine the effectiveness of the respiratory protection. The result is the assigned protection factor (APF). The choice of this factor may vary, depending on the country for which it is used. The technical data sheets in Annex II presents the protective factors assigned to the breathing equipment used in this exposure scenario. It is a half mask which has been tested to European Standard EN 143, EN 140 or EN 405 and has met the relevant requirements of the category P3.

	Assigned protection factors (APF)	
Nominal protection factor	EN 140 / 143	EN 405
United Kingdom	20	10

APF presented in annex C of the NF EN 529 standard

Table 10: Assigned protection factor for United Kingdom

The decision was made to use an APF of 10. This ties in with a precautionary approach and with the methodology of the modelling approaches of MEASE[1], recommended in the technical guidance of ECHA (ECHA 20162).

Exposure Limits

Substance	**Long-term exposure limit (8-hr TWA reference period)**		**Short-term exposure limit (15-minute reference period)**		**Comments**
	PPM	**Mg.m3**	**PPM**	**Mg.m3**	
Chromium (VI) Trioxide		0.01		0.3(2)	Carc. - Capable of causing cancer and/or heritable genetic damage Sen. - Capable of causing occupational asthma BMGV. Biological Monitoring Guidance Values

Table 11: List Source(s)

[1] MEASE is a modelling tool for exposure estimation at the workplace. As described in section 9.1.2.3, the modelling approach of this CSR, is based on the ART Tool for a Tier 2 exposure estimation. MEASE is not used because it is a Tier 1 exposure estimation. However, the present version of ART cannot estimate the exposure with respiratory protective equipment and consequently an assigned protection factor needs to be determined.

2 Guidance on information requirements and chemical safety assessment, Chapter R.14: Occupational exposure estimation.

9.2.1 Environmental Contributing Scenario 1

Industrial use resulting in inclusion onto a matrix.

9.2.1.1 Conditions of Use

Parameter	Information
Product Characteristics	
• Product	*Hexavalent chromium in a mixture*
• Physical form	*Liquid*
• Amount	*0.4 t / year*
• Weight fraction of the substance in the liquid mixture	*Concentration of substance in a bath is in the range 1.3 to 5 % (w/w)*
Operational conditions	
• Emission sources	*No release is expected on the process, except for:* – *Air extraction from the baths treatment* – *Waste production during the treatment of liquid effluents* *The integrity of the process circuit is regularly monitored.* *The possibilities of release are detailed below.*
• Atmospheric emissions	*Air from local extraction of the baths in the plating shop is collected through a specific system. The air is then evacuated through a chimney on the roof of the plating shop. The possible atmospheric emissions will be considered in the following part of the CSR.*
• Liquid effluents	*Liquid effluents containing concentrated hexavalent chromium is pumped, using a drum pump into a clean IBC. The lid is secured tightly back on to the IBC and it is moved to storage prior to collection by a licensed waste disposal company.* *The rinse water streams are segregated into Acid / Chrome and Alkali / Cyanide before running into the effluent treatment plant for processing. Chrome reduction, Cyanide oxidation, Neutralisation (ph9.00), Flocculation and Settlement are carried out before the waste stream is discharged to sewer.*
• Waste production	*All the waste (sludge and used materials) produced during these treatments is managed by a specialised certified waste company.*

Table 12: condition of use for the contributing scenario 1

9.2.1.2 Releases

Considering the data presented in Table 9, only atmospheric release could be considered. The air emissions are treated through a specific process, which reduces hexavalent chromium.

Experts considered in different official reports on possible exposure to hexavalent chromium[3&4], that the most probable risk would be in the local air compartment. Indeed, on water and soil, hexavalent chromium is transformed into trivalent chromium via redox reaction[5].

Moreover, in the EU RAR about release of hexavalent chromium compounds from use in metal treatment, no air release was considered (except during formulation of products)[6].

In order to provide more information on possible atmospheric release, the following table (13) presents the maximum tonnage of substances considered and the distance between the emission source located on the plating shop and the first home.

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[3] European Union Risk Assessment Report on hexavalent chromium substances (Volume 53 3rd priority list)

[4] INERIS - Fiche de données toxicologiques et environnementales du chrome et de ses dérivés

[5] EPA Ground Water Issue, Natural Attenuation of Hexavalent Chromium in Groundwater and Soils, EPA154015-941505, 1994

[6] EU RAR (European Union Risk Assessment Report); *Chromium trioxide, Sodium chromate, sodium dichromate, ammonium dichromate and potassium dichromate Risk Assessment.* 3rd priority list volume 53. 2005

Company	Site	Distance	Total tonnage
AB Connectors	Abercynon	=100 m	0.75

Table 13: Distance from point of release and tonnage of substance

We have both estimated the release based on modelling exposure and used actual discharge measurement from emissions monitoring.

Worst Case Scenario

- Distance from point of release (nearest houses) **100 M**
- Release of chemicals (Tonnes) **0.75 T** based on total volume of chemical purchased and volume of one vat
- Worst case: an atmospheric release of **0.75 tons** per year with a distance of 100m to the nearest home

The technical guidance document part II[7] proposes estimated release factors depending on the activity type.

The associated release factor is determined by the following parameters:

- IC 16 (Industrial category: engineering industry),
- Solubility > 1g/L,
- Vapor pressure <11 Pa,
- MC=3 (Main category: Non-dispersive use)

Thus, the release factor is determined at 0.00001.

Based on this release estimation and the Doury abacus[8] (which estimates the dispersion speed), we calculated the exposure of the general population around the site for the worst case and the associated risk.

Worst case (0.75 tons/100m):

Release per working day is estimated (considering 365 working days per year):

$$\textbf{Daily release, worst case} = \frac{750 \times 1000000 \times 0.00001}{365}$$

$$= 20.55 \text{ mg/day}$$

Worst case, release per day: 20.55 mg/day (average of 0.24 µg/s on 24h)

For the assessment, we took the nearest house at approximately 100m for the worst case.

Atmospheric transfer coefficient (at 100m) from Doury Abacus: 1.87×10^{-3} s/m^3

The release in air adjusted on 24h is:

Release 0.24µg/s **X** Atmospheric transfer coefficient (at 100m) = $0.00045 \mu g/m^3$

From Doury Abacus (1.87×10^{-3} s/m^3)

Actual Discharge Measurement from Emissions Monitoring

- Distance from point of release (nearest houses) **100 M**
- Release of chemicals (Tonnes) **0.002 T** based on total volume of chemical purchased
- Worst case: an atmospheric release of **0.002 tons** per year with a distance of 100m to the nearest home

The technical guidance document part II[7] proposes estimated release factors depending on the activity type.

The associated release factor is determined by the following parameters:

- IC 16 (Industrial category: engineering industry),
- Solubility > 1g/L,
- Vapor pressure <11 Pa,
- MC=3 (Main category: Non-dispersive use)

Thus, the release factor is determined at 0.00001.

Based on this release estimation and the Doury abacus[8] (which estimates the dispersion speed), we calculated the exposure of the general population around the site for the worst case and the associated risk.

Worst case (0.002 tons/100m):

Release per working day is estimated (considering 365 working days per year):

$$\textbf{Daily release, worst case} = \frac{2 \times 1000000 \times 0.00001}{365}$$

= 0.055 mg/day

Worst case, release per day: 0.055 mg/day (average of 0.00064 µg/s on 24h)

For the assessment, we took the nearest house at approximately 100m for the worst case.

Atmospheric transfer coefficient (at 100m) from Doury Abacus: 1.87×10^{-3} s/m^3

The release in air adjusted on 24h is:

Release 0.00064µg/s **X** Atmospheric transfer coefficient (at 100m) = 0.0000012µg/m^3

From Doury Abacus (1.87×10^{-3} s/m^3)

[7] Technical Guidance Document on risk assessment, part II about environmental risk assessment

[8] Abaques d'evaluation directe des transferts atmospheriques d'effluents gazeux, Doury et al, February 1980

9.2.1.3 Exposure and risks for the environment and man via the environment

As described above, release of hexavalent chromium in the environment via soil and water are negligible. No exposure to the substance of man via environment is therefore considered in this exposure scenario via these compartments.

Considering the release in the atmospheric compartment, after calculation, the exposures for general population are:

o 0.45 x 10^{-3} µg/m3 per 24h and considering 365 working days for the worst case.

The excess of risk of lung cancer for the general population will be adjusted to the review period.

Weighted excess of lung cancer risk for general population	**Value**
Excess risk of lung cancer, per µg/m3 of Cr (VI) based on 70 years, 365 days per year, 24h per day (RAC 2013)	$2.9x10^{-2}$
Excess risk of lung cancer, per µg/m3 of Cr (VI) based on 1 year, 365 days per year, 24h per day	$4.1x10^{-4}$
Excess risk of lung cancer, per µg/m3 of Cr (VI) based on 7 years (original review period for Use-2), 365 days per year, 24h per day	$2.9x10^{-3}$
Excess risk of lung cancer, per µg/m3 of Cr (VI) based on 12 years 365 days per year, 24h per day	$5.0x10^{-3}$

Table 14: RAC adjusted excess of risk calculation for general population

Excess risk	**Worst case**	**Value**
Final individual excess risk of lung cancer based on 7 years (review period for Use-2), 365 days per year, 24h per day	(0.75 tons & 100m)	$0.45x10^{-6}$

Table 14: Risk calculation for general population

All the calculated excess risks presented in the above table are in the order of magnitude of 10^{-6}. The approach used is a generic approach with several uncertainties which lead to an over-estimation of the exposure:

- The results presented above are based on worst case scenario (in terms of tonnage of substance and distance from the source of emission).

- The air extraction is evacuated from the plating shop through a chimney located on the roof of the plating shop. This chimney is not located high enough to consider a wide atmospheric dispersion.

- Specific treatment process for treating the air extracted from the process, before evacuating it in the atmosphere (acido-basic scrubber, mist eliminator…) are not considered in the generic estimation presented above.

- This estimation does not take into account the degradation/transformation reaction of hexavalent chromium. In the environment, including in the air compartment, hexavalent chromium is a strong oxidising agent which can react with a wide range of reducing agents to form chromium (III)16. It has also been shown that chromium (VI) can be photochemically reduced by UV-light to chromium (III).

Conclusion

Compared to the worker's excess risk of lung cancer

Considering the risk management measures implemented

Considering the level of containment of the process

Considering the uncertainties which lead our calculation to an over-estimation

Considering that the decision point for "acceptable" lifetime cancer risk levels used for general population are generally around 10^{-5} *

The risk for general population is considered as negligible.

* This decision point is presented in the technical guidance of ECHA

9.2.2 Worker Contributing Scenario 1 (WCS 1) Initial Make Up of Solution

This contributing scenario deals with the exposure of workers during the initial make up of solution containing hexavalent chromium in the vat treatment, as described in paragraph 9.1.1.1.

9.2.2.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No	1333-82-0
Scenario Details	
Number of activities	1
Total Duration	30 mins
Non-exposure period	0
Emissions	
Emission Sources	Far field
Duration	30 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	Room temperature
Vapour Pressure	11Pa
Liquid Mole Fraction	1
Activity Emission Potential	
Activity Class	Falling liquids
Situation	Transfer of liquid product with flow of 1 - 10 l/minute
Containment Level	Open process
Loading Type	Splash loading, where the liquid dispenser remains at the top of the reservoir and the liquid splashes freely
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	3000m3
Risk Management Measures	

Localised Controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal Enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	3M™ Maintenance-Free Reusable Half Mask (Technical Data Sheets (TDS) in Annex II)
Other Personal Protective Equipment	Face Visor (approved according to EN 166) Polysol Chemical Resistant Glove (TDS in Annex II) Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 15: Conditions of use of Worker Contributing Scenario 1

9.2.2.2 Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0003 mg/m^3.

The 90% confidence interval is 0.000055 mg/m^3 to 0.0021 mg/m^3.

9.2.3 Worker Contributing Scenario 2 (WCS 2) Dipping Connector Parts into Passivate

This contributing scenario deals with the exposure of workers during the dipping of connector parts into passivate solution containing hexavalent chromium in the vat, as described in paragraph 9.1.1.1.

