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## 9.2. Exposure scenario 2: Manufacture - Manufacture of the substance in the catalyst industry

Environment contributing scenario(s):	
Manufacture of the substance in the catalyst industry	ERC 1
Worker contributing scenario(s):	
Raw material handling	PROC 26
Closed batch process	PROC 3
Fully contained process	PROC 1
Small scale handling/transfer of solutions	PROC 9
Laboratory analyses	PROC 15
Wet cleaning	PROC 8a
Vacuum cleaning	PROC 26

### Explanation on the approach taken for the ES

It is noted that this exposure scenario focusses on exposure to the substance to be registered. Please refer to information on safe use for the handling of the individual raw materials for process steps preceding the chemical transformation step.

### 9.2.1. Environmental contributing scenario 1: Manufacture of the substance in the catalyst industry

#### 9.2.1.1. Conditions of use

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

#### 9.2.1.2. Releases

The GES and associated risk assessment are concerned with releases of Pd to wastewater and air occurring during the manufacture of palladium di(4-oxopent-2-en-2-oate) in the catalyst industry at an industrial facility. It is assumed that wastewater 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 'Manufacture of metal-containing catalysts'<sup>11</sup> and calculation of the maximum tonnage

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<sup>11</sup> CEFIC (2012) Manufacture of metal-containing catalysts. spERC code ECMA 1.1a, v2.0. Available online at

<http://www.cefic.org/Documents/Industry%20sectors/ECMA/ECMA%20-%20SPERC%20Factsheet%20-%20Manufacture%20of%20Metal-containing%20Catalysts%20V5%2027Feb%202012.pdf>

(Msafe) of palladium di(4-oxopent-2-en-2-oate) that can be used without risk to environment. Msafe 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 palladium (see Section 9.0.2).

A summary of the emission characteristics used to quantify the environmental aspects of the generic exposure scenario (GES) for manufacture of palladium di(4-oxopent-2-en-2-oate) in the catalyst industry is detailed below.

<b>1. Title</b>	
<b>ES2: Manufacture of palladium di(4-oxopent-2-en-2-oate) in the catalyst industry</b>	
<b>Life cycle</b>	Manufacture of palladium di(4-oxopent-2-en-2-oate) in the catalyst industry
<b>Systematic title based on use descriptor</b>	ERC: ERC 1 Manufacture of substances
<b>2. Operational conditions and risk management measures</b>	
<b>2.1 Control of environmental exposure</b>	
<b>Environmental related free short title</b>	Manufacture of palladium di(4-oxopent-2-en-2-oate) in the catalyst industry
<b>Systematic title based on use descriptor (environment)</b>	ERC 1 Manufacture of substances
<b>Processes, tasks, activities covered (environment)</b>	Manufacture of palladium di(4-oxopent-2-en-2-oate) in the catalyst industry: As defined by SpERC for 'Manufacture of metal containing catalysts' <sup>9</sup> Raw material delivery and handling, Catalyst manufacture: dissolving, precipitating, filtrating, drying, mixing, forming, impregnation, calcination, sulfiding, stripping, regeneration, reduction, stabilisation, coating and screening, loading of reactor (transfer from big bags/drums/containers). Fresh catalyst packaging: filling operations, cleaning and maintenance and storage of final product.
<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>	
Palladium di(4-oxopent-2-en-2-oate) as a solid.	
Environmental assessment is based on the release factors detailed in the SpERC for 'Manufacture of	

metal-containing catalysts' 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 (M<sub>safe</sub>)</b>	18.6 tonnes palladium di(4-oxopent-2-en-2-oate) (6.50 tonnes Pd equivalent)
<b>Frequency and duration of use</b>	
<b>Pattern of release to the environment</b>	280 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>	
<p><b>Waste water:</b></p> <p>ES Discharge to freshwater via STP: On-site wastewater treatment by chemical precipitation, sedimentation, electrolysis, reverse osmosis, ion exchange and/or filtration. Efficiency &gt;99% (typical values reported in SpERC for 'Manufacture of metal-containing catalysts')</p> <p>and off-site municipal sewage treatment plant (STP) Efficiency 73.4 % (based on European STP monitoring programme)<sup>12</sup></p> <p>Release factor after on-site treatment: 67 g/T (10% of SpERC RF for wastewater)</p> <p><b>Air:</b></p> <p>Treatment of air emissions by cyclones, filters (e.g. fabric, bag, HEPA or ceramic), electrostatic precipitators and/or wet scrubbers. Efficiency 95 to &gt;99% (typical values reported in SpERC for 'Manufacture of metal-containing catalysts')</p>	

