

## 9.4. Exposure scenario 4: Use by professional worker - Use in electroplating or metal surface treatment

**Market sector:** Electroplating and surface treatment

PC 14: Metal surface treatment products, including galvanic and electroplating products

**Sector of use:**

SU 16, Manufacture of computer, electronic and optical products, electrical equipment

<b>Environment contributing scenario(s):</b>	
Use in electroplating or metal surface treatment	ERC 8c
<b>Worker contributing scenario(s):</b>	
Handling of solutions	PROC 8b
Small scale handling of solutions	PROC 9
Handling of high dusty materials	PROC 26
Open or semi-closed wet chemical process	PROC 4
Plating	PROC 13

### Explanation on the approach taken for the ES

During this use, the substance is chemically transformed into gold. Any subsequent handling steps after transformation of the substance are not in the scope of this ES.

### 9.4.1. Environmental contributing scenario 1: Use in electroplating or metal surface treatment

#### 9.4.1.1. Conditions of use

The conditions of use are as described in the generic exposure scenario (GES) below.

#### 9.4.1.2. Releases

The GES and associated risk assessment are concerned with releases of  $\text{KAu}(\text{CN})_2$  to waste-water and air during the use by professional workers of  $\text{KAu}(\text{CN})_2$  in electroplating or metal surface treatment. This waste-water is assumed to be treated at a municipal STP before discharge to freshwater. Exposure assessment for the aquatic environment is based on calculation of the maximum safe tonnage (Msafe) of  $\text{KAu}(\text{CN})_2$  that can be used for electroplating or metal surface treatment by professional workers; modelling of environmental exposure is based on adjustment to release factors (RFs) defined by ERC 8c.

<b>1. Title</b>	
<b>ES4: Use by professional workers - Use in electroplating or metal surface treatment</b>	
<b>Life cycle</b>	Use of potassium dicyanoaurate in electroplating or metal surface treatment
<b>Systematic title based on use descriptor</b>	ERC: ERC 8c
<b>2. Operational conditions and risk management measures</b>	
<b>2.1 Control of environmental exposure</b>	
<b>Environmental related free short title</b>	Use by professional in electroplating or metal surface treatment
<b>Systematic title based on use descriptor (environment)</b>	ERC 8c (Widespread use leading to inclusion into/onto article (indoor))
<b>Processes, tasks, activities covered (environment)</b>	Professional use of potassium dicyanoaurate for electroplating or metal surface treatment: As defined by the ERC 8c release scenario adjusted for the monetary value of gold.
<b>Environmental Assessment Method</b>	Estimates based on ERC 8c for 'Widespread use leading to inclusion into/onto article (indoor)' adjusted for monetary value of gold are used for calculation of maximum tonnage that can be used safely without risk to the environment
<b>Product characteristics</b>	
Potassium dicyanoaurate as solid or aqueous solution.	
Environmental assessment is based on adjustment to ERC 8c release factors and default characteristics for environmental compartments detailed in the ECHA technical guidance and EUSES model.	
<b>Amounts used</b>	
<b>Maximum annual safe use at a site (Msafe)</b>	6.6 kg $\text{KAu}(\text{CN})_2$
<b>Frequency and duration of use</b>	
<b>Pattern of release to the environment</b>	220 days per year per site (SpERC for Industrial use of metals and metal compounds in metallic coating <sup>1</sup> ; this assumes an average working year)
<b>Environment factors not influenced by risk management</b>	
<b>Receiving surface water flow rate</b>	STP: 2,000 m <sup>3</sup> /d (default) Receiving water: 18,000 m <sup>3</sup> /d (default)

<sup>1</sup> ARCHE (2013) Industrial use of metals and metal compounds in metallic coating. SpERC code Eurometaux 5.1 v2.1. Available online at <http://www.arche-consulting.be/metal-csa-toolbox/SPERCs-tool-for-metals/>

