

9.0. Exposure scenario 2: Use at industrial site - Use as an intermediate

Market sector: Manufacture of other substances

PC 19: Intermediate

Sector of use:

SU 9, Manufacture of fine chemicals

SU 14, Manufacture of basic metals, including alloys

Environment contributing scenario(s):	
Use as an intermediate	ERC 6a
Worker contributing scenario(s):	
Handling of medium/high dusty materials	PROC 26
Handling of low dusty materials	PROC 26
Handling of solutions and reaction	PROC 3, 4, 5, 8b, 9, 15
Fully contained process	PROC 1
Wet powder production	PROC 27a
Hot powder production	PROC 27b
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 manufactured substances for process steps commencing the chemical transformation step.

9.0.1. Environmental contributing scenario 1: Use as an intermediate

9.0.1.1. Conditions of use

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

9.0.1.2. Releases

The GES and associated risk assessment are concerned with releases of Pt to wastewater and air arising from the use of dipotassium hexachloroplatinate as an intermediate at an industrial site. Wastewater is treated by an on-site wastewater treatment plant (WWTP) prior to discharge to the receiving water body in a number of ways:

- To freshwater via a municipal sewage treatment plant (STP) [ES 2.1]; or
- Direct discharge to freshwater [ES 2.2].

Airborne emissions are treated by in-stack mitigation systems prior to discharge (all ES). Exposure assessment for the environment is based on representative exposure characteristics from the Pt manufacturing and processing sector for wastewater emissions and adjusted SpERC values for stack emissions to air (supported by a limited amount of emission data).

A sector-wide monitoring dataset is available, based on emissions of total Pt, resulting from production and use of a variety of Pt compounds collected during 2012 - 2016 from sites across Europe. In this assessment the release factor (RF) for wastewater is set at 0.00119 % (equivalent to 11.9 g/T); the 50th percentile measured wastewater release factor from 9 sites. The use of adjusted release factors for air is supported by the available data on measured Pt emissions in air at sites producing Pt compounds. In this assessment the release factor (RF) to air is set at 10% of the SpERC RF for 'manufacture of metal compounds'¹ to air of 0.03% (adjusted from 0.3% and equivalent to 30 g/T) is much higher than the mean measured RF of 15.7 g/T based on quantifiable measurements from four sites manufacturing Pt compounds.

¹ <http://www.arche-consulting.be/content/documents/Eurometaux-1.2.v2.1.pdf>

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9.0.1.3. Risk Management Measures (RMMs)

All sites from the Pt manufacturing and processing sector that provided data on emissions to water reported that wastewater treatment was primarily based on chemical precipitation followed by sedimentation and/or filtration. Two sites reported an additional step involving ion exchange. The reported efficiency for treatment of wastewater containing Pt compounds varied from 98 to 99.99%, with the majority of sites reporting $\geq 99.9\%$ removal efficiency. Similarly, all sites reporting on RMMs for stack emissions to air (n=3) stated the use of wet scrubbers, with the reported efficiency in the range $\geq 99\%$.

9.0.1.4. Exposure Scenario

The use of dipotassium hexachloroplatinate as an industrial intermediate is considered to have the same operating conditions and emission characteristics as manufacture on the basis that many companies in this sector manufacture dipotassium hexachloroplatinate for use as an intermediate and using facilities using this compounds as intermediate would be undertaking similar processes.

