

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

**Market sector:** Electroplating and surface treatment

**Product category used:** PC 14: Metal surface treatment products, including galvanic and electroplating products; PC 15: Non-metal-surface treatment products

**Sector of use:** SU 17: General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment.

Environment contributing scenario(s):		
CS 1	Use in electroplating or metal surface treatment	ERC 8a
Worker contributing scenario(s):		
CS 2	Handling of solutions	PROC 8b
CS 3	Small scale handling of solutions	PROC 9
CS 4	Handling of medium dusty materials	PROC 26
CS 5	Open or semi-closed wet chemical process	PROC 4
CS 6	Plating	PROC 13

### Explanation on the approach taken for the ES

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

### 9.4.1. Env CS 1: Use in electroplating or metal surface treatment (ERC 8a)

#### 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 silver to waste-water and air during the use by professional workers of  $KAg(CN)_2$  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 (M<sub>safe</sub>) of  $KAg(CN)_2$  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 dicyanoargentate in electroplating or metal surface treatment
<b>Systematic title based on use descriptor</b>	<b>ERC:</b> 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</b>	ERC 8c (Widespread use leading to inclusion into/onto

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<b>descriptor (environment)</b>	article (indoor))
<b>Processes, tasks, activities covered (environment)</b>	Professional use of potassium dicyanoargentate for electroplating or metal surface treatment: As defined by the ERC 8c release scenario adjusted for the monetary value of silver.
<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 silver are used for calculation of maximum tonnage that can be used safely without risk to the environment
<b>Product characteristics</b>	
Potassium dicyanoargentate 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>	138 kg KAg(CN) <sub>2</sub> (75 kg Ag metal equivalent)
<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)
<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 80% (based on assessment of available monitoring data and literature) 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 silver as detailed in section 9.02)	
<b>Organizational measures to prevent/limit release from site</b>	

<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/>

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Safety data sheet and instructions for professional use							
<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 of the 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 Ag emissions]</b>							
ERC 8c ES Use by professional worker - Use in electroplating or metal surface treatment*							
Compartment	Unit	PNEC	PEC <sub>regional</sub>	C <sub>local</sub>	PEC	RCR	Methods for calculation of environmental concentrations
ES Discharge to STP	mg Ag/L	0.025 mg/L	6.06 x10 <sup>-6</sup> mg/L	1.01 x10 <sup>-3</sup> mg/L	1.01 x10 <sup>-3</sup> mg/L	0.04	ERC RFs adjusted for monetary value of silver applied to M <sub>safe</sub> tonnage and dilution factor at municipal sewage works
ES Freshwater via STP	mg Ag/L	4.0 x10 <sup>-5</sup> mg/L	6.06 x10 <sup>-6</sup> mg/L	2.62 x10 <sup>-5</sup> mg/L	3.23 x10 <sup>-5</sup> mg/L	0.809	ERC RFs adjusted for monetary value of silver applied to M <sub>safe</sub> tonnage and Ag-specific values for STP removal efficiency and dilution in ultimate receiving water body
Freshwater sediment via STP	mg /kg w.w.	96.4 mg/kg	2.13 mg/kg	1.34 mg/kg	3.47 mg/kg	0.36	ERC RFs adjusted for monetary value of silver applied to M <sub>safe</sub> tonnage and Ag-specific values for STP removal efficiency and dilution in ultimate receiving water body
Terrestrial	mg Ag/kg w.w.	1.24 mg/kg	0.086 mg/kg	1.70 x10 <sup>-2</sup> mg/kg	0.103 mg/kg	0.0831	Modelled increase in soil concentrations due to deposition from atmospheric emissions and application of

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							sewage sludge to land
* All concentrations reported as Ag equivalent due to the silver metal PNEC used for assessment.							
<b>4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES</b>							
<b>Environment</b>							
Scaling tool: Metals EUSES IT tool (free download: <a href="http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool">http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool</a> )							
Scaling of the release to air and water environment includes:							
<ul style="list-style-type: none"> <li>• Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility.</li> <li>• Adjustment of the flow rate for the receiving water body and subsequent dilution factor.</li> </ul>							

### 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 CS 2: Handling of solutions (PROC 8b)

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

### 9.4.2.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> <li>• Physical form of substance: Solution</li> <li>• Maximum emission potential of the substance: Very low <i>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.</i></li> <li>• Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]</li> </ul>
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> <li>• Maximum duration of exposure: 15 - 60 min [Effectiveness Inhalation: 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 steps need to be summed up and the result has to be below 1 to demonstrate safe use.</i></li> </ul>
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> <li>• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>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.</i></li> <li>• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>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.</i></li> <li>• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374</i></li> </ul>

*have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.*

#### 9.4.2.2. Exposure and risks for workers

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

**Table 9.33. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	10 µg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.128
Combined routes, systemic, long-term		RCR = 0.128

#### **Remarks on exposure data from external estimation tools:**

MEASE 1.02.01

#### **Risk characterisation**

Further information on the risk characterisation for local effects or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.4.2.