<b>Dilution capacity, freshwater</b>	Env ES: Discharge to freshwater via STP: DF = 10 (default)
<b>Dilution capacity, marine</b>	NR
<b>Other given operational conditions affecting environmental exposure</b>	
None	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Appropriate process control systems shall be implemented.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
<b>Waste water:</b>	
ES Discharge to freshwater via STP:	
Efficiency 63.9 % (based on standard TGD parameters & known KAuCN <sub>2</sub> partition coefficient for SPM)	
Release factor after on-site treatment: 30,000 g/T (i.e. ERC RF adjusted for monetary value of Ag as detailed in section 9.02)	
<b>Air:</b>	
Release factor after on-site treatment: 15,000 g/T (ERC RF adjusted to 10% based on monetary value of gold as detailed in section 9.02)	
<b>Organizational measures to prevent/limit release from site</b>	
Good practice to minimise releases	
<b>Conditions and measures related to municipal sewage treatment plant (if applicable)</b>	
<b>Municipal Sewage Treatment Plant (STP)</b>	Yes
<b>Discharge rate of the Municipal STP</b>	2 000 m <sup>3</sup> /d (default)
<b>Fate of the sludge from Municipal STP</b>	Worst case scenario assumed that sludge is applied to land
<b>Conditions and measures related to external treatment of waste for disposal</b>	
Not relevant for professional use	
<b>Conditions and measures related to external recovery of waste</b>	
Not relevant for professional use	
<b>3. Exposure and risk estimation</b>	
<b>Environment [based on total KAu(CN)<sub>2</sub> emissions]</b>	
ERC 8c	

<b>ES 4 Use by professional worker - Use in electroplating or metal surface treatment</b>							
<b>Compartment</b>	<b>Unit</b>	<b>PNEC</b>	<b>PEC<sub>regional</sub></b>	<b>C<sub>local</sub></b>	<b>PEC</b>	<b>RCR</b>	<b>Methods for calculation of environmental concentrations</b>
Discharge to STP	mg/L as KAu(CN) <sub>2</sub>	6.0 mg/L	5.02 x10 <sup>-8</sup> mg/L	1.62 x10 <sup>-4</sup> mg/L	1.62 x10 <sup>-4</sup> mg/L	2.71 x10 <sup>-5</sup>	ERC release factor adjusted for monetary value of gold applied to Msafe tonnage and calculated values for STP removal efficiency based on standard guidance and default value for dilution in ultimate receiving water body
Freshwater via STP	mg/L as KAu(CN) <sub>2</sub>	2.0 x10 <sup>-4</sup> mg/L	5.02 x10 <sup>-8</sup> mg/L	1.58 x10 <sup>-5</sup> mg/L	1.59 x10 <sup>-5</sup> mg/L	0.080	ERC release factor adjusted for monetary value of gold applied to Msafe tonnage. STP removal efficiency calculated following standard ECHA guidance and default dilution in ultimate receiving water body
Freshwater sediment via STP	mg/kg w.w. as KAu(CN) <sub>2</sub>	7.3 x10 <sup>-2</sup> mg/kg	3.27 x10 <sup>-5</sup> mg/kg	5.76 x10 <sup>-3</sup> mg/kg	5.79 x10 <sup>-3</sup> mg/kg	0.80	ERC release factor adjusted for monetary value of gold applied to Msafe tonnage. STP removal calculated following standard ECHA guidance and dilution in ultimate receiving water body. Additional factor of 10 included in RCR due to equilibrium partitioning
Terrestrial	mg/kg as KAu(CN) <sub>2</sub>	5.9 x10 <sup>-2</sup> mg/kg	2.99 x10 <sup>-5</sup> mg/kg	1.19 x10 <sup>-3</sup> mg/kg	1.22 x10 <sup>-3</sup> mg/kg	0.021	Modelled increase in soil concentrations due to deposition from atmospheric emissions and application of

							sewage sludge to land
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#### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

##### Environment

Scaling tool: Metals EUSES IT tool (free download: <http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool>)

Scaling of the release to air and water environment includes:

- Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility.
- Adjustment of the flow rate for the receiving water body and subsequent dilution factor.

#### 9.4.1.3. Exposure and risks for man via the environment

Assessment of risks for man via the environment is not relevant for this use, due to electroplating and metal surface treatment being performed using a solution and at very low quantities

### 9.4.2. Worker contributing scenario 1: Handling of solutions (PROC 8b)

#### 9.4.2.1. Conditions of use

Task(s) covered with this contributing scenario: Transfer processes, such as replenishment.

	Method
<b>Product (article) characteristics</b>	
• Physical form of substance: Solution	External Tool (MEASE)
• Maximum emission potential of the substance: Very low (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	External Tool (MEASE)
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
• Maximum duration of exposure: 15 - 60 min [Effectiveness Inhal: 80%; Dermal: 80%]  <i>A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. Please note that whenever a process step with reduced exposure duration needs to be conducted in addition to another process step, the RCRs of these process</i>	External Tool (MEASE)

	Method
<i>steps need to be summed up and the result has to be below 1 to demonstrate safe use.</i>	
<b>Technical and organisational conditions and measures</b>	
• Pattern of use: Non-dispersive use	External Tool (MEASE)
• Pattern of exposure control: Direct handling	External Tool (MEASE)
• Contact level: Intermittent	External Tool (MEASE)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%]	External Tool (MEASE)
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation (Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.)	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes (Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.)	