9.2.3.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No	1333-82-0
Scenario Details	
Number of activities	1
Total Duration	60 mins
Non-exposure period	0
Emissions	
Emission Sources	Far field
Duration	60 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	Room temperature
Vapour Pressure	11Pa
Liquid Mole Fraction	1
Activity Emission Potential	
Activity Class	Activities with agitated surfaces
Situation	Open surface 0.3 – 1m2
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	3000m3
Risk Management Measures	
Localised Controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal Enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	No RPE
Other Personal Protective Equipment	Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 16: Conditions of use of Worker Contributing Scenario 2

9.2.3.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0033 mg/m^3.

The inter-quartile confidence interval is 0.0016 mg/m^3 to 0.007 mg/m^3.

9.2.4 Worker Contributing Scenario 3 (WCS 3) Sampling Vat for Analysis

This contributing scenario deals with the exposure of workers during sampling of vat containing hexavalent chromium for analysis, as described in paragraph 9.1.1.1.

9.2.4.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No.	1333-82-0
Scenario Details	
Number of activities	1
Total Duration	2 mins
Non-exposure period	0
Emissions	
Emission Sources	Far field
Duration	2 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	298 K
Vapour Pressure	11Pa
Liquid Mole Fraction	Minor
Activity Coefficient	1
Activity Emission Potential	
Activity Class	Falling liquids
Situation	Transfer of liquid product with flow of < 0.1 l/minute
Containment Level	Handling that reduces contact between product and adjacent air. Note: This does

	not include processes that are fully contained by localised controls (see next questions).
Loading Type	Splash loading, where the liquid dispenser remains at the top of the reservoir and the liquid splashes freely
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	3000m^3
Risk Management Measures	
Localised Controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	3M™ Specialty Respirators 9900 (Technical Data Sheets (TDS) in Annex II)
Other Personal Protective Equipment	Microflex-93-260 Chemical Resistant Gloves (TDS in Annex II) Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 17: Conditions of use of Worker Contributing Scenario 3

9.2.4.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 75th percentile full-shift exposure is 0.00018 mg/m^3.

The inter-quartile confidence interval is 0.000089 mg/m^3 to 0.00035 mg/m^3.

9.2.5 Worker Contributing Scenario 4 (WCS 4) Lab Analysis

This contributing scenario deals with the exposure of workers during titration of sample to determine chrome content, as described in paragraph 9.1.1.1.

9.2.5.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No.	1333-82-0
Scenario Details	
Number of activities	1
Total Duration	10 mins
Non-exposure period	0
Emissions	
Emission Sources	Near Field
Duration	10 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	293 K
Vapour Pressure	11Pa
Liquid Mole Fraction	Minor
Activity Coefficient	1
Activity Emission Potential	
Activity Class	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Open surface < 0.1 m^2
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	100m^3
Risk Management Measures	
Localised Controls	
Primary	No localized controls (0.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	Only good natural ventilation
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	No RPE
Other Personal Protective Equipment	Microflex-93-260 Chemical Resistant Gloves (TDS in Annex II)

	Safety glasses (approved according to EN 166) Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 18: Conditions of use of Worker Contributing Scenario 4

9.2.5.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 75th percentile full-shift exposure is 0.035 mg/m^3.

The inter-quartile confidence interval is 0.018 mg/m^3 to 0.068 mg/m^3.

9.2.6 Worker Contributing Scenario 5 (WCS 5) Decanting of Chemicals

This contributing scenario deals with the exposure of workers whilst transferring chemical from 25l drum to 2l jug for additions to vat containing hexavalent chromium, as described in paragraph 9.1.1.1.

9.2.6.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No.	1333-82-0
Scenario Details	
Number of activities	1
Total Duration	5 mins
Non-exposure period	0
Emissions	
Emission Sources	Near Field
Duration	5 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids

Process Temperature	293 K
Vapour Pressure	11Pa
Liquid Mole Fraction	Minor
Activity Coefficient	1
Activity Emission Potential	
Activity Class	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Open surface 0.1 – 0.3 m^2
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	3000m^3
Risk Management Measures	
Localised Controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	3M™ Specialty Respirators 9900 (Technical Data Sheets (TDS) in Annex II)
Other Personal Protective Equipment	Polysol Chemical Resistant Glove (TDS in Annex II) Safety glasses (approved according to EN 166) Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 19: Conditions of use of Worker Contributing Scenario 5

9.2.6.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0033 mg/m^3.

The 90% confidence interval is 0.0006 mg/m^3 to 0.023 mg/m^3.

9.2.7 Worker Contributing Scenario 6 (WCS 6) Making Additions to Vat Based on Analysis

This contributing scenario deals with the exposure of workers whilst making up process solution to optimum operating level based on analysis for additions to vat containing hexavalent chromium, as described in paragraph 9.1.1.1.

9.2.7.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No.	1333-82-0
Scenario Details	
Number of activities	1
Total Duration	10 mins
Non-exposure period	0
Emissions	
Emission Sources	Near Field
Duration	10 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	Room temperature
Vapour Pressure	11Pa
Liquid Mole Fraction	Minor
Activity Coefficient	1
Activity Emission Potential	
Activity Class	Activities with agitated surfaces
Situation	Open surface 0.3 - 1 m^2
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	3000m^3
Risk Management Measures	
Localised Controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)

Dispersion	
Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	3M™ Specialty Respirators 9900 (Technical Data Sheets (TDS) in Annex II)
Other Personal Protective Equipment	Polysol Chemical Resistant Glove (TDS in Annex II) Safety glasses (approved according to EN 166) Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 20: Conditions of use of Worker Contributing Scenario 6

9.2.7.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.033 mg/m^3.

The 90% confidence interval is 0.0059 mg/m^3 to 0.23 mg/m^3.

9.2.8 Worker Contributing Scenario 7 (WCS 7) Dipping Parts into Rinse Water After Passivation

This contributing scenario deals with the exposure of workers whilst parts are dipped into water rinse to remove residual chemicals from passivate containing hexavalent chromium, as described in paragraph 9.1.1.1.

9.2.8.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No.	1333-82-0
Scenario Details	
Number of activities	1

Total Duration	5 mins
Non-exposure period	0
Emissions	
Emission Sources	Far Field
Duration	5 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	Room temperature
Vapour Pressure	11Pa
Liquid Mole Fraction	Extremely small
Activity Coefficient	1
Activity Emission Potential	
Activity Class	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Open surface 0.3 - 1 m^2
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	3000m^3
Risk Management Measures	
Localised Controls	
Primary	No localized controls (0.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal Enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	No RPE
Other Personal Protective Equipment	Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 21: Conditions of use of Worker Contributing Scenario 7

9.2.8.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 75th percentile full-shift exposure is 0.00024 mg/m^3.

The inter-quartile confidence interval is 0.00012 mg/m^3 to 0.00047 mg/m^3.

9.2.9 Worker Contributing Scenario 8 (WCS 8) Drying Components

This contributing scenario deals with the exposure of workers whilst drying of components following plating process to remove residual rinse water potentially containing a trace of hexavalent chromium, as described in paragraph 9.1.1.1.

9.2.9.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No.	1333-82-0
Scenario Details	
Number of activities	1
Total Duration	5 mins
Non-exposure period	0
Emissions	
Emission Sources	Near Field
Duration	5 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	Room temperature
Vapour Pressure	11Pa
Liquid Mole Fraction	Extremely small
Activity Coefficient	1
Activity Emission Potential	
Activity Class	Handling of contaminated objects
Situation	Activities with treated/contaminated objects (surface 0.3-1 m^2)
Contamination level	Contamination > 90 % of surface
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	

Work Area	Indoors
Room Size	3000m^3
Risk Management Measures	
Localised Controls	
Primary	No localized controls (0.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	No RPE
Other Personal Protective Equipment	Polysol Chemical Resistant Glove (TDS in Annex II) Safety glasses (approved according to EN 166) Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 22: Conditions of use of Worker Contributing Scenario 8

9.2.9.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.004 mg/m^3.

The 90% confidence interval is 0.00072 mg/m^3 to 0.028 mg/m^3.

9.2.10 Worker Contributing Scenario 9 (WCS 9) Discharge of Waste Solution

This contributing scenario deals with the exposure of workers whilst pumping out of process tank containing hexavalent chromium when solution needs changing, as described in paragraph 9.1.1.1.

9.2.10.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No.	1333-82-0
Scenario Details	
Number of activities	1
Total Duration	15 mins
Non-exposure period	0
Emissions	
Emission Sources	Far Field
Duration	15 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	Room temperature
Vapour Pressure	11Pa
Liquid Mole Fraction	Minor
Activity Coefficient	1
Activity Emission Potential	
Activity Class	Falling liquids
Situation	Transfer of liquid product with flow of 10 - 100 l/minute
Contamination level	Handling that reduces contact between product and adjacent air. Note: This does not include processes that are fully contained by localised controls (see next questions).
Loading type	Splash loading, where the liquid dispenser remains at the top of the reservoir and the liquid splashes freely
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	3000m^3
Risk Management Measures	
Localised Controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal enclosure	No personal enclosure (0.00 % reduction)
Dispersion	

Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	3M™ Maintenance-Free Reusable Half Mask (Technical Data Sheets (TDS) in Annex II)
Other Personal Protective Equipment	Face Visor (approved according to EN 166) Polysol Chemical Resistant Glove (TDS in Annex II) Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 23: Conditions of use of Worker Contributing Scenario 9

9.2.10.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0003 mg/m^3.

The 90% confidence interval is 0.000054 mg/m^3 to 0.0021 mg/m^3.

9.2.11 Worker Contributing Scenario 10 (WCS 10) Operators in Work Area Not Associated with Chrome Passivate Process

This contributing scenario deals with the exposure of various workers employed in the department completing tasks not associated with hexavalent chrome but in the vicinity of vat containing hexavalent chromium, as described in paragraph 9.1.1.1.

9.2.11.1 Conditions of Use

In this contributing scenario, exposure is estimated with the modelling approach of ART (Advanced REACH Tool) version 1.5.

Chemical Details	
Chemical	Chromium trioxide
CAS No.	1333-82-0
Scenario Details	
Number of activities	1

Total Duration	480 mins
Non-exposure period	0
Emissions	
Emission Sources	Far Field
Duration	480 mins
Operational Controls	
Substance Emission Potential	
Substance Product Type	Liquids
Process Temperature	Room temperature
Vapour Pressure	11Pa
Liquid Mole Fraction	Minor
Activity Coefficient	1
Activity Emission Potential	
Activity Class	Activities with agitated surfaces
Situation	Open surface 0.3 - 1 m^2
Surface Contamination	
Process Fully Enclosed?	No
Effective Housekeeping Practices in Place?	Yes
Dispersion	
Work Area	Indoors
Room Size	3000m^3
Risk Management Measures	
Localised Controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)
Personal Protective Equipment	
Respiratory Protective Equipment (RPE)	No RPE
Other Personal Protective Equipment	Safety glasses (approved according to EN 166) Safety footwear (approved according to EN ISO 20345)
Version of the modelling tool: ART (Advanced REACH Tool) version 1.5	

Table 24: Conditions of use of Worker Contributing Scenario 10

9.2.11.2 Predicted Exposure Levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE is considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0034 mg/m^3.

The 90% confidence interval is 0.0006 mg/m^3 to 0.023 mg/m^3.

9.3 Exposure Scenario 2 for Consumers:

This section is not relevant since no consumers will use the final manufactured articles because these are high technology equipment and they are not intended to be used by consumers. Only professional workers use the treated connector parts.

Considering that there is no liquid form of the mixture of hexavalent chromium remaining on the article, there is no possibility of exposure to hexavalent chromium via inhalation route.

Considering that:

- the remaining hexavalent chromium on the article is included into a matrix composed of the formation of oxidized surface of the article.

- the thick layer of this matrix is in the order of magnitude of micrometre.

- the remaining hexavalent chromium is lower than 0.01% for each article.

The cutaneous route of exposure is considered negligible.

Furthermore, as indicated by RAC, there is no data to indicate that dermal exposure to Cr (VI) compounds presents a cancer risk to humans. NIOSH reports that some data indicates that CrVI is reduced prior to systemic uptake (Corbett GE et al. 1997; Liu KJ et al. 1997).

The cancer risk to workers via dermal route in the case of the use of connectors produced is therefore considered negligible.

