9.4. Exposure scenario 4: Use at industrial site - Use as a Homogeneous Process Catalyst

Market sector: Catalysts

PC 21: Laboratory Chemicals

Sector of use:

SU 8, Manufacture of bulk, large scale chemicals (including petroleum products)

SU 9, Manufacture of fine chemicals

SU 24, Scientific research and development

Environment contributing scenario(s):	
Use as a Homogeneous Process Catalyst	ERC 4
Worker contributing scenario(s):	
Small scale handling/transfer of solutions/suspensions	PROC 9
Closed batch process	PROC 3
Fully contained process	PROC 1
Powder handling	PROC 26
Laboratory analyses	PROC 15
Wet cleaning	PROC 8a
Vacuum cleaning	PROC 26

9.4.1. Environmental contributing scenario 1: Use as a Homogeneous Process Catalyst9.4.1.1. 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 Pd to wastewater and air occurring during the use of palladium di(4-oxopent-2-en-2-oate) as a homogenous process catalyst at an industrial facility. The 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 'Formulation of metal compounds in pigments, paints and coating industry sector'[16] and calculation of the maximum tonnage (Msafe) of palladium di(4-oxopent-2-en-2-oate) that can be used without unacceptable risk to the environment. Environmental exposure modelling using release factors

[16] http://www.arche-consulting.be/content/documents/Eurometaux-2.2a-c.v2.1.pdf.

defined by the SpERC for the use of metals in the formulation of paints and pigments was sufficient to derive an adequate tonnage for this use of palladium di(4-oxopent-2-en-2-oate) so exposure assessment stopped at Tier 2 (i.e. no refinement to the SpERC RFs based on the monetary value of palladium was necessary).

The SpERC for the use of metals in the formulation of paints and pigments has been used in the absence of a SpERC for the downstream use of catalysts at industrial sites or suitable emission data for this specific sector use. This SpERC was selected as palladium di(4-oxopent-2-en-2-oate) is used as a homogenous catalyst in a liquid matrix during processing, and is therefore is in a similar form to metals contained in inks and paints. The approach is considered to be conservative as emissions from the use of palladium di(4-oxopent-2-en-2-oate) as a homogeneous catalyst are likely to be negligible as the catalyst is loaded and unloaded by a controlled, automated process (with an exhaust system to collect any emissions), and the catalyst is used within a closed system. The catalyst and organic end product are separated by continuous distillation and palladium di(4-oxopent-2-en-2-oate) remains in the reactor for further use as catalyst..
A summary of the emission characteristics used to describe the environmental aspects of the generic exposure scenario (GES) for industrial use of palladium di(4-oxopent-2-en-2-oate)-containing catalysts is detailed below.

1. Title **ES 4: Use at industrial site – Use as a Homogeneous Process Catalyst**	
Life cycle	Use of palladium di(4-oxopent-2-en-2-oate) as a homogeneous process catalyst at industrial sites
Systematic title based on use descriptor	ERC: ERC 4 – Use of non-reactive processing aid at industrial site (no inclusion into or onto article)
2. Operational conditions and risk management measures	
2.1 Control of environmental exposure	
Environmental related free short title	Use of palladium di(4-oxopent-2-en-2-oate) at industrial site as a catalyst
Systematic title based on use descriptor (environment)	ERC 4 (Use of non-reactive processing aid at industrial site (no inclusion into or onto article))
Processes, tasks, activities covered (environment)	Industrial use of palladium di(4-oxopent-2-en-2-oate) containing catalysts: Loading of reactor (automated transfer), use in closed reactor, catalyst and organic end product are separated by continuous distillation (palladium di(4-oxopent-2-en-2-oate) remains in the reactor for further use as catalyst).
Environmental Assessment Method	Estimates of environmental emissions based on adjusted

	SpERC RFs are used for calculation of maximum tonnage that can be used safely without unacceptable risk to the environment
Product characteristics Palladium di(4-oxopent-2-en-2-oate) as aqueous solution. Environmental assessment is based on the release factors detailed in the SpERC for 'Formulation of metal compounds in pigments, paints and coating industry sector'[16] and default characteristics for environmental compartments detailed in the ECHA technical guidance and EUSES model.	
Amounts used	
Maximum annual safe use at a site	6.97 tonnes palladium di(4-oxopent-2-en-2-oate) (2.40 tonnes Pd equivalent)
Frequency and duration of use	
Pattern of release to the environment	150 days per year per site (SpERC[16])
Environment factors not influenced by risk management	
Receiving surface water flow rate	STP: 2,000 m^3/d (default) Receiving water: 18,000 m^3/d (default)
Dilution capacity, freshwater	Discharge to freshwater via STP: DF = 10 (default)
Dilution capacity, marine	Not relevant
Other given operational conditions affecting environmental exposure	
None	
Technical conditions and measures at process level (source) to prevent release	
Appropriate process control systems shall be implemented.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Waste water: 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 'Formulation of metal compounds in pigments, paints and coating industry sector'16) and off-site municipal sewage treatment plant (STP) Efficiency 73.4 % (based on European STP monitoring programme)[17]	

[17] 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: 100 g/T (SpERC RF for wastewater)

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 'Formulation of metal compounds in pigments, paints and coating industry sector'[16])

Release factor after on-site treatment: 50 g/T (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)

Municipal Sewage Treatment Plant (STP)	Yes
Discharge rate of the Municipal STP	2 000 m^3/d (default)
Fate of the sludge from Municipal STP	The sludge is incinerated (with ash going to landfill)

Conditions and measures related to external treatment of waste for disposal

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.