A summary of the emission characteristics used to quantify the environmental aspects of the generic exposure scenario (GES) for use of dipotassium hexachloroplatinate as an intermediate at industrial sites is detailed below:

1. Title	
ES2: Use as an intermediate at industrial site	
Life cycle	Use as an intermediate at industrial site
Systematic title based on use descriptor	ERC: ERC 6A Use as an intermediate – industrial
2. Operational conditions and risk management measures	
2.1 Control of environmental exposure	
Environmental related free short title	Use as an industrial intermediate

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Systematic title based on use descriptor (environment)	ERC 6A Use as an intermediate – industrial
Processes, tasks, activities covered (environment)	Use as an industrial intermediate: delivery and processing of dipotassium hexachloroplatinate, cleaning & maintenance.
Environmental Assessment Method	Estimates based on monitoring data of emissions, local and regional concentrations are used for calculation of PECs
Product characteristics Dipotassium hexachloroplatinate as solid or aqueous solution. Environmental assessment is based on the estimated emission of dipotassium hexachloroplatinate in wastewater discharge and in stack emissions to air.	
Amounts used	
Annual production/use at a site	ES 2.1 and ES 2.2: 74.7 tonnes dipotassium hexachloroplatinate (30.0 tonnes Pt metal equivalent); 90P from sector data
Frequency and duration of use	
Pattern of release to the environment	330 days per year per site (50P from sector data)
Environment factors not influenced by risk management	
Receiving surface water flow rate	ES 2.1: STP: 3,000 m ³ /d (minimum STP size from sector data) Receiving water: 93,000 m ³ /d (based on 50P dilution factor from sector data)

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	ES 2.2: Receiving water: Receiving water: 2,997,000 m ³ /d (maximum allowable dilution factor of 1000; assumption made on knowledge of sector data.)
Dilution capacity, freshwater	ES 2.1: Discharge to freshwater via STP: DF in STP = 25; DF in receiving water = 32 (sector data) ES 2.2: Direct discharge to freshwater: DF = 1,000 (maximum allowable)
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: All ES: On-site wastewater treatment by chemical precipitation, sedimentation and/or filtration. Efficiency 99.9 % (sector data) Release factor after on-site treatment: 11.9 g/T (50P from sector data) ES 2.1. Off-site municipal sewage treatment plant (STP) Efficiency 57.1 % (based on European STP monitoring programme ²)	

² 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

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Air: All ES: 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' ³)	
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)	ES 2.1: Yes ES 2.2: No
Discharge rate of the Municipal STP	ES 2.1: 3 000 m ³ /d (minimum from sector data)
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	
Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the platinum content of the waste is elevated enough, internal or external recovery/recycling should be considered. Fraction of daily/annual use expected in waste: 0% Appropriate waste codes: 06 04 05*, 06 05 02*, 10 07 01, 10 07 02, 10 07 03, 10 07 05, 10 08 16, 15 02 02*, 16 01 18, 16 08 01, 16 08 06*, 16 08 07*, 19 08 06*, 20 01 40,	

³ ARCHE (2013) Manufacture of metal compounds. spERC code Eurometaux 1.2.v2.1. Available online at <http://www.arche-consulting.be/metal-csa-toolbox/SPERCs-tool-for-metals/>

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Suitable disposal: Hazardous waste produced during the manufacture and downstream use is sent to a recycler only marginal amounts are sent to a landfill or an incinerator.

Waste containing platinum is recycled for almost a 100%

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2016)

Conditions and measures related to external recovery of waste

Dipotassium hexachloroplatinate- and other Pt -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).

3. Exposure and risk estimation

Environment [based on total Pt emissions]

ERC 6A

ES 2 Use as an industrial intermediate*

Compartment	Unit	PNEC	PEC _{regiona} l	C _{local}	PEC	RCR	Methods for calculation of environmental concentrations
Discharge to STP (ES 2.1)	mg Pt/L	0.125 mg/L	N.A.	1.55 x 10 ⁻⁴ mg/L	1.55 x 10 ⁻⁴ mg/L	1.2 x 10 ⁻³	Reasonable worst case exposure modelling based on 90P sector tonnage & 50P release factor
Freshwater via STP (ES 2.1)	mg Pt/L	1.4 x 10 ⁻⁴ mg/L	3.81 x 10 ⁻⁸ mg/L	4.71 x 10 ⁻⁶ mg/L	4.75 x 10 ⁻⁶ mg/L	3.39 x 10 ⁻²	
Freshwater following	mg Pt/L	1.4 x 10 ⁻⁴	3.81 x 10 ⁻⁸ mg/L	3.51 x 10 ⁻⁷	3.89 x 10 ⁻⁷ mg/L	2.78 x 10 ⁻³	