10 Risk Characterisation Related to Combined Exposure

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

This CSR analyses only hexavalent chromium exposure at the workplace for an industrial use. There is no possibility of exposure for professional use. The risk characterisation is performed for the Abercynon site for the Authorised use of the substance.

The risk characterisation presented in this section focuses on the inhalation exposure.

10.1.1 Workers

Two different common assumptions are made in order to estimate the frequencies of exposure during one typical year. The plating shop is considered open during 1 week per year. Each individual employee only works 44 weeks a year. Each worker working with the solutions is issued with overalls that are cleaned by an external industrial cleaning company after use. Each worker is also issued with a locker to store their Personal Protective Equipment (PPE).

The distribution of workers' tasks involves the worker contributing scenarios,

- WCS 1 Initial Make Up of Solution
- WCS 2 Dipping Connector Parts into Passivate
- WCS 3 Sampling Vat for Analysis
- WCS 4 Lab Analysis
- WCS 5 Decanting of Chemical
- WCS 6 Making Additions to Vat Based on Analysis (Maintenance)
- WCS 7 Dipping Parts into Rinse Water After Passivation
- WCS 8 Drying of Components
- WCS 9 Discharge of Waste Solution
- WCS 10 Operators in Work Area Not Associated with Chrome Passivate Process

10.1.2 Exposure Estimations for Workers

The exposures are presented as follows:

	Time / Frequency

Worker Contribution Scenario (WCS)	Duration of the task	Frequency (for 12 workers of the plating shop)	Frequency (for 1 of the workers of the plating shop)
WCS 1 Initial Make Up of Solution	30 mins	1 per day	(1*5*44)/12 per year
WCS 2 Dipping Connector Parts into Passivate	60 mins	1 per day	(1*5*44)/12 per year
WCS 3 Sampling Vat for Analysis	2 mins	1 per day	(1*5*44)/12 per year
WCS 4 Lab Analysis	10 mins	1 per day	(1*5*44)/12 per year
WCS 5 Decanting of Chemical	5 mins	1 per day	(1*5*44)/12 per year
WCS 6 Making Additions to Vat Based on Analysis (Maintenance)	10 mins	1 per day	(1*5*44)/12 per year
WCS 7 Dipping Parts into Rinse Water After Passivation	5 mins	1 per day	(1*5*44)/12 per year
WCS 8 Drying of Components	5 mins	1 per day	(1*5*44)/12 per year
WCS 9 Discharge of Waste Solution	15 mins	1 per day	(1*5*44)/12 per year
WCS 10 Operators in Work Area Not Associated with Chrome Passivate Process	480 mins	1*44 per year / worker	(1*5*44)/12 per year

Table 25: Exposure Estimations for Workers

10.1.3 Comparison Between Modelling and Monitoring

Air monitoring is carried out at the Abercynon site, and this includes the monitoring of chromium. Static monitoring has been carried out by external body. External sampling involved placement of static pump in various locations; adjacent to the passivate tanks (containing hexavalent chromium chemistry). Operator worn pumps have also been used to monitor personal samples. These are attached to the operator(s) for several hours as they carry out their various tasks, specifically:

- Dipping Connector Parts into Passivate
- Dipping Parts into Rinse Water After Passivation
- Drying of Components

- Operators in Work Area Not Associated with Chrome Passivate Process

The measured and modelled exposures are as follows:

Monitoring Results mg/m³		**Modelling Results mg/m³**	
Static measurement adjacent to bath (258 mins)	0.00029	Operators in Work Area Not Associated with Chrome Passivate Process	0.0034
Personal measurement (296 mins)	0.00024	Dipping Connector Parts into Passivate	0.0033
		Dipping Parts into Rinse Water After Passivation	0.00024
		Drying of Components	0.004

Table 26: Measured and modelled results

Samples for the monitoring results above were collected by drawing air at 2 litres/minute through a NaOH treated filter housed in a SKC IOM sampling head. The sampling head was connected to a sampling pump with appropriate tubing. For personal monitoring, the sampling head was mounted in the worker's breathing zone, e.g. on his/her lapel. Following exposure, the filters were analysed via Colorimetry. The measurements are similar, but slightly lower than the modelling results.

10.1.4 Risk Characterisation

As discussed previously in chapter 9.1.2.3, the risk characterisation will be based on the RAC/27/2013/0 Rev.1, which establishes a reference dose response relationship for the carcinogenicity of hexavalent chromium.

Excess of lung cancer risk: $4*10^{-3}$ per µg Cr (VI)/m^3 based on a 40-year working life (8h/day, 220 days per year).

Moreover, and since chromium exposures are due to the volatility of a liquid mixture, we estimated the cancer risk mainly for lung cancer and maximised the excess of cancer risk without considering the risk for small intestine cancer.

Based on all of this information, the tables below show the calculation of the excess risk for lung cancer weighted by the working conditions on the industrial site.

Weighted excess risk of lung cancer	Value
Excess risk of lung cancer. per µg/m3 of Cr (VI) based on 40 working years. 220 days per year. 8h per day (RAC 2013)	$4x10^{-3}$
Excess risk of lung cancer. per µg/m3 of Cr (VI) based on 1 working year. 220 days per year. 8h per day	$1x10^{-4}$
Excess risk of lung cancer. per µg/m3 of Cr (VI) based on 4 working years. 220 days per year. 8h per day	$4x10^{-4}$
Excess risk of lung cancer. per µg/m3 of Cr (VI) based on 7 working years. 220 days per year. 8h per day	$7x10^{-4}$
Excess risk of lung cancer. per µg/m3 of Cr (VI) based on 12 working years. 220 days per year. 8h per day	$1.2x10^{-3}$

Table 27: Excess risk of lung cancer calculation

Considering the data presented in the above table and the exposure estimations based on the modelling approach, the excess risks are calculated in the following tables.

In the following sections the global exposure and risks are considered. It has to be stressed that the average of exposure is calculated by taking into account the respiratory protective equipment (RPE) if it is used as indicated in the previous sections.

The raw exposure estimations considered for each contributing scenario are summarised in the following table:

Contributing Scenario	Raw exposure without RPE ($µg.m^{-3}$)	Raw exposure with RPE ($µg.m^{-3}$)
WCS 1 Initial Make Up of Solution	0.3	0.03
WCS 2 Dipping Connector Parts into Passivate	3.3	No RPE used
WCS 3 Sampling Vat for Analysis	0.18	0.018
WCS 4 Lab Analysis	35.0	No RPE used
WCS 5 Decanting of Chemical	3.3	0.33
WCS 6 Making Additions to Vat Based on Analysis (Maintenance)	33.0	3.3
WCS 7 Dipping Parts into Rinse Water After Passivation	0.24	No RPE used
WCS 8 Drying of Components	4.0	No RPE used
WCS 9 Discharge of Waste Solution	0.3	0.03
WCS 10 Operators in Work Area Not Associated with Chrome Passivate Process	3.4	No RPE used

Table 28: Summary of the raw exposures (modelled concentrations)

10.1.4.1 General conclusion

All the individual excess of risk for all the workers involved in the operations using hexavalent chromium as described in this CSR does not exceed the order of magnitude of 10^{-5}.

The decision point for "acceptable" lifetime (i.e., a working life of 40 years) cancer risk levels used for individual risk levels for workers are generally around 10^{-5} but higher or lower levels have been considered to be tolerable under certain circumstances[10].

Workers in the Plating Shop		
Average of exposure ($\mu g.m^{-3}$)	Individual excess risk of lung cancer ($\mu g.m^{-3}$)	Total excess risk of lung cancer ($\mu g.m^{-3}$)
4.9648	0.0200	0.1986

10.1.5 Analysis of uncertainties and improvement of management

The exposures considered in this CSR are based on several hypotheses. They were made in order to respect a conservative approach and consequently, led to an overestimation of the exposure.

They mainly concern the following items:

1) Definition of the APF:

The applicant made the choice to tie in with a precautionary approach by using an APF of 10 for all the RPE used.

2) Modelling approach

All measurements performed on site and presented in this CSR show lower values than the modelling estimations. Consequently, modelling estimations are considered as the maximum level of exposures at the workplace. Even if the modelling approach is demonstrated to be an over estimation, the applicant made the choice to use this approach in order to be sure that the assessment is covering all the tasks involved in the use of hexavalent chromium.

[10] ECHA Guidance on information requirements and chemical safety assessment, chapter R8, Appendix R. 8-14 page 141. R8, Appendix R. 8-14 page 140

3) Inputs for modelling

The inputs used for modelling cannot be strictly representative of the realistic use performed on site. In order to be completely transparent, for all the contributing scenarios, the inputs used are compared to the condition of use on site in tables 15 to 24 in 9.2. All the inputs have been chosen in order not to over-estimate the exposure estimation for each contributing scenario and to consider the worst-case scenario. Consequently, the inputs for each contributing scenarios are the worst inputs to be considered and thus lead to an over-estimation.

4) Duration of tasks and frequency used

The duration and the frequencies of the tasks were considered by taking into account the maximum possible increase of activity presented in accordance with the tonnage estimation. It does not probably reflect the exact frequencies and duration involved during the review period, but the applicant made the choice to present the maximum realistic estimation in order to cover potential future activities.

Hence, the excess risk previously presented can be considered as the maximum consideration, taking into account all uncertainties.

Furthermore, the compliance with the operating conditions described in this CSR will be periodically controlled and the efficiency of the risk management measures (mainly ventilations and RPE) will be regularly verified according to a written procedure for the site. New protective equipment is available for all workers in order to maintain the possibility to change them easily.

All workers involved are made aware of the best practices of work to ensure that the level of exposure is as low as possible. They are also trained adequately to the identification of the hazardous substances and associated practices through a formal education procedure.

The applicant will furthermore perform measurements adapted to the contributing scenarios in order to confirm that the measured level of exposure will be lower than the levels estimated in this CSR by modelling approach. Consequently, measurement at the workplace will be regularly performed in order to verify the main raw exposures estimated with the modelling approach.

11 References

ECHA (European Chemicals Agency), *Guidance on information requirements and chemical safety assessment. Chapter R14: Occupational exposure estimation*. 2012; Version 2.1; Ref ECHA-2010-G-09-EN
http://echa.europa.eu/documents/10162/13632/information_requirements_r14_en.pdf

European Union Risk Assessment Report on hexavalent chromium substances (Volume 53 3rd priority list)
https://echa.europa.eu/documents/10162/3be377f2-cb05-455f-b620-af3cbe2d570b

INERIS - Fiche de données toxicologiques et environnementales du chrome et de ses dérivés
https://substances.ineris.fr/fr/substance/getDocument/2739

EPA Ground Water Issue, Natural Attenuation of Hexavalent Chromium in Groundwater and Soils, EPA154015-941505, 1994
https://www.epa.gov/remedytech/natural-attenuation-hexavalent-chromium-groundwater-and-soils

EU RAR (European Union Risk Assessment Report); *Chromium trioxide, Sodium chromate, sodium dichromate, ammonium dichromate and potassium dichromate Risk Assessment.* 3rd priority list volume 53. 2005
http://echa.europa.eu/documents/10162/3be377f2-cb05-455f-b620-af3cbe2d570b

Technical Guidance Document on risk assessment, part II about environmental risk assessment. 2003 Doury et al., Abaques d'evaluation directe des transferts atmospheriques d'effluents gazeux. 1980.
https://inis.iaea.org/collection/NCLCollectionStore/_Public/19/017/19017287.pdf

National Institute for Occupational Safety and Health, Occupational Safety and Health Administration Request for information Occupational Exposure to Hexavalent Chromium (CrVI); September 2013
2013_128.pdf

ECHA Guidance on information requirements and chemical safety assessment, chapter R8, Appendix R. 8-14 page 141. R8, Appendix R. 8-14 page 140
https://echa.europa.eu/

Annex

Annex I Advanced Reach Tool (ART) Reports

The version of the modelling tool: ART (Advanced REACH Tool) version 1.5

Annex I.I ART Report - Initial Make Up of Solution

ART REPORT – Initial make up of solution – 06-Feb-25

Making up of new process solution

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0
Scenario details	
Number of activities	1
Total duration (mins)	30
Nonexposure period (mins)	0
Metadata	
ART version	1.5
Creator	
Date created	06-Feb-25
Date last edited	01-Jan-01

Details for Activity Solution Make up from new

Emission sources:	Near field	Duration (mins):	30
	Far field ✓		

Far-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	Room temperature
Vapour pressure	11 Pa
Liquid mole fraction	Minor
Activity coefficient	1
Activity emission potential	
Activity class	Falling liquids
Situation	Transfer of liquid product with flow of 1 - 10 l/minute
Containment level	Open process
Loading type	Splash loading, where the liquid dispenser remains at the top of the reservoir and the liquid splashes freely
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m³

Risk Management Measures

Localised controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0003 mg/m³.