Conditions and measures related to external recovery of waste

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.

3. Exposure and risk estimation

Environment [based on total Pd emissions]
ERC 4

ES 4 Use at industrial site – Use of process catalysts*

Compartment	Unit	PNEC	$PEC_{regional}$	C_{local}	PEC	RCR	Methods for calculation of environmental concentrations
Discharge to STP	mg Pd/L	1.46 mg/L	1.75 $x10^{-7}$ mg/L	2.13 $x10^{-4}$ mg/L	2.13 $x10^{-4}$ mg/L	1.5 $x10^{-4}$	SpERC RFs applied to Msafe tonnage
Freshwater via STP	mg Pd/L	2.66 $x10^{-5}$ mg/L	1.75 $x10^{-7}$ mg/L	2.05 $x10^{-5}$ mg/L	2.07 $x10^{-5}$ mg/L	0.78	

Freshwater sediment via STP	mg Pd/kg w.w.	0.06 mg/kg	3.33 x10^{-4} mg/kg	0.011 mg/kg	0.0114 mg/kg	0.19	
Terrestrial (all scenarios)	mg Pd/kg w.w.	1.04 x 10^{-2} mg/kg	1.64 x10^{-3} mg/kg	4.80 x10^{-7} mg/kg	1.64 x10^{-3} 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.							

9.4.2. Worker contributing scenario 1: Small scale handling/transfer of solutions/suspensions (PROC 9)

9.4.2.1. Conditions of use

	Method
Product (article) characteristics	
• 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)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
Technical and organisational conditions and measures	
• Pattern of use: Non-dispersive use	External Tool (MEASE)
• Pattern of exposure control: Direct handling	External Tool (MEASE)
• Contact level: Intermittent	External Tool (MEASE)
Conditions and measures related to personal protection, hygiene and health evaluation	
• Eye protection: Eye protection to be worn to protect from adverse effects	

	Method
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.)	

9.4.2.2. Exposure and risks for workers

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

Table 14. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	**10 µg/m³** (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.

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

9.4.3.1. Conditions of use

	Method
Product (article) characteristics	
• 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)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
Technical and organisational conditions and measures	
• 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)
Conditions and measures related to personal protection, hygiene and health evaluation	
• 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.)	

	Method
• 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.)	

9.4.3.2. Exposure and risks for workers

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

Table 15. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	**10 µg/m³** (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
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.

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

9.4.4.1. Conditions of use

	Method
Product (article) characteristics	
• 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)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
Technical and organisational conditions and measures	
• 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)
Conditions and measures related to personal protection, hygiene and health evaluation	
• 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	

	Method
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.)	

9.4.4.2. Exposure and risks for workers

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

Table 16. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	**1 µg/m³** (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
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.

9.4.5. Worker contributing scenario 4: Powder handling (PROC 26)

9.4.5.1. Conditions of use

	Method
Product (article) characteristics	
• 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)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
Technical and organisational conditions and measures	
• 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)
Conditions and measures related to personal protection, hygiene and health evaluation	
• 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	

	Method
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.)	

9.4.5.2. Exposure and risks for workers

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

Table 17. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	**2.2E3 µg/m³** (External Tool (MEASE))	RCR = 0.086
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
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.

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

9.4.6.1. Conditions of use

	Method
Product (article) characteristics	
• 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)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
Technical and organisational conditions and measures	
• Pattern of use: Non-dispersive use	External Tool (MEASE)
• Pattern of exposure control: Direct handling	External Tool (MEASE)
• Contact level: Intermittent	External Tool (MEASE)
Conditions and measures related to personal protection, hygiene and health evaluation	
• 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.)	

9.4.6.2. Exposure and risks for workers

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

Table 18. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	**10 µg/m³** (External Tool (MEASE))	RCR < 0.01
Inhalation, local, long-term		Qualitative (see below)
Inhalation, local, acute		Qualitative (see below)
Dermal, systemic, long-term	**17.14 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.

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

9.4.7.1. Conditions of use

	Method
Product (article) characteristics	

	Method
• 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)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
Technical and organisational conditions and measures	
• Pattern of use: Non-dispersive use	External Tool (MEASE)
• Pattern of exposure control: Direct handling	External Tool (MEASE)
• Contact level: Extensive	External Tool (MEASE)
Conditions and measures related to personal protection, hygiene and health evaluation	
• 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.)	

9.4.7.2. Exposure and risks for workers

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

Table 19. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk characterisation

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	**50 µg/m³** (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.

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

9.4.8.1. Conditions of use

	Method
Product (article) characteristics	
• 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	External Tool (MEASE)

	Method
this assessment.)	
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	External Tool (MEASE)
Technical and organisational conditions and measures	
• Integrated local exhaust ventilation: Lower confidence limit (industrial use) (Standard efficiency) [Effectiveness Inhal: 84%] *Surrogate exposure determinant used to reflect the efficiency of a vacuum cleaner.*	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 dust.	External Tool (MEASE)
Conditions and measures related to personal protection, hygiene and health evaluation	
• 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%]	External Tool (MEASE)
• 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.)	

9.4.8.2. Exposure and risks for workers

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

Table 20. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk characterisation
Inhalation, systemic, long-term	**80 µg/m³** (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

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.