#### 9.4.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

**Table 1. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	<b>10 µg/m<sup>3</sup></b> (External Tool (MEASE))	RCR = 0.141
Inhalation, systemic, acute		Qualitative (see below)
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	<b>0.69 µg/kg bw/day</b> (External Tool (MEASE))	RCR < 0.01
Dermal, local, long-term		Qualitative (see below)

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Dermal, local, acute		Qualitative (see below)
Eye, local		Qualitative (see below)
Combined routes, systemic, long-term		RCR = 0.148

#### Remarks on exposure data

#### External Tool (MEASE)

- Dermal, systemic, long-term:  
For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

#### Conclusion on risk characterisation

Further information on the risk characterisation for local or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is below the DNELs and local effects are not expected. Therefore, risks are adequately controlled.

### 9.4.3. Worker contributing scenario 2: Small scale handling of solutions (PROC 9)

#### 9.4.3.1. Conditions of use

Task(s) covered with this contributing scenario: Transfer processes, such as replenishment (including manual replenishment).

	Method
<b>Product (article) characteristics</b>	
• Physical form of substance: Solution	External Tool (MEASE)
• Maximum emission potential of the substance: Very low (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	External Tool (MEASE)
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
• Maximum duration of exposure: 15 - 60 min [Effectiveness Inhal: 80%; Dermal: 80%]	External Tool (MEASE)

	Method
<i>A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. Please note that whenever a process step with reduced exposure duration needs to be conducted in addition to another process step, the RCRs of these process steps need to be summed up and the result has to be below 1 to demonstrate safe use.</i>	
<b>Technical and organisational conditions and measures</b>	
• Pattern of use: Non-dispersive use	External Tool (MEASE)
• Pattern of exposure control: Direct handling	External Tool (MEASE)
• Contact level: Intermittent	External Tool (MEASE)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%]	External Tool (MEASE)
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation (Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.)	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes (Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.)	

#### 9.4.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

**Table 2. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	10 µg/m <sup>3</sup> (External Tool (MEASE))	RCR = 0.141
Inhalation, systemic, acute		Qualitative (see below)
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)



Route of exposure and type of effects	Exposure concentration	Risk characterisation
Dermal, systemic, long-term	<b>0.69 µg/kg bw/day</b> (External Tool (MEASE))	RCR < 0.01
Dermal, local, long-term		Qualitative (see below)
Dermal, local, acute		Qualitative (see below)
Eye, local		Qualitative (see below)
Combined routes, systemic, long-term		RCR = 0.148

#### Remarks on exposure data

##### External Tool (MEASE)

- Dermal, systemic, long-term:  
For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

#### Conclusion on risk characterisation

Further information on the risk characterisation for local or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is below the DNELs and local effects are not expected. Therefore, risks are adequately controlled.

### 9.4.4. Worker contributing scenario 3: Handling of high dusty materials (PROC 26)

#### 9.4.4.1. Conditions of use

Task(s) covered with this contributing scenario: Transfer processes, such as replenishment (including manual replenishment).

	Method
<b>Product (article) characteristics</b>	
• Physical form of substance: Solid	External Tool (MEASE)
• Maximum emission potential of the substance: High (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	External Tool (MEASE)
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)

	Method
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
<ul style="list-style-type: none"> <li>Maximum duration of exposure: &lt; 15 min [Effectiveness Inhal: 90%; Dermal: 90%]</li> </ul> <p><i>A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. Please note that whenever a process step with reduced exposure duration needs to be conducted in addition to another process step, the RCRs of these process steps need to be summed up and the result has to be below 1 to demonstrate safe use.</i></p>	External Tool (MEASE)
<b>Technical and organisational conditions and measures</b>	
<ul style="list-style-type: none"> <li>Pattern of use: Non-dispersive use</li> </ul>	External Tool (MEASE)
<ul style="list-style-type: none"> <li>Pattern of exposure control: Direct handling</li> </ul>	External Tool (MEASE)
<ul style="list-style-type: none"> <li>Contact level: Intermittent</li> </ul>	External Tool (MEASE)
<ul style="list-style-type: none"> <li>Exterior local exhaust ventilation: Lower confidence limit (industrial use) (Standard efficiency) [Effectiveness Inhal: 75%]</li> </ul>	External Tool (MEASE)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
<ul style="list-style-type: none"> <li>Respiratory protective equipment (RPE): RPE with minimum APF = 20 (APF = assigned protection factor according to EN 529. At minimum any combination of particle filter class P3 with mask according to EN 140, EN 1827 or filtering half mask (FF P3) according to EN 149 or combination of P2 filter with face piece according to EN 12941 or EN 12942 or any RPE providing higher APFs according to EN 529 is required.) [Effectiveness Inhal: 95%]</li> </ul>	External Tool (MEASE)
<ul style="list-style-type: none"> <li>Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%]</li> </ul>	External Tool (MEASE)
<ul style="list-style-type: none"> <li>Eye protection: Eye protection to be worn to protect from adverse effects to the eyes (Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.)</li> </ul>	