The 90% confidence interval is 0.000055 mg/m³ to 0.0021 mg/m³.

Annex I.II ART Report - Dipping Connector Parts into Passivate

ART REPORT – Dipping connector parts into passivate – 12-Feb-25

parts immersed in passivate solution to achieve required surface finish

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0

Scenario details	
Number of activities	1
Total duration (mins)	60
Nonexposure period (mins)	0

Metadata	
ART version	1.5
Creator	
Date created	12-Feb-25
Date last edited	01-Jan-01

Details for Activity dipping parts into passivate solution

Emission sources: Near field
Far field ✓

Duration (mins): 60

Far-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	Room temperature
Vapour pressure	11 Pa
Liquid mole fraction	Minor
Activity coefficient	1
Activity emission potential	
Activity class	Activities with agitated surfaces
Situation	Open surface 0.3 - 1 m²
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m³

Risk Management Measures

Localised controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0033 mg/m³.

The inter-quartile confidence interval is 0.0016 mg/m³ to 0.007 mg/m³.

Annex I.III ART Report - Sampling Vat for Analysis

ART REPORT – Sampling bath for analysis – 06-Feb-25

A small amount (typically 100 ml) of the mixture is taken from the process vat in order to perform a titration to determine the Chrome level

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0
Scenario details	
Number of activities	1
Total duration (mins)	2
Nonexposure period (mins)	0
Metadata	
ART version	1.5
Creator	
Date created	06-Feb-25
Date last edited	01-Jan-01

Details for Activity (untitled)sampling

Emission sources: Near field ✓ Far field

Duration (mins): 2

Near-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	298 K
Vapour pressure	11 Pa
Liquid mole fraction	Minor
Activity coefficient	1
Activity emission potential	
Activity class	Falling liquids
Situation	Transfer of liquid product with flow of < 0.1 l/minute
Containment level	Handling that reduces contact between product and adjacent air. Note: This does not include processes that are fully contained by localised controls (see next questions).
Loading type	Splash loading, where the liquid dispenser remains at the top of the reservoir and the liquid splashes freely
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m³

Risk Management Measures

Localised controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 75th percentile full-shift exposure is 0.00018 mg/m³.

The inter-quartile confidence interval is 0.000089 mg/m³ to 0.00035 mg/m³.

Annex I.IV ART Report - Lab Analysis

ART REPORT – Lab Analysis – 06-Feb-25

Titration of sample to determine Chrome content

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0

Scenario details	
Number of activities	1
Total duration (mins)	10
Nonexposure period (mins)	0

Metadata	
ART version	1.5
Creator	
Date created	06-Feb-25
Date last edited	01-Jan-01

Details for Activity Volumetric Analysis

Emission sources: Near field ✓ Duration (mins): 10

Far field

Near-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	293 K
Vapour pressure	11 Pa
Liquid mole fraction	Minor
Activity coefficient	1
Activity emission potential	
Activity class	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Open surface < 0.1 m²
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	100 m³

Risk Management Measures

Localised controls	
Primary	No localized controls (0.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	Only good natural ventilation

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 75th percentile full-shift exposure is 0.035 mg/m³.

The inter-quartile confidence interval is 0.018 mg/m³ to 0.068 mg/m³.

Annex I.V ART Report - Decanting of Chemical

ART REPORT – Decanting of Chemical – 06-Feb-25

Transferring chemical from 25l drum to 2l jug for additions

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0

Scenario details	
Number of activities	1
Total duration (mins)	5
Nonexposure period (mins)	0

Metadata	
ART version	1.5
Creator	
Date created	06-Feb-25
Date last edited	01-Jan-01

Details for Activity Transfer of chemicals to jug

Emission sources: Near field ✓ Duration (mins): 5

Far field

Near-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	293 K
Vapour pressure	11 Pa
Liquid mole fraction	Minor
Activity coefficient	1
Activity emission potential	
Activity class	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Open surface 0.1 – 0.3 m²
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m³

Risk Management Measures

Localised controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0033 mg/m³.

The 90% confidence interval is 0.0006 mg/m³ to 0.023 mg/m³.

Annex I.VI ART Report - Making Additions to Vat Based on Analysis (Maintenance)

ART REPORT – Making additions to vat based on analysis – 06-Feb-25

Making up process solution to optimum operating level based on analysis of solution

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0
Scenario details	
Number of activities	1
Total duration (mins)	10
Nonexposure period (mins)	0
Metadata	
ART version	1.5
Creator	
Date created	06-Feb-25
Date last edited	01-Jan-01

Details for Activity additions of chemicals to process tank

Emission sources: Near field ✓ Duration (mins): 10

Far field

Near-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	Room temperature
Vapour pressure	11 Pa
Liquid mole fraction	Minor
Activity coefficient	1
Activity emission potential	
Activity class	Activities with agitated surfaces
Situation	Open surface 0.3 - 1 m²
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m³

Risk Management Measures

Localised controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.033 mg/m³.

The 90% confidence interval is 0.0059 mg/m³ to 0.23 mg/m³.

Annex I.VII ART Report - Dipping Parts into Rinse Water After Passivation

ART REPORT – Dipping parts into rinse water after passivation – 12-Feb-25

Parts dipped into water rinse to remove residual chemicals from passivate

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0
Scenario details	
Number of activities	1
Total duration (mins)	5
Nonexposure period (mins)	0
Metadata	
ART version	1.5
Creator	
Date created	12-Feb-25
Date last edited	01-Jan-01

Details for Activity Rinsing of parts after passivation

Emission sources: Near field
Far field ✓

Duration (mins): 5

Far-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	Room temperature
Vapour pressure	11 Pa
Liquid mole fraction	Extremely small
Activity coefficient	1
Activity emission potential	
Activity class	Activities with relatively undisturbed surfaces (no aerosol formation)
Situation	Open surface 0.3 - 1 m²
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m³

Risk Management Measures

Localised controls	
Primary	No localized controls (0.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 75th percentile full-shift exposure is 0.00024 mg/m³.

The inter-quartile confidence interval is 0.00012 mg/m³ to 0.00047 mg/m³.

Annex I.VIII ART Report - Drying of Components

ART REPORT – drying of components – 06-Feb-25

Drying of components following plating process

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0

Scenario details	
Number of activities	1
Total duration (mins)	5
Nonexposure period (mins)	0

Metadata	
ART version	1.5
Creator	
Date created	06-Feb-25
Date last edited	01-Jan-01

Details for Activity (untitled)

Emission sources: Near field ✓ Duration (mins): 5

Far field

Near-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	Room temperature
Vapour pressure	11 Pa
Liquid mole fraction	Extremely small
Activity coefficient	1
Activity emission potential	
Activity class	Handling of contaminated objects
Situation	Activities with treated/contaminated objects (surface 0.3-1 m²)
Contamination level	Contamination > 90 % of surface
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m³

Risk Management Measures

Localised controls	
Primary	No localized controls (0.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.004 mg/m³.

The 90% confidence interval is 0.00072 mg/m³ to 0.028 mg/m³.

Annex I.IX ART Report - Discharge of Waste Solution

ART REPORT – Discharge of waste solution – 06-Feb-25

Pumping out of process tank when solution needs changing

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0

Scenario details	
Number of activities	1
Total duration (mins)	15
Nonexposure period (mins)	0

Metadata	
ART version	1.5
Creator	
Date created	06-Feb-25
Date last edited	01-Jan-01

Details for Activity Pumping out of used solution

Emission sources: Near field

Far field ✓

Duration (mins): 15

Far-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	Room temperature
Vapour pressure	11 Pa
Liquid mole fraction	Minor
Activity coefficient	1
Activity emission potential	
Activity class	Falling liquids
Situation	Transfer of liquid product with flow of 10 - 100 l/minute
Containment level	Handling that reduces contact between product and adjacent air. Note: This does not include processes that are fully contained by localised controls (see next questions).
Loading type	Splash loading, where the liquid dispenser remains at the top of the reservoir and the liquid splashes freely
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m³

Risk Management Measures

Localised controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

Predicted exposure levels

ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

Mechanistic model results

The predicted 90th percentile full-shift exposure is 0.0003 mg/m³.

The 90% confidence interval is 0.000054 mg/m³ to 0.0021 mg/m³.

Annex I.X ART Report - Operators in Work Area Not Associated with Chrome Passivate Process

ART REPORT – Operators in work area not associated with chrome passivate process – 10-Feb-25

Various operators employed in the department completing tasks not associated with hexavalent chrome

Chemical details	
Chemical	Chromium Trioxide
CAS No.	1333-82-0
Scenario details	
Number of activities	1
Total duration (mins)	480
Nonexposure period (mins)	0
Metadata	
ART version	1.5
Creator	
Date created	10-Feb-25
Date last edited	01-Jan-01

Details for Activity Other operators working in department not associated directly with hexavalent chrome process

Emission sources: Near field

Far field ✓

Duration (mins): 480

Far-field exposure

Operational Conditions

Substance emission potential	
Substance product type	Liquids
Process temperature	Room temperature
Vapour pressure	11 Pa
Liquid mole fraction	Minor
Activity coefficient	1
Activity emission potential	
Activity class	Activities with agitated surfaces
Situation	Open surface 0.3 - 1 m^2
Surface contamination	
Process fully enclosed?	No
Effective housekeeping practices in place?	Yes
Dispersion	
Work area	Indoors
Room size	3000 m^3

Risk Management Measures

Localised controls	
Primary	Fixed capturing hood (90.00 % reduction)
Secondary	No localized controls (0.00 % reduction)
Segregation	No segregation (0.00 % reduction)
Personal enclosure	No personal enclosure (0.00 % reduction)
Dispersion	
Ventilation rate	3 air changes per hour (ACH)

