

## 9.9. Exposure scenario 9: Use at industrial sites - Use in electrochemical and galvanic plating

**Market sector:** Electrochemical and galvanic plating

**Product category used:** PC 14: Metal surface treatment products, including galvanic and electroplating products

**Sector of use:** SU 14: Manufacture of basic metals, including alloys; SU 15: Manufacture of fabricated metal products, except machinery and equipment

Environment contributing scenario(s):		
CS 1	Use in electrochemical and galvanic plating	ERC 5
Worker contributing scenario(s):		
CS 2	Small scale handling of the substance	PROC 9
CS 3	Open or semi-closed process	PROC 4
CS 4	Dipping and pouring	PROC 13
CS 5	Wet cleaning	PROC 28

### 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.

### 9.9.1. Env CS 1: Use in electrochemical and galvanic plating (ERC 5)

#### 9.9.1.1. Conditions of use

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

#### 9.9.1.2. Releases

The GES and associated risk assessment are concerned with releases of TCA to waste-water and air occurring during surface treatment or plating with TCA at an industrial facility. This waste-water is discharged to freshwater following treatment at a municipal STP. Exposure assessment for the aquatic environment is based on parameter values from the SpERC for 'Industrial use of metals and metal compounds in metallic coating'<sup>1</sup> and calculation of the maximum tonnage (M<sub>safe</sub>) of TCA that can be used without risk to environment. M<sub>safe</sub> is calculated using release factors (RFs) adjusted to 10% of the values recommend in the SpERC for base metals based on the monetary value of gold (see Section 9.0.2).

A summary of the emission characteristics used to quantify the environmental aspects of the generic exposure scenario (GES) for industrial use of TCA in electroplating or surface treatment is detailed below.

**Table 9.81. The generic exposure scenario (GES) for industrial use of TCA in electroplating or surface treatment**

<b>1. Title</b>	
<b>ES9: Use at industrial site - Use in electroplating or metal surface treatment</b>	
<b>Life cycle</b>	Use of TCA in electroplating or metal surface treatment
<b>Systematic title based on use</b>	<b>ERC:</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/>

<b>descriptor</b>	ERC 5 – Industrial use resulting in inclusion into or onto a matrix
<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 of TCA at industrial site in electroplating or metal surface treatment
<b>Systematic title based on use descriptor (environment)</b>	ERC 5 (Industrial use resulting in inclusion into or onto a matrix)
<b>Processes, tasks, activities covered (environment)</b>	Industrial use of TCA for electroplating or metal surface treatment: As defined by SpERC for 'Industrial use of metals and metal compounds in metallic coating' <sup>7</sup> <ul style="list-style-type: none"> <li>- Production of imaging and printing articles</li> <li>- Production of printing plates</li> <li>- Application of imaging and printing chemicals</li> </ul>
<b>Environmental Assessment Method</b>	Estimates of environmental emissions based on adjusted SpERC RFs are used for calculation of maximum tonnage that can be used safely without risk to the environment
<b>Product characteristics</b> TCA as aqueous solution.  Environmental assessment is based on the release factors detailed in the SpERC for 'Industrial use of metals and metal compounds in metallic coating' 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>	8 tonnes TCA (4.6 tonnes Au equivalent)
<b>Frequency and duration of use</b>	
<b>Pattern of release to the environment</b>	220 days per year per site (SpERC <sup>7</sup> )
<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>	Discharge to freshwater via STP: DF = 10 (default)
<b>Dilution capacity, marine</b>	Not relevant
<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: On-site wastewater treatment by chemical precipitation, sedimentation, electrolysis, reverse osmosis, ion exchange and/or filtration.	

Efficiency >99% (typical values reported in SpERC for 'Industrial use of metals and metal compounds in metallic coating')

and off-site municipal sewage treatment plant (STP)

Efficiency 88.7% (based on standard TGD parameters & measured partition coefficient for TCA in relation to SPM normalised to organic carbon)

Release factor after on-site treatment: 500 g/T (10% of SpERC RF for waste-water)

**Air:**

Treatment of air emissions by cyclones, filters (e.g. fabric, bag, HEPA or ceramic), electrostatic precipitators and/or wet scrubbers.

Efficiency 95 to >99% (typical values reported in SpERC for 'Industrial use of metals and metal compounds in metallic coating')

Release factor after on-site treatment: 2000 g/T (10% of SpERC RF for air)

**Organizational measures to prevent/limit release from site**

Regular operator training.

**Conditions and measures related to municipal sewage treatment plant (if applicable)**

<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>	The sludge is incinerated (with ash going to landfill)

**Conditions and measures related to external treatment of waste for disposal**

TCA- and other Au-containing waste is filled into containers and transported to licensed recycling facilities for recovery or disposed of at landfill.

**Conditions and measures related to external recovery of waste**

TCA- and other Au-containing waste suitable for recycling may be recycled either internally or at licensed recycling facility.