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

### 9.4.3. Worker CS 3: Small scale handling of solutions (PROC 9)

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

#### 9.4.3.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> <li>Physical form of substance: Solution</li> <li>Maximum emission potential of the substance: Very low</li> </ul> <p><i>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.</i></p> <ul style="list-style-type: none"> <li>Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]</li> </ul>
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> <li>Maximum duration of exposure: 15 - 60 min [Effectiveness Inhalation: 80%, Dermal: 80%]</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>
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> <li>Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation</li> </ul> <p><i>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.</i></p> <ul style="list-style-type: none"> <li>Eye protection: Eye protection to be worn to protect from adverse effects to the eyes</li> </ul> <p><i>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.</i></p> <ul style="list-style-type: none"> <li>Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard)</li> </ul> <p><i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i></p>

#### 9.4.3.2. Exposure and risks for workers

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

Table 9.34. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	10 µg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.128
Combined routes, systemic, long-term		RCR = 0.128

**Remarks on exposure data from external estimation tools:**

MEASE 1.02.01

**Risk characterisation**

Further information on the risk characterisation for local effects or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.4.2.

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

**9.4.4. Worker CS 4: Handling of medium dusty materials (PROC 26)**

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

**9.4.4.1. Conditions of use**

Product (Article) characteristics
<ul style="list-style-type: none"> <li>Physical form of substance: Solid</li> <li>Maximum emission potential of the substance: Medium</li> </ul> <p><i>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.</i></p> <ul style="list-style-type: none"> <li>Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]</li> </ul>
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> <li>Maximum duration of exposure: &lt; 15 min [Effectiveness Inhalation: 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>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> <li>Exterior local exhaust ventilation: Lower confidence limit (professional use) [Effectiveness Inhalation: 69%]</li> </ul>
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> <li>Respiratory protective equipment (RPE): RPE with minimum APF = 10 [Effectiveness Inhalation: 90%]</li> </ul> <p><i>APF = assigned protection factor according to EN 529. At minimum any combination of particle filter class P2 with mask according to EN 140, EN 1827 or EN 136 or filtering half mask (FF P2) according to EN 149 or combination of P1 filter with face piece according EN 12942 or any RPE providing higher APFs according to EN 529 is required.</i></p> <ul style="list-style-type: none"> <li>Eye protection: Eye protection to be worn to protect from adverse effects to the eyes</li> </ul> <p><i>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.</i></p> <ul style="list-style-type: none"> <li>Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard)</li> </ul> <p><i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i></p>

**9.4.4.2. Exposure and risks for workers**

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

Table 9.35. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	25 µg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.321
Combined routes, systemic, long-term		RCR = 0.321

**Remarks on exposure data from external estimation tools:**

MEASE 1.02.01

**Risk characterisation**

Further information on the risk characterisation for local effects or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.4.2.

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

### 9.4.5. Worker CS 5: Open or semi-closed wet chemical process (PROC 4)

#### 9.4.5.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> <li>Physical form of substance: Solution</li> <li>Maximum emission potential of the substance: Very low</li> </ul> <p><i>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.</i></p> <ul style="list-style-type: none"> <li>Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]</li> </ul>
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> <li>Maximum duration of exposure: &gt; 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]</li> </ul>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> <li>Exterior local exhaust ventilation: Lower confidence limit (professional use) [Effectiveness Inhalation: 69%]</li> </ul>
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> <li>Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation</li> </ul> <p><i>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.</i></p> <ul style="list-style-type: none"> <li>Eye protection: Eye protection to be worn to protect from adverse effects to the eyes</li> </ul> <p><i>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.</i></p> <ul style="list-style-type: none"> <li>Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard)</li> </ul> <p><i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i></p>

#### 9.4.5.2. Exposure and risks for workers

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

Table 9.36. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	31 µg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.397

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Route of exposure and type of effects	Exposure concentration	Risk quantification
Combined routes, systemic, long-term		RCR = 0.397

### Remarks on exposure data from external estimation tools:

MEASE 1.02.01

### Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation, for local dermal effects and local effects to the eyes is given in Section 9.0.4.2.

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

## 9.4.6. Worker CS 6: Plating (PROC 13)

### 9.4.6.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> <li>• Physical form of substance: Solution</li> <li>• Maximum emission potential of the substance: Very low <i>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.</i></li> <li>• Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]</li> </ul>
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> <li>• Maximum duration of exposure: &gt; 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]</li> </ul>
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> <li>• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>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.</i></li> <li>• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>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.</i></li> <li>• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i></li> </ul>

### 9.4.6.2. Exposure and risks for workers

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

**Table 9.37. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	50 µg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.641
Combined routes, systemic, long-term		RCR = 0.641

### Remarks on exposure data from external estimation tools:

MEASE 1.02.01

### Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation,

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for local dermal effects and local effects to the eyes is given in Section 9.0.4.2. Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.