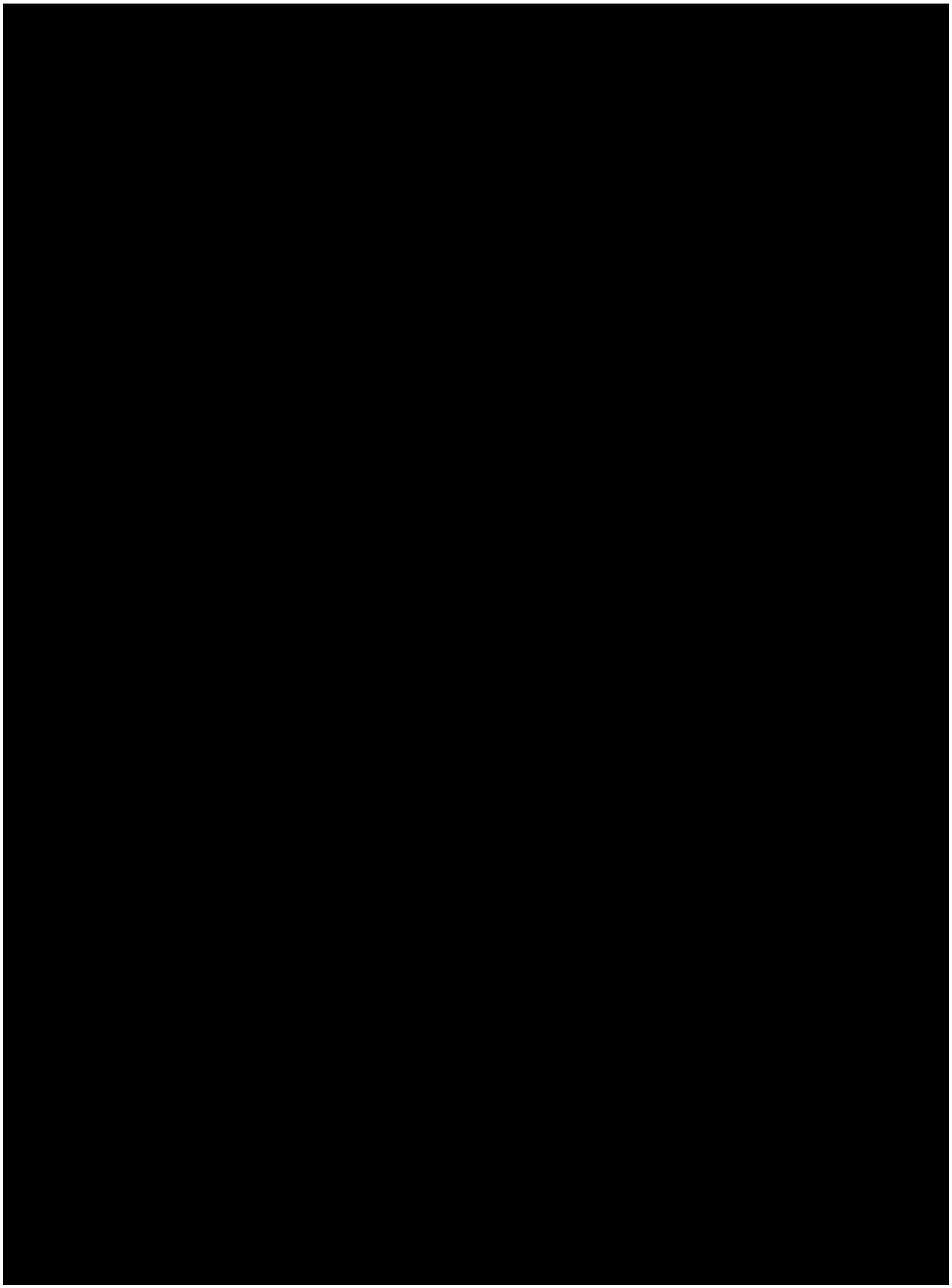
Predicted exposure levels

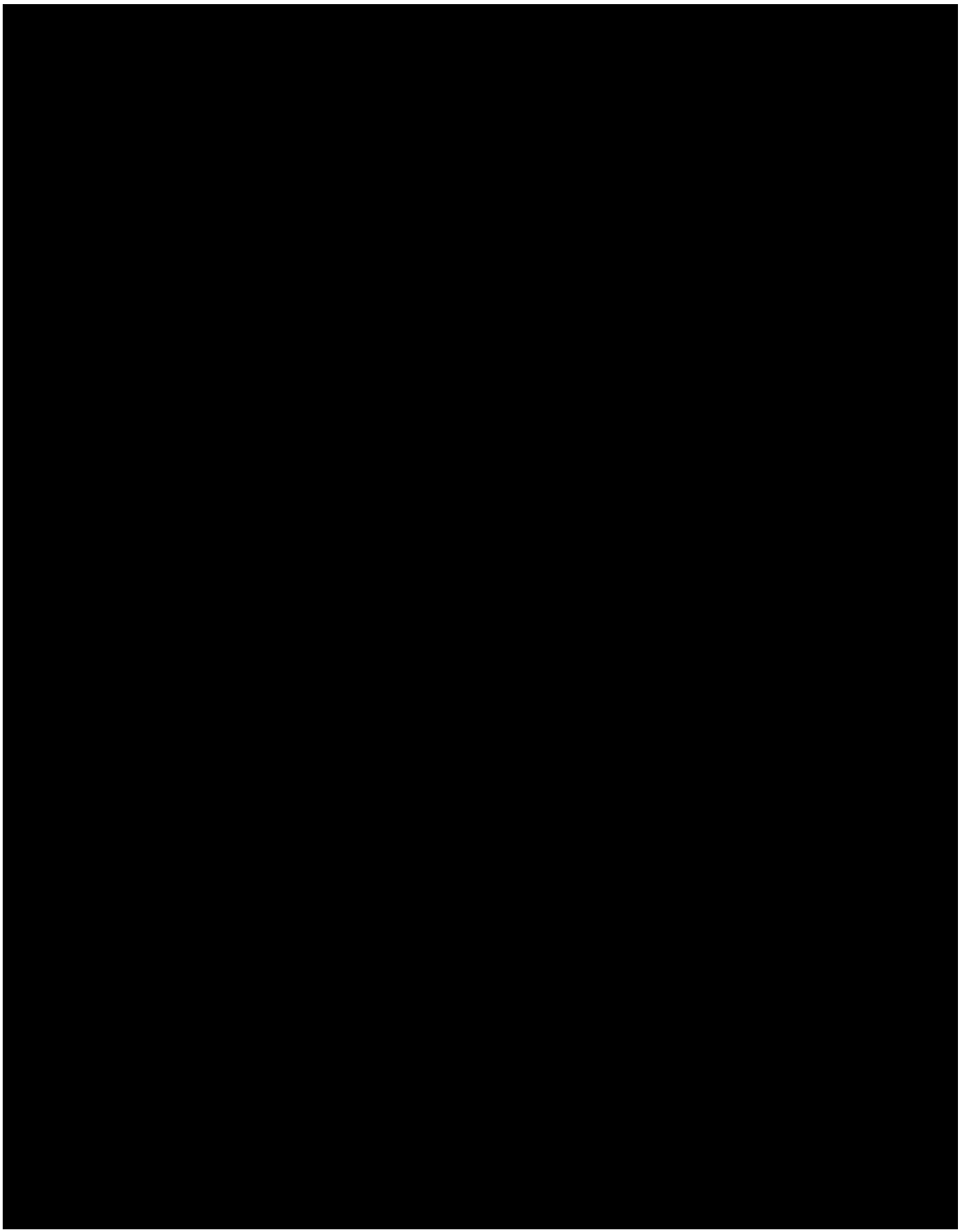
ART predicts air concentrations in a worker's personal breathing zone outside of any Respiratory Protection Equipment (RPE). The use of RPE must be considered separately.

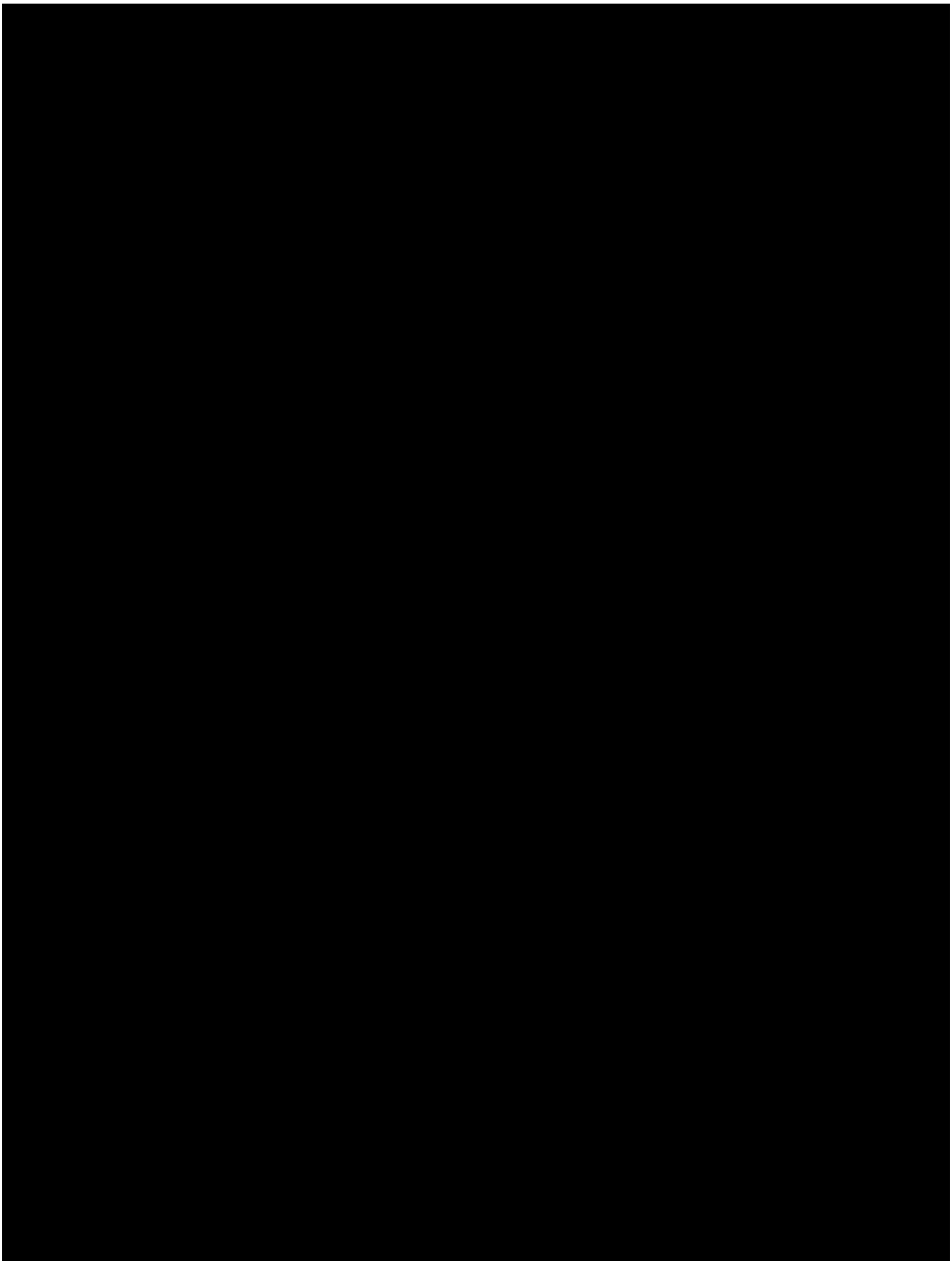
Mechanistic model results

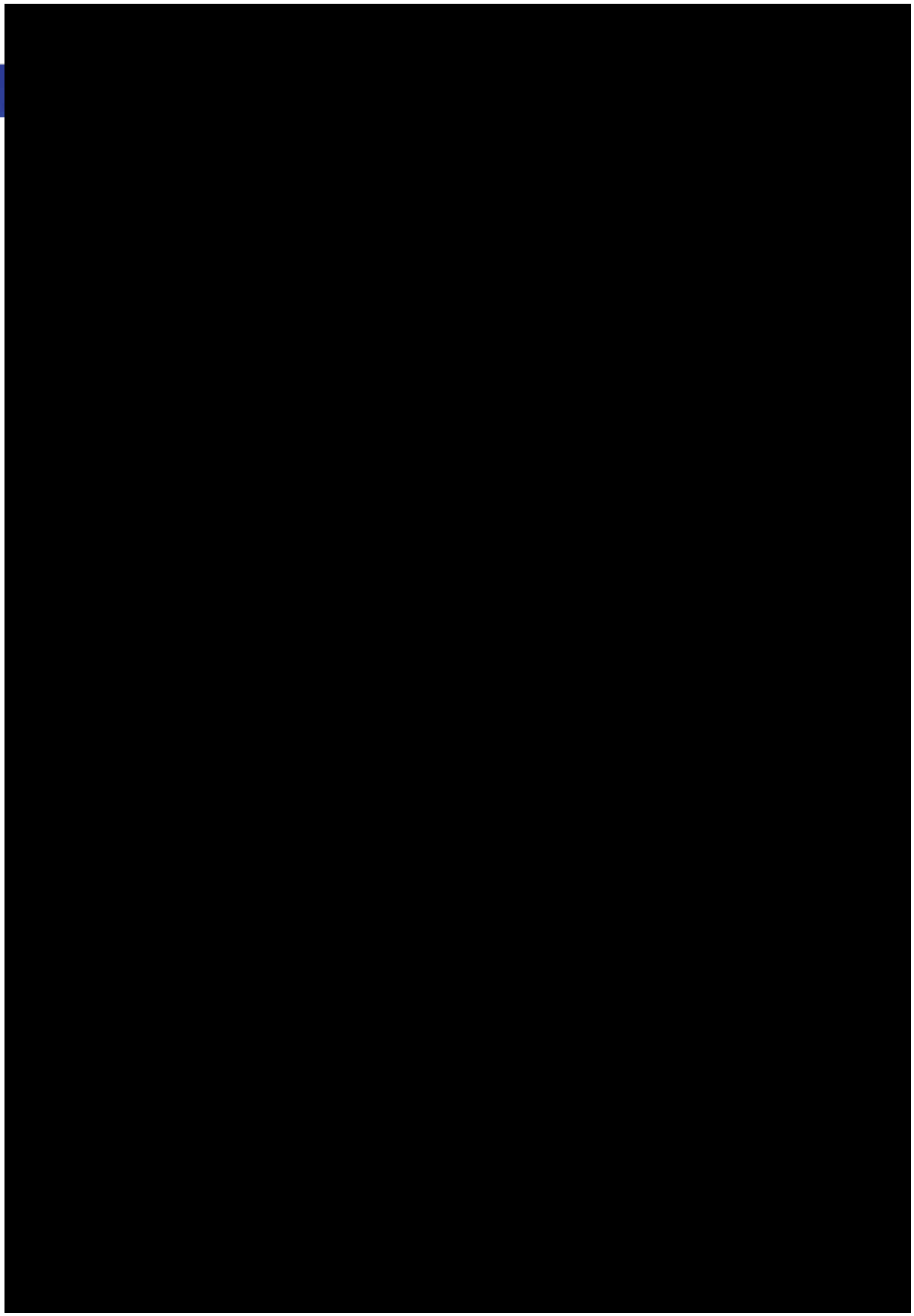
The predicted 90th percentile full-shift exposure is 0.0034 mg/m^3.