**3. Exposure and risk estimation**

<b>Environment</b>							
ERC 5							
ES 9 Use at industrial site - Use in electroplating or metal surface							
Compartment	Unit	PNEC	PEC <sub>regional</sub>	C <sub>local</sub>	PEC	RCR	Methods for calculation of environmental concentrations
Discharge to STP	mg TCA/L	0.2 mg/L	2.05 x10 <sup>-7</sup> mg/L	1.03 x10 <sup>-3</sup> mg/L	1.03 x10 <sup>-3</sup> mg/L	0.0051	Adjusted SpERC emission factors applied to M <sub>safe</sub> tonnage and dilution factor at municipal STP

Freshwater via STP	mg TCA/L	1.04 x10 <sup>-3</sup> mg/L	2.05 x10 <sup>-7</sup> mg/L	7.91 x10 <sup>-3</sup> mg/L	7.93 x10 <sup>-3</sup> mg/L	0.076	Adjusted SpERC emission factors applied to M <sub>safe</sub> tonnage and value for STP removal efficiency measured on measured partition coefficient. Plus dilution in ultimate receiving water body based on TGD default
Freshwater sediment via STP	mg TCA/kg w.w.	4.5 mg/kg	4.11 x10 <sup>-4</sup> mg/kg	0.343 mg/kg	0.344 mg/kg	0.76	Adjusted SpERC emission factors applied to M <sub>safe</sub> tonnage. Partitioning to SPM/sediment based on measured partition coefficient.
Terrestrial	mg TCA/kg w.w.	3.65 mg/kg	1.89 x10 <sup>-3</sup> mg/kg	4.4 x10 <sup>-6</sup> mg/kg	1.89 x10 <sup>-3</sup> mg/kg	0.0005	Modelled increase in soil concentrations due to deposition from atmospheric emissions (i.e. assuming no application of sewage sludge to land)

**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.

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

Assessment of risks for man via the environment is based on inhalation exposure to airborne particulates containing TCA released to the atmosphere during the industrial use of TCA in electroplating or metal surface treatment.

**Table 9.82. Exposure and risks for man via the environment**

Annual emission to air (kg TCA)	Emission days per year	Concentration in local air (mg TCA/m <sup>3</sup> )	Annual average concentration in air (mg TCA/m <sup>3</sup> )	DNEL (mg TCA/m <sup>3</sup> )	RCR
1.6	220	2.0 x10 <sup>-6</sup>	1.2 x10 <sup>-6</sup>	0.007	2.9 x10 <sup>-4</sup>

### 9.9.2. Worker CS 2: Small scale handling of the substance (PROC 9)

Task(s) covered with this contributing scenario: Small scale transfer and filling process.

#### 9.9.2.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> <li>Physical form of substance: Liquid</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>Pattern of use: Non-dispersive use</li> <li>Pattern of exposure control: Direct handling</li> <li>Contact level: Intermittent</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>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> <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>

#### 9.9.2.2. Exposure and risks for workers

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

**Table 9.83. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.071
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic,		RCR = 0.146

Route of exposure and type of effects	Exposure concentration	Risk quantification
long-term		

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

MEASE 1.02.01

Explanations: 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.

**Risk characterisation**

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route 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.

### 9.9.3. Worker CS 3: Open or semi-closed process (PROC 4)

Task(s) covered with this contributing scenario: Mixing and blending.

#### 9.9.3.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> <li>Physical form of substance: Liquid</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>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> <li>Pattern of use: Non-dispersive use</li> <li>Pattern of exposure control: Non-direct handling</li> </ul>
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> <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>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>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>

#### 9.9.3.2. Exposure and risks for workers

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

**Table 9.84. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.05 mg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.357

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.432

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

MEASE 1.02.01

Explanations: 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.

**Risk characterisation**

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route 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.

## 9.9.4. Worker CS 4: Dipping and pouring (PROC 13)

### 9.9.4.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> <li>Physical form of substance: Liquid</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>Pattern of use: Non-dispersive use</li> <li>Pattern of exposure control: Direct handling</li> <li>Contact level: Intermittent</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>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> <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>

### 9.9.4.2. Exposure and risks for workers

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

**Table 9.85. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.071
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.146

**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 and via the dermal route 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.

## 9.9.5. Worker CS 5: Wet cleaning (PROC 28)

### 9.9.5.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> <li>Physical form of substance: Liquid</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>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> <li>Pattern of use: Non-dispersive use</li> <li>Pattern of exposure control: Direct handling</li> <li>Contact level: Extensive</li> <li>Additional operational conditions for cleaning and maintenance: Maintenance and repair work only at machinery/systems which are not in operation. Minor cleaning tasks may be conducted under operation.</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%] <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></li> <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> <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> </ul>

### 9.9.5.2. Exposure and risks for workers

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

**Table 9.86. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5E-3 mg/m <sup>3</sup> (MEASE: 1.02.01)	RCR = 0.036
Dermal, systemic, long term	0.03 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.75
Combined routes, systemic, long-term		RCR = 0.786

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

MEASE 1.02.01

Explanations: According to ECHA Guidance R. 12 (Version 3.0, December 2015) PROC 28 should be used as descriptor for cleaning and maintenance activities. In MEASE, Version 1.02.01, PROC 28 is not available and PROC 8a was used as surrogate in MEASE for the exposure calculation.

Dermal, systemic, long term

For calculation of dermal 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.

**Risk characterisation**

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route 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.