<sup>12</sup> Stutt E, Wilson I, Merrington G & Rothenbacher K (2016) Determining the Removal of Platinum Group Metals in Industrial Effluent during Sewage Treatment. In: Abstracts Book of the SETAC Europe 26th Annual Meeting – 22-26 May 2016, Nantes, France, Society of Environmental Toxicology and Chemistry

Release factor after on-site treatment: 25 g/T (10% of SpERC RF for air)							
<b>Organizational measures to prevent/limit release from site</b>							
Regular operator training.							
<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>		The sludge is incinerated (with ash going to landfill)					
<b>Conditions and measures related to external treatment of waste for disposal</b>							
Palladium di(4-oxopent-2-en-2-oate)- and other Pd-containing waste is filled into containers and transported to licensed recycling facilities for recovery or disposed of at landfill.							
<b>Conditions and measures related to external recovery of waste</b>							
Palladium di(4-oxopent-2-en-2-oate)- and other Pd-containing waste suitable for recycling may be recycled either internally or at licensed recycling facility.							
<b>3. Exposure and risk estimation</b>							
<b>Environment [based on total Pd emissions]</b>							
ERC 1 Manufacture of substances							
<b>ES 2 Use at industrial site – Manufacture of palladium di(4-oxopent-2-en-2-oate) in the catalyst industry*</b>							
Compartment	Unit	PNEC	PEC <sub>regional</sub>	C <sub>local</sub>	PEC	RCR	Methods for calculation of environmental concentrations
Discharge to STP	mg Pd/L	1.46 mg/L	1.75 x10 <sup>-7</sup> mg/L	2.07 x10 <sup>-4</sup> mg/L	2.07 x10 <sup>-4</sup> mg/L	1.4 x10 <sup>-4</sup>	Adjusted SpERC emission factors applied to M <sub>safe</sub> tonnage and dilution factor at municipal STP
Freshwater via STP	mg Pd/L	2.66 x10 <sup>-5</sup> mg/L	1.75 x10 <sup>-7</sup> mg/L	2.00 x10 <sup>-5</sup> mg/L	2.01 x10 <sup>-5</sup> mg/L	0.76	Adjusted SpERC emission factors applied to M <sub>safe</sub> tonnage and value for measured STP removal efficiency. Plus, dilution in ultimate receiving water body based on TGD default

Freshwater sediment via STP	mg Pd/k g w.w.	0.060 mg/kg	3.33 x10 <sup>-4</sup> mg/kg	0.011 mg/kg	0.0111 mg/kg	0.18	Adjusted SpERC emission factors applied to Msafe tonnage. Partitioning to SPM/sediment based on measured partition coefficient.
Terrestrial (all scenarios)	mg Pd/k g w.w.	1.04 x 10 <sup>-2</sup> mg/kg	1.64 x10 <sup>-3</sup> mg/kg	4.40 x10 <sup>-8</sup> mg/kg	1.64 x10 <sup>-3</sup> mg/kg	0.16	Modelled increase in soil concentrations due to deposition from atmospheric emissions (i.e. assuming no application of sewage sludge to land)

\* All concentrations reported as Pd equivalent due to the Pd metal PNEC used for assessment.

#### 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.

## 9.2.2. Worker contributing scenario 1: Raw material handling (PROC 26)

### 9.2.2.1. Conditions of use

	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)
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	

	Method
• 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)
• Generic local exhaust ventilation: Lower confidence limit (industrial use) (Standard efficiency) [Effectiveness Inhal: 78%]	External Tool (MEASE)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• 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.)	
• 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.)	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) (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.)	

### 9.2.2.2. Exposure and risks for workers

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

**Table 11. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	2.2E3 µg/m <sup>3</sup> (External Tool (MEASE))	RCR = 0.086
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	141.4 µg/kg bw/day (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 = 0.09

#### 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 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 well below the DNELs and no local effects are expected. Therefore, risks are adequately controlled.

### 9.2.3. Worker contributing scenario 2: Closed batch process (PROC 3)

#### 9.2.3.1. 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)
• 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>	

	Method
• 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)
• Level of containment: Closed process	External Tool (MEASE)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• 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.)	
• 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.)	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) (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.)	