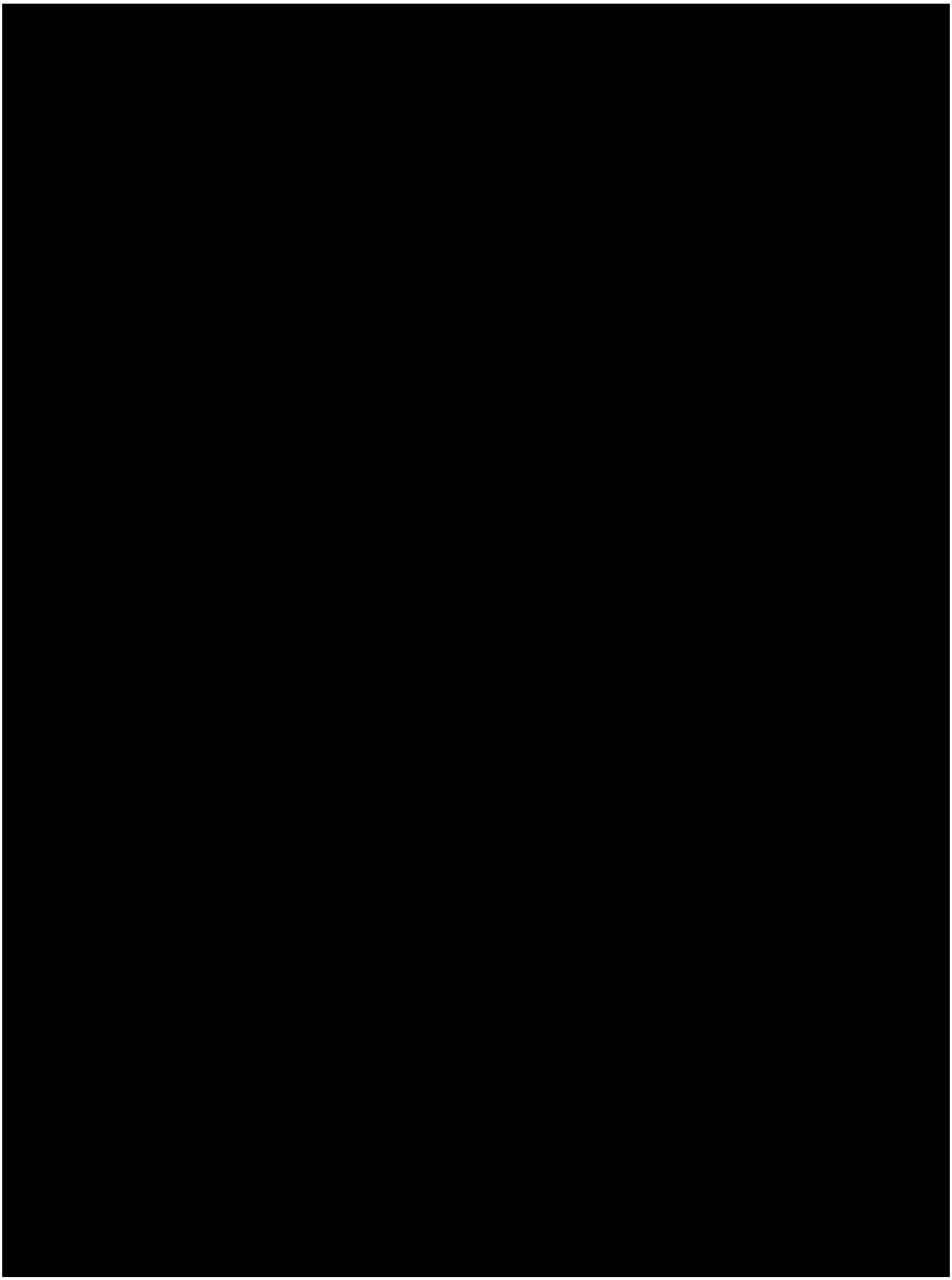
The 90% confidence interval is 0.0006 mg/m^3 to 0.023 mg/m^3.

