9.2. Exposure scenario 2: Use at industrial sites - Use as an intermediate

Market sector: Manufacture of other substances
Sector of use: SU 8: Manufacture of bulk, large scale chemicals (including petroleum products); SU 9: Manufacture of fine chemicals

Environment contributing scenario(s):		
CS 1	Use as an intermediate ES 2.1	ERC 6a
CS 2	Use as an intermediate ES 2.2	ERC 6a
CS 3	Use as an intermediate ES 2.3	ERC 6a
Worker contributing scenario(s):		
CS 4	Raw material handling	PROC 26
CS 5	Closed batch process	PROC 3
CS 6	Process at elevated temperature	PROC 22
CS 7	Wet cleaning	PROC 8a
CS 8	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 manufactured substances for process steps commencing the chemical transformation step.

9.2.1. Env CS 1: Use as an intermediate ES 2.1 (ERC 6a)

Assessment entity group used for the assessment of this contributing scenario: Pd dissolved for ENV assessment

9.2.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 28 tonnes/year *93.5 tonnes diammonium hexachloropalladate (28.0 tonnes Pd metal equivalent); 90P from sector data*
• Daily use amount at site: <= 0.1 tonnes/day *Based on 280 days per year (50P from sector data)*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Site specific [Effectiveness Water: 73.4%]
• Discharge rate of STP: >= 3E3 m3/day
• Application of the STP sludge on agricultural soil: No *The sludge is incinerated (with ash going to landfill)*
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *Dihydrogen tetrachloropalladate- and other Pd -containing waste suitable for recycling may be recycled either internally or at licensed recycling facility.* *The sludge from the on-site treatment plant is processed for metal reclamation (recycling).*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 9.3E4 m3/day
• Discharge to: Freshwater only

Fate (release percentage) in the biological sewage treatment plant

The biological STP is site specific and the releases to the various compartments have been set by the assessor for some assessment entities. They are distributed in the following way:

Assessment entities	Pd dissolved
Release to water	26.6%
Release to air	0%
Release to sludge	73.4%
Release degraded	0%

Explanation for Pd dissolved:
Stutt E, Wilson I, Merrington G & Rothenbacher K (2016) Determining the Removal of Platinum Group Metals in Industrial Effluent during Sewage Treatment.

9.2.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.19. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Pd dissolved	Estimated release factor	**Release factor before on site RMM:** 5.62E-3% **Release factor after on site RMM:** 5.62E-3% **Local release rate:** 5.62E-3 kg/day **Explanation:** On-site wastewater treatment by chemical precipitation, sedimentation and/or filtration. Efficiency 99.9 % (sector data) Release factor after on-site treatment: 56.2 g/T (50P from sector data)
Air	Pd dissolved	Estimated release factor	**Release factor before on site RMM:** 3E-3% **Release factor after on site RMM:** 3E-3% **Local release rate:** 3E-3 kg/day **Explanation:** Treatment of air emissions by wet scrubbers and filters (e.g. fabric, bag, HEPA). Release factor after on-site treatment: 30 g/T (10% of SpERC RF for 'Manufacture of metal compounds')
Non agricultural soil	Pd dissolved	Estimated release factor	**Release factor after on site RMM:** 0% **Explanation:** No direct emissions to soil.

9.2.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.20. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Pd dissolved	**Local PEC:** 1.52E-5 mg/L RCR = 0.338	Final RCR = 0.338
Sediment (freshwater)	Pd dissolved	**Local PEC:** 0.037 mg/kg dw RCR = 0.136	Final RCR = 0.136
Sewage Treatment Plant	Pd dissolved	**Local PEC:** 4.98E-4 mg/L RCR = 9.47E-4	Final RCR < 0.01
Agricultural soil	Pd dissolved	**Local PEC:** 2.13E-3 mg/kg dw RCR = 0.108	Final RCR = 0.108

9.2.2. Env CS 2: Use as an intermediate ES 2.2 (ERC 6a)

Assessment entity group used for the assessment of this contributing scenario: Pd dissolved for ENV assessment

9.2.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 28 tonnes/year *93.5 tonnes diammonium hexachloropalladate (28.0 tonnes Pd metal equivalent); 90P from sector data*
• Daily use amount at site: <= 0.1 tonnes/day *Based on 280 days per year (50P from sector data)*
Conditions and measures related to biological sewage treatment plant
• Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *Dihydrogen tetrachloropalladate- and other Pd -containing waste suitable for recycling may be recycled either internally or at licensed recycling facility.* *The sludge from the on-site treatment plant is processed for metal reclamation (recycling).*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 2.98E6 m3/day
• Discharge to: Freshwater only
• Discharge rate of effluent: >= 3E3 m3/day