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direct discharge (ES 2.2)		mg/L		mg/L			
Freshwater sediment via STP (ES 2.1)	mg Pt/k g w.w.	0.0568 mg/kg	N.A. ⁴	1.92 x 10 ⁻³ mg/kg g	1.92 x 10 ⁻³ mg/kg	0.34 [†]	
Freshwater sediment via direct discharge (ES 2.2)	mg Pt/k g w.w.	0.0568 mg/kg	N.A. ¹⁶	1.58 x 10 ⁻⁴ mg/kg g	1.58 x 10 ⁻⁴ mg/kg	0.028 [†]	
Terrestrial (ES 2.1 and 2.2)	mg Pt/k g w.w.	4.61 x 10 ⁻³ mg/kg	8.37 x 10 ⁻⁴ mg/kg	1.64 x 10 ⁻⁶ mg/kg g	8.39 x 10 ⁻⁴ mg/kg	0.18	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 Pt equivalent due to the Pt metal PNEC used for assessment.							
† Additional factor of 10 applied in RCR calculation to account for use of PNEC derived by equilibrium partitioning.							

⁴ The concentration in freshly deposited sediment is taken as the PEC for sediment, therefore, the properties of suspended matter are used. The concentration in bulk sediment can be derived from the corresponding water body concentration, assuming a thermodynamic partitioning equilibrium. (ECHA (2016) Guidance on information requirements and chemical safety assessment. Chapter R16: Environmental exposure estimation (Version 3.0, February 2016))

N.A. = not applicable

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.

9.0.2. Worker contributing scenario 1: Handling of medium/high dusty materials (PROC 26)

9.0.2.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: solid	Analogous data
• Maximum emission potential of the substance: High (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if platinum substances of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data
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%]	Monitoring data

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	Method
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> • The following types of exhaust ventilations are appropriate: <ul style="list-style-type: none"> - Generic local exhaust ventilation - Exterior exhaust ventilation - Integrated exhaust ventilation <p>A minimum efficiency of 80 % has to be assured.</p>	Analogous data
<ul style="list-style-type: none"> • Level of containment: <ul style="list-style-type: none"> - Chloroplatinates have to be handled in at least partly-contained systems with only limited manual interventions. - The level of containment should be as high as possible, easy maintenance should be allowed by system design. 	
<ul style="list-style-type: none"> • Level of automation: <p>The level of automation should be as high as possible in order to reduce potential for exposure. This is inherently covered in the dermal exposure assessment by the reflection of an “incidental or intermittent” contact level (please refer to the dermal exposure pattern below).</p>	
<ul style="list-style-type: none"> • Removal of residuals: <p>Removal of dusty residuals is considered to be part of regular work. Dust may not be blown off with compressed air. Please refer to the introduction for more detailed information on how clean work environments are ensured and on how to contamination is avoided in the platinum industry.</p>	
<ul style="list-style-type: none"> • Dermal exposure pattern: <ul style="list-style-type: none"> - Pattern of use: Non-dispersive use - Pattern of exposure control: Direct handling - Contact level: Intermittent 	Analogous data

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	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• 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.	
<ul style="list-style-type: none">• Eye protection: 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.	
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

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9.0.2.2. Exposure and risks for workers

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

Table 1. Exposure concentrations and risks for workers

	CI Pt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	3.63 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	APF = 40: 0.09 µg solPt/m ³
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	0.03 mg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CI Pt manufacturers raw material handling)

- Inhalation, systemic, long-term:
Number of measured data points: 17

The estimated exposure level represents the 90th percentile of the exposure distribution for estimate #01 (GSD=3.7).