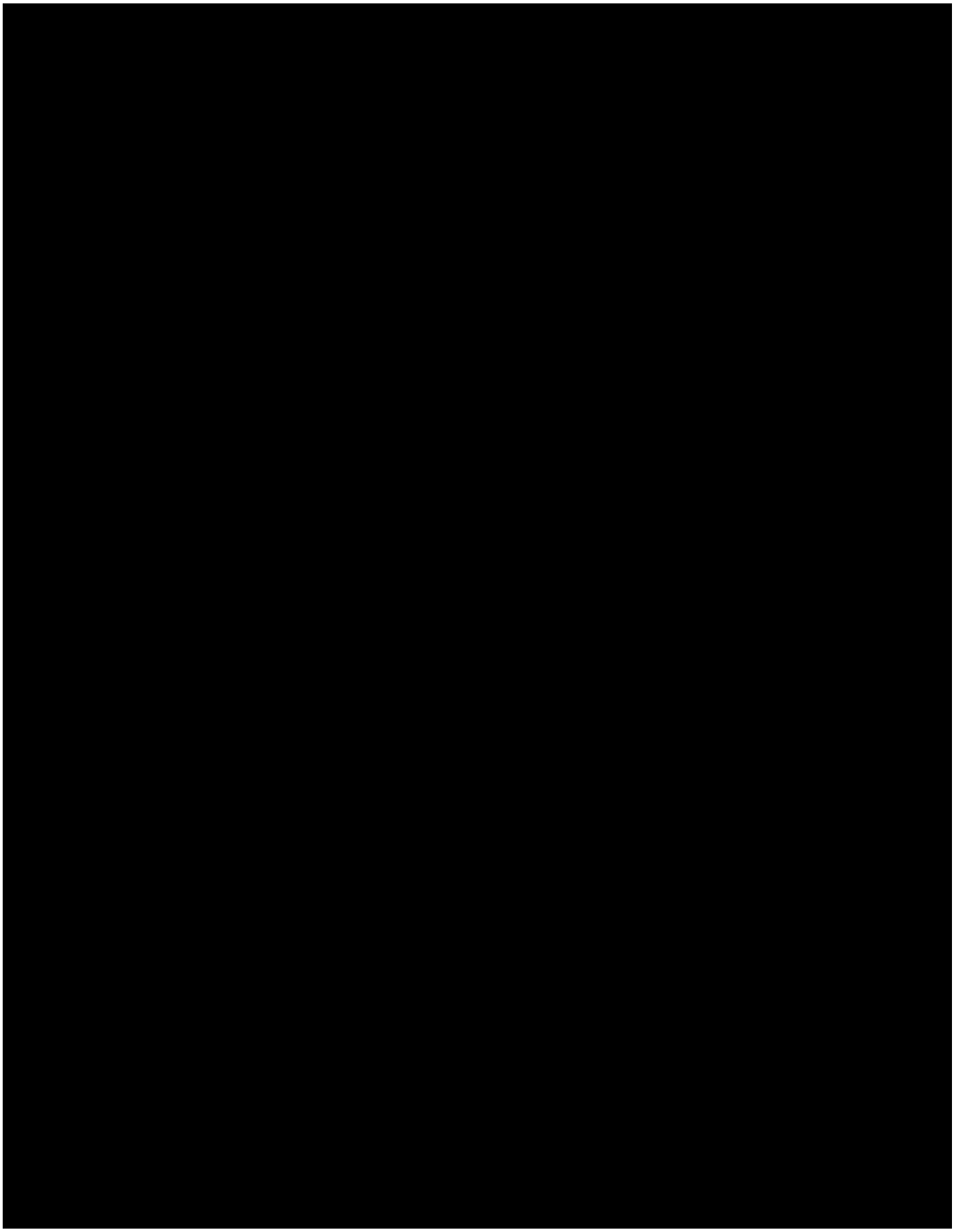


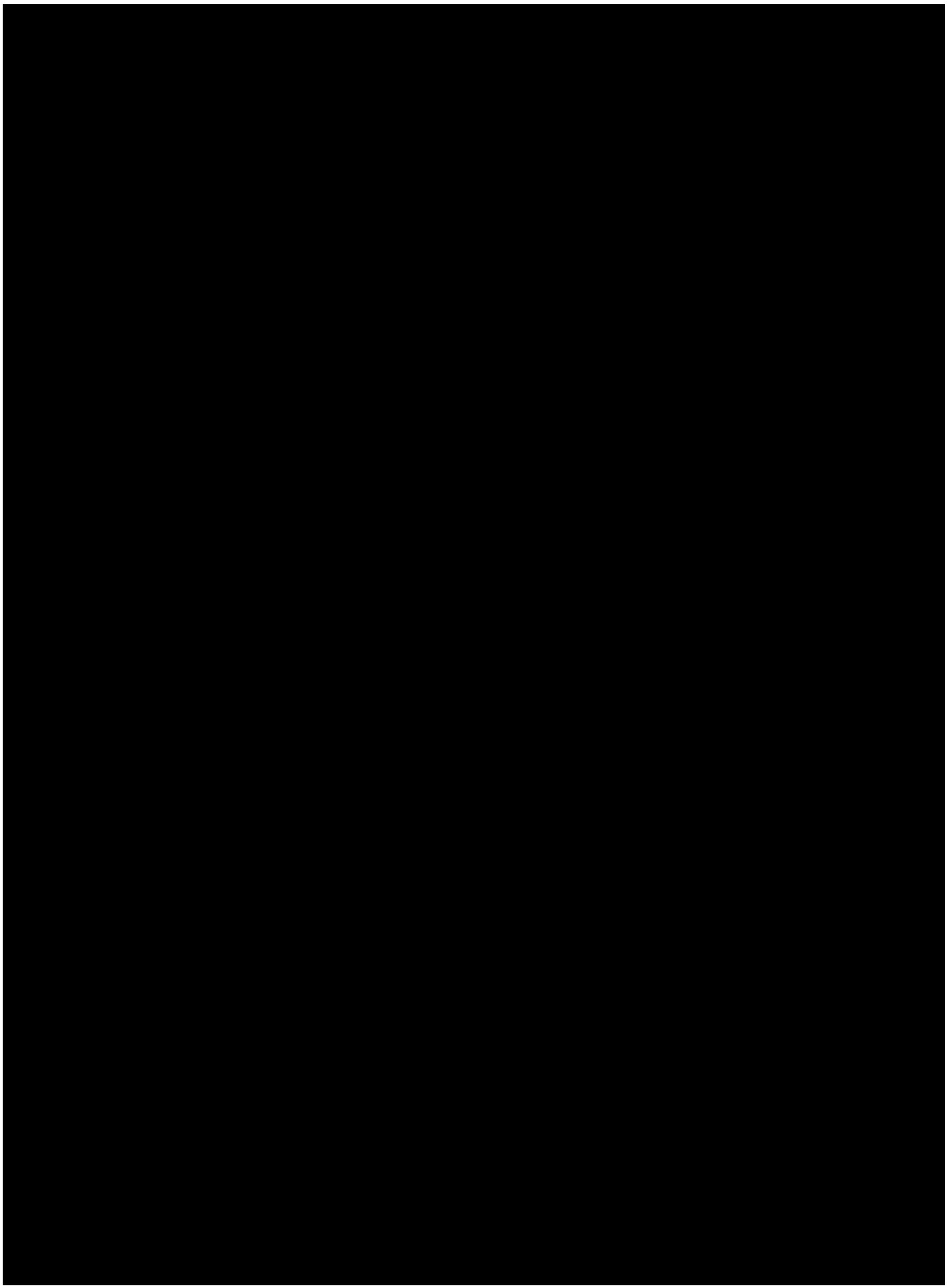


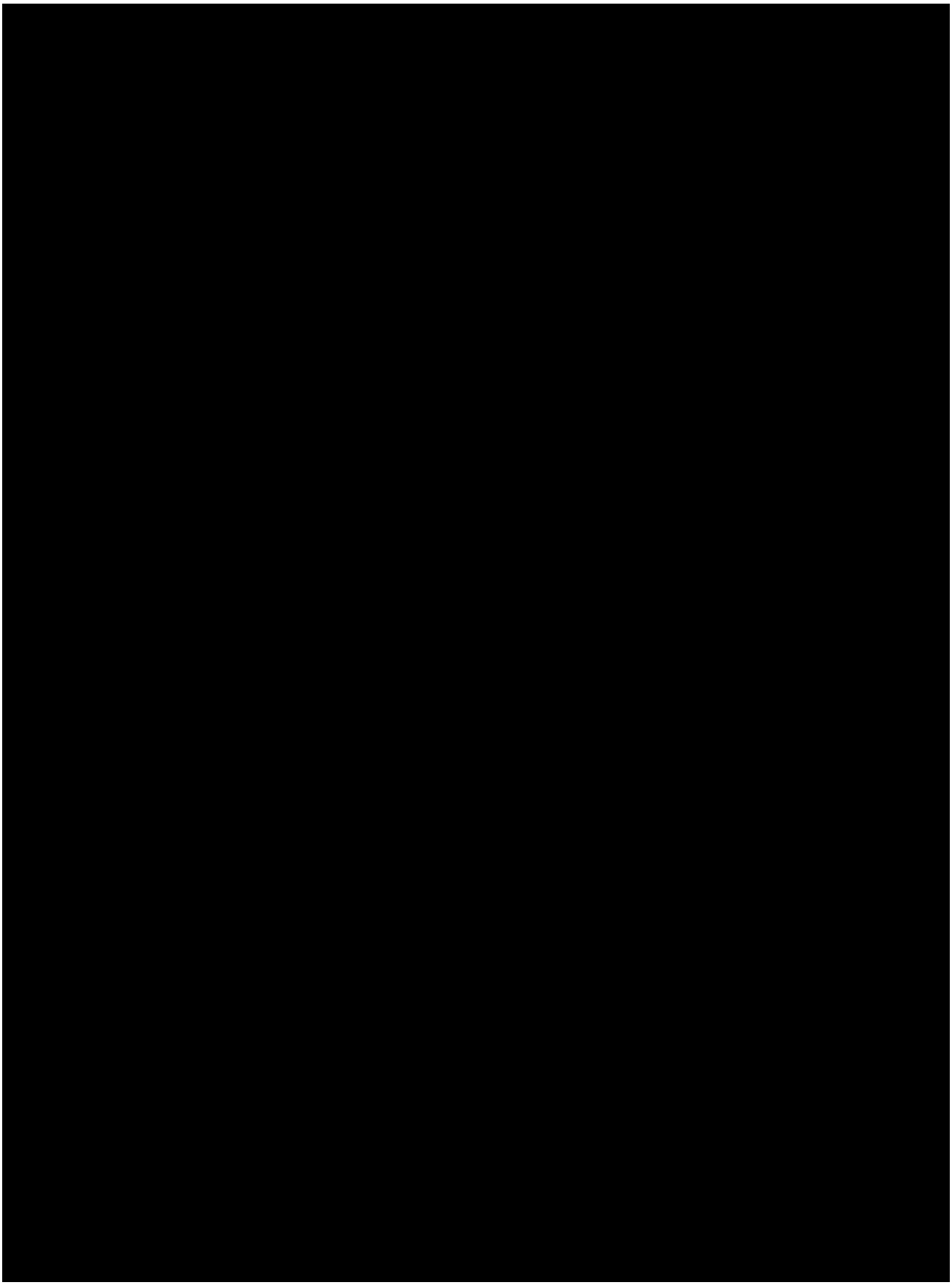












Annex III LEV Test Results (Survey October 2024)

REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 Plant Code: D04F11 Previous Report: 031023-004-0071EMO
Site: 00005 Schedule: D0070 Date Issued: 26 Oct 2024
Report Number: 261024-006-0076EMO LEV3A

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3a. Identification of LEV plant	Fume Extraction Plant Line1 Plant No.:- LEV2
3b. Is this unchanged from initial record?	No initial records or commissioning reports available.
4. Location of LEV plant	Dipping and Plating Shop
5a. Identification of process	De-greasing of components.
5b. Is this unchanged from initial record?	No initial records or commissioning reports available.
6a. Hazardous substance(s)	See Plant Report Continuation
6b. Is this unchanged from initial record?	See Plant Report Continuation
7. Regulations applicable	Control of Substances Hazardous to Health Regulations 2002: Reg. 9
8. Condition at time of examination and test	Normal operation.
9. Does the LEV control the hazardous substance(s)?	Observational methods confirm visual control of the hazardous substance(s).
10. Method used to make judgment at 9 above (e.g. visual, air flow, static pressure, etc)	Visual, airflow & smoke test.
11. Condition of filter(s)	Fully enclosed, no access.
12. Are the elements of the LEV plant in good working order?	Yes
13. Repairs/modifications required to ensure the LEV plant effectively controls the hazardous substance(s)	None.
14. Intended operating performance	See Plant Report Continuation
15. Observations/notes	See Plant Report Continuation

Number of extraction points: 13 Number to be used at any one time: 10

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 24 Oct 2024 Date of Last Examination: 28 Sep 2023

Competent Person: Date of Next Examination: 24 Oct 2025

Signature: #11 Qualification: Engineer Surveyor

HSB Engineering Insurance Services Limited
Registered in England and Wales: 03010292
Chancery Place, 50 Brown Street, Manchester M2 2JT
Registered as a branch in Ireland: 906105
28 Windsor Place, Lower Pembroke Street, Dublin 2

Telephone: 0845 345 5510
HSB Engineering Insurance Services Limited
is accredited by the United Kingdom
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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 Plant Code: D04F11 Previous Report: 031023-004-0071EMO
Site: 00005 Schedule: D0070 Date Issued: 26 Oct 2024
Report Number: 261024-007-0076EMO LEV3B

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SP
3. Identification of LEV plant	Fume Extraction Plant Line1 Plant No.:- LEV2

Test Point	Static Pressure (Pa)	Face Dimensions (mm)	Duct Dimensions (mm)	Area (m^2)	Capture Velocity (m/s)	Face Velocity (m/s)	Duct Velocity (m/s)	Volume Flow (m^3/s)
Tp2A	---	430x40	---	0.0172	---	21.2	Ave 21.2	0.365
Tp3A	---	430x40	---	0.0172	---	Ave 27.4	---	0.471
Tp6A	---	550x 40	---	0.022	---	Ave 17. 8	---	0.392
Tp7A	---	550x40	---	0.022	---	Ave 12.2	---	0.268
Tp8A	---	550x40	---	0.022	---	Ave 14.9	---	0.328
Tp9A	---	550x40	---	0.022	---	Ave 14.7	---	0.323
Tp10A	---	520x40	---	0.021	---	Ave 21.8	---	0.453
Tp11A	---	1200x60	---	0.072	---	Ave 7.4	---	0.533
Tp12A	430x40	430x40	---	0.0172	---	Ave 6.2	---	0.107
Tp13A	---	430x40	---	0.0172	---	Ave 21.4	---	0.368

Reference of arrangement/layout drawing(s) which identify the plant: ----

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 24 Oct 2024 Date of Last Examination: 28 Sep 2023

Competent Person: #12 Date of Next Examination: 24 Oct 2025

Signature: Qualification: Engineer Surveyor

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 Plant Code: D04E11 Previous Report: 031023-007-0071EMO
Site: 00005 Schedule: D0071 Date Issued: 26 Oct 2024
Report Number: 261024-009-0076EMO LEV3A

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3a. Identification of LEV plant	Fume Extraction Plant Plant No.:- LEV1
3b. Is this unchanged from initial record?	No initial records or commissioning reports available.
4. Location of LEV plant	Dipping and plating shop
5a. Identification of process	Extrusion.
5b. Is this unchanged from initial record?	No initial records or commissioning reports available.
6a. Hazardous substance(s)	Paint and solvent fumes containing, but not limited to, xylene, toluene, isocyanates etc.
6b. Is this unchanged from initial record?	No initial records or commissioning reports available.
7. Regulations applicable	Control of Substances Hazardous to Health Regulations 2002: Reg. 9
8. Condition at time of examination and test	Normal operation.
9. Does the LEV control the hazardous substance(s)?	Observational methods confirm visual control of the hazardous substance(s) but see sections below for further information.
10. Method used to make judgment at 9 above (e.g. visual, air flow, static pressure, etc)	Visual, airflow & smoke test.
11. Condition of filter(s)	No access due to location.
12. Are the elements of the LEV plant in good working order?	Yes, but see following sections for further information.
13. Repairs/modifications required to ensure the LEV plant effectively controls the hazardous substance(s)	System requires thorough cleaning. Duct faces to be thoroughly cleaned Duct control flap knobs broken, seized or missing. Repair
14. Intended operating performance	See Plant Report Continuation
15. Observations/notes	See Plant Report Continuation

Number of extraction points: 9 Number to be used at any one time: 9

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 Date of Last Examination: 28 Sep 2023

Competent Person: #13 Date of Next Examination: 25 Oct 2025

Signature: Qualification: Engineer Surveyor

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 **Plant Code:** D04E11 **Previous Report:** 031023-007-0071EMO
Date Issued: 26 Oct 2024
Site: 00005 **Schedule:** D0071 **Report Number:** 261024-010-0076EMO **LEV3B**

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3. Identification of LEV plant	Fume Extraction Plant Plant No.:- LEV3

Test Point	Static Pressure (Pa)	Face Dimensions (mm)	Duct Dimensions (mm)	Area (m^2)	Capture Velocity (m/s)	Face Velocity (m/s)	Duct Velocity (m/s)	Volume Flow (m^3/s)
Hot Rinse	---	550x40	---	0.022	---	Ave 9.3	---	0.205
Passive	---	550x40	---	0.022	---	Ave 6.8	---	0.15
Hot soak	---	550x40	---	0.022	---	Ave4.1	---	0.09
Cold Rinse	---	550x40	---	0.022	---	Ave 9.7	---	0.213
Silver plate	---	550x40	---	0.022	---	Ave 8.6	---	0.189
Cyanide dip	---	550x40	---	0.022	---	Ave8.3	---	0.183
Gold plate	---	550x40	---	0.022	---	Ave 12.7	---	0.279
Bright Nickel	---	550x40	---	0.023	---	Ave 7.1	---	0.156

Reference of arrangement/layout drawing(s) which identify the plant: ----

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 **Date of Last Examination:** 28 Sep 2023

Competent Person: #14 **Date of Next Examination:** 25 Oct 2025

Signature: **Qualification:** Engineer Surveyor

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: H8L0064632 Plant Code: D04D11 Previous Report: 031023-010-0071BMO
Site: 00005 Schedule: D0072 Date Issued: 26 Oct 2024
Report Number: 261024-012-0076BMO LEV3A