#### 9.4.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

**Table 3. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	<b>31 µg/m<sup>3</sup></b> (External Tool (MEASE))	RCR = 0.437
Inhalation, systemic, acute		Qualitative (see below)
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	<b>1.41 µg/kg bw/day</b> (External Tool (MEASE))	RCR = 0.014
Dermal, local, long-term		Qualitative (see below)
Dermal, local, acute		Qualitative (see below)
Eye, local		Qualitative (see below)
Combined routes, systemic, long-term		RCR = 0.451

#### Remarks on exposure data

#### **External Tool (MEASE)**

- Dermal, systemic, long-term:  
For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

#### Conclusion on risk characterisation

Further information on the risk characterisation for local or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is below the DNELs and local effects are not expected. Therefore, risks are adequately controlled.

### **9.4.5. Worker contributing scenario 4: Open or semi-closed wet chemical process (PROC 4)**

#### **9.4.5.1. Conditions of use**

	Method
<b>Product (article) characteristics</b>	
• Physical form of substance: Solution	External Tool (MEASE)
• Maximum emission potential of the substance: Very low (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower	External Tool (MEASE)

	Method
dustiness are being handled in parallel) are thus automatically covered in this assessment.)	
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
<b>Technical and organisational conditions and measures</b>	
• Pattern of use: Non-dispersive use	External Tool (MEASE)
• Pattern of exposure control: Non-direct handling	External Tool (MEASE)
• Contact level: Intermittent	External Tool (MEASE)
• Exterior local exhaust ventilation: Lower confidence limit (industrial use) (Standard efficiency) [Effectiveness Inhal: 75%]	External Tool (MEASE)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%]	External Tool (MEASE)
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation (Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.)	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes (Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.)	

#### 9.4.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

**Table 4. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	31 µg/m <sup>3</sup> (External Tool (MEASE))	RCR = 0.437

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, acute		Qualitative (see below)
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	<b>0.34 µg/kg bw/day</b> (External Tool (MEASE))	RCR < 0.01
Dermal, local, long-term		Qualitative (see below)
Dermal, local, acute		Qualitative (see below)
Eye, local		Qualitative (see below)
Combined routes, systemic, long-term		RCR = 0.44

#### **Remarks on exposure data**

#### **External Tool (MEASE)**

- Dermal, systemic, long-term:  
For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

#### **Conclusion on risk characterisation**

Further information on the risk characterisation for local or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is below the DNELs and local effects are not expected. Therefore, risks are adequately controlled.

### **9.4.6. Worker contributing scenario 5: Plating (PROC 13)**

#### **9.4.6.1. Conditions of use**

	Method
<b>Product (article) characteristics</b>	
• Physical form of substance: Solution	External Tool (MEASE)
• Maximum emission potential of the substance: Very low (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	External Tool (MEASE)

	Method
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
<b>Technical and organisational conditions and measures</b>	
• Pattern of use: Non-dispersive use	External Tool (MEASE)
• Pattern of exposure control: Direct handling	External Tool (MEASE)
• Contact level: Intermittent	External Tool (MEASE)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%]	External Tool (MEASE)
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation (Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.)	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes (Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.)	

#### 9.4.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

**Table 5. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	50 µg/m <sup>3</sup> (External Tool (MEASE))	RCR = 0.704
Inhalation, systemic, acute		Qualitative (see below)
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Dermal, systemic, long-term	<b>3.43 µg/kg bw/day</b> (External Tool (MEASE))	RCR = 0.034
Dermal, local, long-term		Qualitative (see below)
Dermal, local, acute		Qualitative (see below)
Eye, local		Qualitative (see below)
Combined routes, systemic, long-term		RCR = 0.738

#### **Remarks on exposure data**

#### **External Tool (MEASE)**

- Dermal, systemic, long-term:  
For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

#### **Conclusion on risk characterisation**

Further information on the risk characterisation for local or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is below the DNELs and local effects are not expected. Therefore, risks are adequately controlled.