9.2.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.21. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Pd dissolved	Estimated release factor	**Release factor before on site RMM:** 5.62E-3% **Release factor after on site RMM:** 5.62E-3% **Local release rate:** 5.62E-3 kg/day **Explanation:** On-site wastewater treatment by chemical precipitation, sedimentation and/or filtration. Efficiency 99.9 % (sector data) Release factor after on-site treatment: 56.2 g/T (50P from sector data)
Air	Pd dissolved	Estimated release factor	**Release factor before on site RMM:** 3E-3% **Release factor after on site RMM:** 3E-3% **Local release rate:** 3E-3 kg/day **Explanation:** Treatment of air emissions by wet scrubbers and filters (e.g. fabric, bag, HEPA). Release factor after on-site treatment: 30 g/T (10% of SpERC RF for 'Manufacture of metal compounds')
Non agricultural soil	Pd dissolved	Estimated release factor	**Release factor after on site RMM:** 0% **Explanation:** No direct emissions to soil.

9.2.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.22. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Pd dissolved	**Local PEC:** 1.99E-6 mg/L RCR = 0.044	Final RCR = 0.044
Sediment (freshwater)	Pd dissolved	**Local PEC:** 4.9E-3 mg/kg dw RCR = 0.018	Final RCR = 0.018
Agricultural soil	Pd dissolved	**Local PEC:** 2.13E-3 mg/kg dw RCR = 0.108	Final RCR = 0.108

9.2.3. Env CS 3: Use as an intermediate ES 2.3 (ERC 6a)

Assessment entity group used for the assessment of this contributing scenario: Pd dissolved for ENV assessment

9.2.3.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 0.5 tonnes/year *1.67 tonnes diammonium hexachloropalladate (0.50 tonnes Pd metal equivalent); calculated Msafe*
• Daily use amount at site: <= 1.8E-3 tonnes/day *Based on 280 days per year (50P from sector data)*
Conditions and measures related to biological sewage treatment plant
• Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *Dihydrogen tetrachloropalladate- and other Pd -containing waste suitable for recycling may be recycled either internally or at licensed recycling facility.* *The sludge from the on-site treatment plant is processed for metal reclamation (recycling).*
Other conditions affecting environmental exposure
• Discharge to: Marine water only
• Discharge rate of effluent: >= 120 m3/day
• Dilution factor to marine water: <= 100

9.2.3.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.23. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Pd dissolved	Estimated release factor	**Release factor before on site RMM:** 1E-3% **Release factor after on site RMM:** 1E-3% **Local release rate:** 1.8E-5 kg/day
Air	Pd dissolved	Estimated release factor	**Release factor before on site RMM:** 3E-3% **Release factor after on site RMM:** 3E-3% **Local release rate:** 5.4E-5 kg/day
Non agricultural soil	Pd dissolved	Estimated release factor	**Release factor after on site RMM:** 0%

9.2.3.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.24. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Marine water	Pd dissolved	Clocal: 1.21E-6 mg/L (estimated by Calculation with Kp susp. matter marine (logKp = 4.21)) RCR = 0.273	Final RCR = 0.273
Sediment (marine water)	Pd dissolved	Clocal: 0.02 mg/kg dw (estimated by Calculation with Kp susp. matter marine (logKp = 4.21)) RCR = 0.735	Final RCR = 0.735
Agricultural soil	Pd dissolved	**Local PEC:** 1.85E-3 mg/kg dw RCR = 0.094	Final RCR = 0.094

9.2.4. Worker CS 4: Raw material handling (PROC 26)

Assessment entity group used for the assessment of this contributing scenario: diammonium hexachloropalladate for OCC assessment

9.2.4.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: Solid	MEASE 1
• Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
• Maximum emission potential of the substance: Low	MEASE 1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
Technical and organisational conditions and measures	
• Contact level: Intermittent	MEASE 1
• Pattern of exposure control: Direct handling	MEASE 1
• Pattern of use: Non-dispersive use	MEASE 1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (medium hazard)	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes	

9.2.4.2. Exposure and risks for workers

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

Table 9.25. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	diammonium hexachloropalladate	1.5E3 µg/m³ (MEASE 1) RCR = 0.319	Final RCR = 0.319
Dermal, systemic, long term	diammonium hexachloropalladate	141.4 µg/kg bw/day (MEASE 1) RCR = 0.106	Final RCR = 0.106

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Combined routes, systemic, long-term			Final RCR = 0.425

Remarks on exposure data from external estimation tools:

MEASE 1 for diammonium hexachloropalladate:
Explanation: 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

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):
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.
Additional remarks on risk characterisation: 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 CS 5: Closed batch process (PROC 3)

Assessment entity group used for the assessment of this contributing scenario: diammonium hexachloropalladate for OCC assessment