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3a. Identification of LEV plant	Fume Extraction Plant Scrubber Plant No.:- LEV4
3b. Is this unchanged from initial record?	No initial records or commissioning reports available.
4. Location of LEV plant	Dipping and plating shop
5a. Identification of process	De-greasing of components.
5b. Is this unchanged from initial record?	No initial records or commissioning reports available.
6a. Hazardous substance(s)	Paint and solvent fumes containing, but not limited to, xylene, toluene, isocyanates etc.
6b. Is this unchanged from initial record?	No initial records or commissioning reports available.
7. Regulations applicable	Control of Substances Hazardous to Health Regulations 2002: Reg. 9
8. Condition at time of examination and test	Normal operation.
9. Does the LEV control the hazardous substance(s)?	Observational methods confirm visual control of the hazardous substance(s).
10. Method used to make judgment at 9 above (e.g. visual, air flow, static pressure, etc)	Visual, airflow & smoke test.
11. Condition of filter(s)	Scrubber.
12. Are the elements of the LEV plant in good working order?	Yes
13. Repairs/modifications required to ensure the LEV plant effectively controls the hazardous substance(s)	None.
14. Intended operating performance	See Plant Report Continuation
15. Observations/notes	See Plant Report Continuation

Number of extraction points: 7 Number to be used at any one time: 5

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024
Date of Last Examination: 28 Sep 2023
Competent Person:
Signature: #15
Date of Next Examination: 25 Oct 2025
Qualification: Engineer Surveyor

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 Plant Code: D04D11 Previous Report: 031023-010-0071EMO
Site: 00005 Schedule: D0072 Date Issued: 26 Oct 2024
Report Number: 261024-013-0076EMO LEV3B

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3. Identification of LEV plant	Fume Extraction Plant Scrubber Plant No.:- LEV4

Test Point	Static Pressure (Pa)	Face Dimensions (mm)	Duct Dimensions (mm)	Area (m^2)	Capture Velocity (m/s)	Face Velocity (m/s)	Duct Velocity (m/s)	Volume Flow (m^3/s)
F1 scr jigstrip	---	430x40	---	0.0172	---	19.6	---	0337
F2 scr	---	1380x40	---	0.0552	---	Ave 7.1	-	0.392
F3 scr	---	430x40	---	0..0172	---	Ave 16.3	---	.028
F4 scr	---	2050x40	---	0.082	---	Ave 7.2	---	0.59
F5 scr	---	1950x50	---	0.0975	---	Ave 10.7	---	1.043

Reference of arrangement/layout drawing(s) which identify the plant: ----

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 Date of Last Examination: 28 Sep 2023

Competent Person: Date of Next Examination: 25 Oct 2025

Signature: #16 Qualification: Engineer Surveyor

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 **Plant Code:** D04B11 **Previous Report:** 031023-013-0071EMO
Date Issued: 26 Oct 2024
Site: 00005 **Schedule:** D0073 **Report Number:** 261024-015-0076EMO LEV3A

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3a. Identification of LEV plant	Fume Extraction Plant Plant No.:- LEV5
3b. Is this unchanged from initial record?	No initial records or commissioning reports available.
4. Location of LEV plant	Plating line 2
5a. Identification of process	De-greasing of components.
5b. Is this unchanged from initial record?	No initial records or commissioning reports available.
6a. Hazardous substance(s)	Paint and solvent fumes containing, but not limited to, xylene, toluene, isocyanates etc.
6b. Is this unchanged from initial record?	No initial records or commissioning reports available.
7. Regulations applicable	Control of Substances Hazardous to Health Regulations 2002: Reg. 9
8. Condition at time of examination and test	Normal operation.
9. Does the LEV control the hazardous substance(s)?	Observational methods confirm visual control of the hazardous substance(s).
10. Method used to make judgment at 9 above (e.g. visual, air flow, static pressure, etc)	Visual, airflow, smoke test and dust lamp.
11. Condition of filter(s)	Fully enclosed, no access.
12. Are the elements of the LEV plant in good working order?	Yes
13. Repairs/modifications required to ensure the LEV plant effectively controls the hazardous substance(s)	None.
14. Intended operating performance	See Plant Report Continuation
15. Observations/notes	See Plant Report Continuation

Number of extraction points: 3 Number to be used at any one time: 3

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 **Date of Last Examination:** 28 Sep 2023

Competent Person: **Date of Next Examination:** 25 Oct 2025

Signature: #17 **Qualification:** Engineer Surveyor

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28 Windsor Place, Lower Pembroke Street, Dublin 2

Telephone: 0845 345 5510
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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 **Plant Code:** D04B11 **Previous Report:** 031023-013-0071EMO
Site: 00005 **Schedule:** D0073 **Date Issued:** 26 Oct 2024
Report Number: 261024-016-0076EMO LEV3B

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3. Identification of LEV plant	Fume Extraction Plant Plant No.:- LEV5

Test Point	Static Pressure (Pa)	Face Dimensions (mm)	Duct Dimensions (mm)	Area (m^2)	Capture Velocity (m/s)	Face Velocity (m/s)	Duct Velocity (m/s)	Volume Flow (m^3/s)
Cadmium plate F1	---	1835x50	---	0.0925	---	Ave 12.6	---	1.165
Yellow passiveF2	---	1835x50	---	0.0917	---	Ave 9.8	---	0.899
Olive drab F3	---	1835x35	---	0.064	---	Ave 11.4	---	0.73

Reference of arrangement/layout drawing(s) which identify the plant: ----

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 **Date of Last Examination:** 28 Sep 2023
Competent Person: #18 **Date of Next Examination:** 25 Oct 2025
Signature: **Qualification:** Engineer Surveyor

HSB Engineering Insurance Services Limited
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28 Windsor Place, Lower Pembroke Street, Dublin 2

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 Plant Code: D04F11 Previous Report: 031023-016-0071EMO
Date Issued: 26 Oct 2024
Site: 00005 Schedule: D0074 Report Number: 261024-018-0076EMO LEV3A

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3a. Identification of LEV plant	Fume Extraction Plant Line 3 Plant No.:- LEV6
3b. Is this unchanged from initial record?	No initial records or commissioning reports available.
4. Location of LEV plant	Line 3
5a. Identification of process	Extrusion.
5b. Is this unchanged from initial record?	No initial records or commissioning reports available.
6a. Hazardous substance(s)	Paint and solvent fumes containing, but not limited to, xylene, toluene, isocyanates etc.
6b. Is this unchanged from initial record?	No initial records or commissioning reports available.
7. Regulations applicable	Control of Substances Hazardous to Health Regulations 2002: Reg. 9
8. Condition at time of examination and test	Normal operation.
9. Does the LEV control the hazardous substance(s)?	Observational methods confirm visual control of the hazardous substance(s).
10. Method used to make judgment at 9 above (e.g. visual, air flow, static pressure, etc)	Visual, airflow & smoke test.
11. Condition of filter(s)	Fully enclosed, no access.
12. Are the elements of the LEV plant in good working order?	Yes, but see following sections for further information.
13. Repairs/modifications required to ensure the LEV plant effectively controls the hazardous substance(s)	System requires thorough cleaning. Advise all duct faces are thoroughly cleaned Repair duct flap control knobs on main ducting
14. Intended operating performance	See Plant Report Continuation
15. Observations/notes	See Plant Report Continuation

Number of extraction points: 11 Number to be used at any one time: 11

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 Date of Last Examination: 28 Sep 2023

Competent Person: #19 Date of Next Examination: 25 Oct 2025

Signature: Qualification: Engineer Surveyor

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 **Plant Code:** D04F11 **Previous Report:** 031023-016-0071EMO
Date Issued: 26 Oct 2024
Site: 00005 **Schedule:** D0074 **Report Number:** 261024-019-0076EMO LEV3B

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3. Identification of LEV plant	Fume Extraction Plant Line 3 Plant No.:- LEV6

Test Point	Static Pressure (Pa)	Face Dimensions (mm)	Duct Dimensions (mm)	Area (m^2)	Capture Velocity (m/s)	Face Velocity (m/s)	Duct Velocity (m/s)	Volume Flow (m^3/s)
Tank 5	---	1835x32	---	0.06	---	Av 1.3	---	0.076
Tank 8	P	1835x32	---	0.06	---	---	Ave 4.9	0.294
Tank 11	---	1835x50	---	0.09	---	Ave 8.9	---	0.801
Tank 12	---	1835x50	---	0.09	---	Ave 5.8	---	0.522
Tank 15	---	1835x42	---	0.08	---	Ave 4.8	---	0.384
Tank 16	---	1835x42	---	0.08	---	Ave 5.8	---	0.464
Tank 19	---	1835x30	---	0.06	---	Ave 1.3	---	0.078
Tank 21	---	1835x30	---	0.06	---	Ave 4.6	---	0.276
Tank 27	---	1835x50	---	0.09	---	Ave 1.8	---	0.162
Tank 28	---	1835x50	---	0.09	---	Ave 6.8	---	0.612
Tank 33	---	1835x50	---	0.09	---	Ave3.4	---	0.306

Reference of arrangement/layout drawing(s) which identify the plant: ----

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 **Date of Last Examination:** 28 Sep 2023

Competent Person: #20 **Date of Next Examination:** 25 Oct 2025

Signature: **Qualification:** Engineer Surveyor

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 **Plant Code:** D04A11 **Previous Report:** 031023-019-0071EMO
Date Issued: 26 Oct 2024
Site: 00005 **Schedule:** D0075 **Report Number:** 261024-021-0076EMO LEV3A

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3a. Identification of LEV plant	Fume Extraction Plant Plant No.:- LEV7
3b. Is this unchanged from initial record?	No initial records or commissioning reports available.
4. Location of LEV plant	Dipping and plating shop
5a. Identification of process	Extrusion.
5b. Is this unchanged from initial record?	No initial records or commissioning reports available.
6a. Hazardous substance(s)	Paint and solvent fumes containing, but not limited to, xylene, toluene, isocyanates etc.
6b. Is this unchanged from initial record?	No initial records or commissioning reports available.
7. Regulations applicable	Control of Substances Hazardous to Health Regulations 2002: Reg. 9
8. Condition at time of examination and test	Normal operation.
9. Does the LEV control the hazardous substance(s)?	Observational methods confirm visual control of the hazardous substance(s).
10. Method used to make judgment at 9 above (e.g. visual, air flow, static pressure, etc)	Visual, airflow & smoke test.
11. Condition of filter(s)	No access due to location.
12. Are the elements of the LEV plant in good working order?	Yes, but see following sections for further information.
13. Repairs/modifications required to ensure the LEV plant effectively controls the hazardous substance(s)	Advise the fitting of more curtains to system around extraction area
14. Intended operating performance	Face velocity at extraction point(s) Minimum face velocity 0.5-1.0 m/s
15. Observations/notes	See Plant Report Continuation

Number of extraction points: 1 **Number to be used at any one time:** 1

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 **Date of Last Examination:** 28 Sep 2023

Competent Person: #21 **Date of Next Examination:** 25 Oct 2025

Signature: **Qualification:** Engineer Surveyor

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REPORT OF THOROUGH EXAMINATION AND TEST OF LOCAL EXHAUST VENTILATION (LEV) PLANT

HSB
A Munich Re company

Policy: HBL0064632 **Plant Code:** D04A11 **Previous Report:** 031023-019-0071EMO
Date Issued: 26 Oct 2024
Site: 00005 **Schedule:** D0075 **Report Number:** 261024-022-0076EMO **LEV3B**

1. Name of company	T T ELECTRONICS PLC & SUBSIDIARY COS AB CONNECTORS LTD
2. Address	Ynysboeth Factory Estate, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF
3. Identification of LEV plant	Fume Extraction Plant Plant No.:- LEV7

Test Point	Static Pressure (Pa)	Face Dimensions (mm)	Duct Dimensions (mm)	Area (m^2)	Capture Velocity (m/s)	Face Velocity (m/s)	Duct Velocity (m/s)	Volume Flow (m^3/s)
1	---	140	---	0.0154	09 ø500 mm	23.2	---	0.357

Reference of arrangement/layout drawing(s) which identify the plant: ----

I certify that on the date stated, I thoroughly examined & tested the plant specified above & the results of my examination & test(s) are as shown.

Date of Examination: 25 Oct 2024 **Date of Last Examination:** 28 Sep 2023

Competent Person: #22 **Date of Next Examination:** 25 Oct 2025

Signature: **Qualification:** Engineer Surveyor

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