### 9.2.3.2. Exposure and risks for workers

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

**Table 12. 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 < 0.01
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	1.71 µg/kg bw/day (External Tool	RCR < 0.01

Route of exposure and type of effects	Exposure concentration	Risk characterisation
	(MEASE))	
Dermal, local, long-term		Qualitative (see below)
Dermal, local, acute		Qualitative (see below)
Eye, local		Qualitative (see below)
Combined routes, systemic, long-term		RCR < 0.01

### 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 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 well below the DNELs and no local effects are expected. Therefore, risks are adequately controlled.

## 9.2.4. Worker contributing scenario 3: Fully contained process (PROC 1)

### 9.2.4.1. 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)
• 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	External Tool (MEASE)

	Method
Inhal: 0%; Dermal: 0%]	
<b>Technical and organisational conditions and measures</b>	
• Level of containment: Closed process	External Tool (MEASE)
• Pattern of use: Closed system without breaches	External Tool (MEASE)
• Pattern of exposure control: Non-direct handling	External Tool (MEASE)
• Contact level: None	External Tool (MEASE)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• 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.)	
• 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.)	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) (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.)	

#### 9.2.4.2. 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	1 µg/m <sup>3</sup> (External Tool (MEASE))	RCR < 0.01
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	1.71 µg/kg bw/day (External Tool (MEASE))	RCR < 0.01

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Dermal, local, long-term		Qualitative (see below)
Dermal, local, acute		Qualitative (see below)
Eye, local		Qualitative (see below)
Combined routes, systemic, long-term		RCR < 0.01

#### 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 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 well below the DNELs and no local effects are expected. Therefore, risks are adequately controlled.

## 9.2.5. Worker contributing scenario 4: Small scale handling/transfer of solutions (PROC 9)

### 9.2.5.1. 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 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: > 240 min (not restricted) [Effectiveness	External Tool (MEASE)

	Method
Inhal: 0%; Dermal: 0%]	
<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>	
• 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.)	
• 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.)	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) (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.)	

### 9.2.5.2. 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	<b>10 µg/m<sup>3</sup></b> (External Tool (MEASE))	RCR < 0.01
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	<b>34.29 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 < 0.01

#### 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 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 well below the DNELs and no local effects are expected. Therefore, risks are adequately controlled.

## 9.2.6. Worker contributing scenario 5: Laboratory analyses (PROC 15)

### 9.2.6.1. 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)
• 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>	

	Method
• 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>	
• 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.)	
• 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.)	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) (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.)	

### 9.2.6.2. Exposure and risks for workers

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

**Table 6. 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 < 0.01
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	<b>17.14 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)

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Combined routes, systemic, long-term		RCR < 0.01

### 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 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 well below the DNELs and no local effects are expected. Therefore, risks are adequately controlled.

## 9.2.7. Worker contributing scenario 6: Wet cleaning (PROC 8a)

### 9.2.7.1. Conditions of use

	Method
<b>Product (article) characteristics</b>	
• Physical form of substance: Solution, suspension	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: > 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)

	Method
• Contact level: Extensive	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)
• 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.)	
• 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.)	

### 9.2.7.2. Exposure and risks for workers

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

**Table 7. 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 < 0.01
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	34.29 µg/kg bw/day (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 < 0.01

#### 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 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 well below the DNELs and no local effects are expected. Therefore, risks are adequately controlled.

## 9.2.8. Worker contributing scenario 7: Vacuum cleaning (PROC 26)

### 9.2.8.1. Conditions of use

	Method
<b>Product (article) characteristics</b>	
• Physical form of substance: Solid, powder / dust	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)
<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>	
• Integrated local exhaust ventilation: Lower confidence limit (industrial use) (Standard efficiency) [Effectiveness Inhal: 84%] <i>Surrogate exposure determinant used to reflect the efficiency of a vacuum cleaner.</i>	External Tool (MEASE)
• Pattern of use: Non-dispersive use	External Tool (MEASE)
• Pattern of exposure control: Non-direct handling	External Tool (MEASE)
• Contact level: Extensive	External Tool (MEASE)
• Additional operational conditions for cleaning: No direct manual removal of	External Tool (MEASE)

	Method
dust.	
<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>	

### 9.2.8.2. Exposure and risks for workers

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

**Table 8. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	80 µg/m <sup>3</sup> (External Tool (MEASE))	RCR < 0.01
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	1.41 µg/kg bw/day (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 < 0.01

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### **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 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 well below the DNELs and no local effects are expected. Therefore, risks are adequately controlled.