9.2.5.1. Conditions of use

	Method
Product (article) characteristics	
• Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
• Maximum emission potential of the substance: Low	MEASE 1
• Physical form of substance: Solid	MEASE 1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
Technical and organisational conditions and measures	
• Contact level: Intermittent	MEASE 1
• Level of containment: Closed process	MEASE 1
• Pattern of exposure control: Non-direct handling	MEASE 1
• Pattern of use: Non-dispersive use	MEASE 1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (medium hazard)	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes	

9.2.5.2. Exposure and risks for workers

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

Table 9.26. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	diammonium hexachloropalladate	100 µg/m³ (MEASE 1) RCR = 0.021	Final RCR = 0.021
Dermal, systemic, long term	diammonium hexachloropalladate	1.71 µg/kg bw/day (MEASE 1) RCR = 1.29E-3	Final RCR < 0.01
Combined routes, systemic, long-term			Final RCR = 0.023

Remarks on exposure data from external estimation tools:

MEASE 1 for diammonium hexachloropalladate:
Explanation: 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

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):
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.
Additional remarks on risk characterisation: 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 CS 6: Process at elevated temperature (PROC 22)

Assessment entity group used for the assessment of this contributing scenario: diammonium hexachloropalladate for OCC assessment

9.2.6.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: Solid	MEASE 1
• Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
• Maximum emission potential of the substance: High (temperature based)	MEASE 1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
Technical and organisational conditions and measures	
• Contact level: Incidental	MEASE 1
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] Inhalation explanation: *Efficiency for industrial use*	MEASE 1
• Pattern of exposure control: Non-direct handling	MEASE 1
• Pattern of use: Non-dispersive use	MEASE 1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (medium hazard)	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes	

9.2.6.2. Exposure and risks for workers

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

Table 9.27. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	diammonium hexachloropalladate	1.54E3 µg/m³ (MEASE 1) RCR = 0.328	Final RCR = 0.328
Dermal, systemic, long term	diammonium hexachloropalladate	14.14 µg/kg bw/day (MEASE 1) RCR = 0.011	Final RCR = 0.011
Combined routes, systemic, long-term			Final RCR = 0.338

Remarks on exposure data from external estimation tools:

MEASE 1 for diammonium hexachloropalladate:
Explanation: 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

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):
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.
Additional remarks on risk characterisation: 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 CS 7: Wet cleaning (PROC 8a)

Assessment entity group used for the assessment of this contributing scenario: diammonium hexachloropalladate for OCC assessment

9.2.7.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: Solution, suspension	MEASE 1
• Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
• Maximum emission potential of the substance: Very low	MEASE 1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
Technical and organisational conditions and measures	
• Contact level: Extensive	MEASE 1
• Pattern of exposure control: Direct handling	MEASE 1
• Pattern of use: Non-dispersive use	MEASE 1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation	
• 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%]	MEASE 1
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes	

9.2.7.2. Exposure and risks for workers

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

Table 9.28. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	diammonium hexachloropalladate	50 µg/m³ (MEASE 1) RCR = 0.011	Final RCR = 0.011
Dermal, systemic, long term	diammonium hexachloropalladate	34.29 µg/kg bw/day (MEASE 1) RCR = 0.026	Final RCR = 0.026
Combined routes, systemic, long-term			Final RCR = 0.036

Remarks on exposure data from external estimation tools:

MEASE 1 for diammonium hexachloropalladate:
Explanation: 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

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):
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.
Additional remarks on risk characterisation: 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 CS 8: Vacuum cleaning (PROC 26)

Assessment entity group used for the assessment of this contributing scenario: diammonium hexachloropalladate for OCC assessment

9.2.8.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: Solid, powder / dust	MEASE 1
• Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
• Maximum emission potential of the substance: High	MEASE 1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	MEASE 1
Technical and organisational conditions and measures	
• Contact level: Extensive	MEASE 1
• Integrated local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 84%] *Surrogate exposure determinant used to reflect the efficiency of a vacuum cleaner.* Inhalation explanation: *Efficiency for industrial use*	MEASE 1
• Pattern of exposure control: Non-direct handling	MEASE 1
• Pattern of use: Non-dispersive use	MEASE 1
• Additional operational conditions for cleaning: No direct manual removal of dust.	MEASE 1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin	

	Method
(medium hazard)	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes	

9.2.8.2. Exposure and risks for workers

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

Table 9.29. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	diammonium hexachloropalladate	1.6E3 µg/m³ (MEASE 1) RCR = 0.34	Final RCR = 0.34
Dermal, systemic, long term	diammonium hexachloropalladate	14.14 µg/kg bw/day (MEASE 1) RCR = 0.011	Final RCR = 0.011
Combined routes, systemic, long-term			Final RCR = 0.351

Remarks on exposure data from external estimation tools:

MEASE 1 for diammonium hexachloropalladate:
Explanation: 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

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):
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.
Additional remarks on risk characterisation: Under the prescribed conditions of use, exposure is well below the DNELs and no local effects are expected. Therefore, risks are adequately controlled.