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Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:
Number of measured data points: 26

The estimated exposure level represents the 90th percentile of the exposure distribution for NDI in consideration of appropriate use of gloves.

Conclusion on risk characterisation

Further information on the risk characterisation for all qualitative hazard conclusions is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is maintained at a very low level and the risk for any adverse health effects is minimised to the technically feasible level. Therefore, risks are adequately controlled.

9.0.3. Worker contributing scenario 2: Handling of low dusty materials (PROC 26)

9.0.3.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: solid	Analogous data
• Maximum emission potential of the substance: Low (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if platinum substances of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data

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	Method
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%]	Analogous data

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	Method
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> • The following types of exhaust ventilations are appropriate: <ul style="list-style-type: none"> - Generic local exhaust ventilation - Exterior exhaust ventilation - Integrated exhaust ventilation <p>A minimum efficiency of 80 % has to be assured.</p>	Analogous data
<ul style="list-style-type: none"> • Level of containment: <ul style="list-style-type: none"> - The physical form of the platinum substance may be considered as some containment considerably reducing emissions. - Chloroplatinates have to be handled in at least partly-contained systems with only limited manual interventions. - The level of containment should be as high as possible, easy maintenance should be allowed by system design. 	
<ul style="list-style-type: none"> • Level of automation: <p>The level of automation should be as high as possible in order to reduce potential for exposure. This is inherently covered in the dermal exposure assessment by the reflection of an “incidental or intermittent” contact level (please refer to the dermal exposure pattern below).</p>	
<ul style="list-style-type: none"> • Removal of residuals: <p>Removal of dusty residuals is considered to be part of regular work. Dust may not be blown off with compressed air. Please refer to the introduction for more detailed information on how clean work environments are ensured and on how to contamination is avoided in the platinum industry.</p>	
<ul style="list-style-type: none"> • Dermal exposure pattern: <ul style="list-style-type: none"> - Pattern of use: Non-dispersive use - Pattern of exposure control: Direct handling - Contact level: Intermittent 	Analogous data

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	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• 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.	
<ul style="list-style-type: none">• Eye protection: 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.	
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

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9.0.3.2. Exposure and risks for workers

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

Table 2. Exposure concentrations and risks for workers

	CIPt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	0.38 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	APF = 10: 0.04 µg solPt/m ³
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	0.03 mg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CIPt manufacturers raw material handling)

- Inhalation, systemic, long-term:
Number of measured data points: 3

The estimated exposure level represents the 95th percentile of the exposure distribution for estimate #02 (GSD=1.9).

Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:
Number of measured data points: 26

The estimated exposure level represents the 90th percentile of the exposure distribution for NDI in consideration of appropriate use of gloves.

9.0.4. Worker contributing scenario 3: Handling of solutions and reaction (PROC 3, 4, 5, 8b, 9, 15)

9.0.4.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: liquid (solution, suspension)	Analogous data
• Maximum emission potential of the substance: Very low (It is noted that spraying operations are not covered in this assessment.)	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data
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%]	Analogous data

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	Method
Technical and organisational conditions and measures	
<ul style="list-style-type: none">• The following types of exhaust ventilations are appropriate:<ul style="list-style-type: none">- Generic local exhaust ventilation- Integrated exhaust ventilation <p>A minimum efficiency of 80 % has to be assured.</p>	Analogous data
<ul style="list-style-type: none">• Level of containment:<ul style="list-style-type: none">- Chloroplatinates have to be handled in at least partly-contained systems with only limited manual interventions.- The level of containment should be as high as possible, easy maintenance should be allowed by system design.	
<ul style="list-style-type: none">• Level of automation: <p>The level of automation should be as high as possible in order to reduce potential for exposure. This is inherently covered in the dermal exposure assessment by the reflection of an “incidental or intermittent” contact level (please refer to the dermal exposure pattern below).</p>	
<ul style="list-style-type: none">• Removal of residuals: <p>Splashes are to be removed immediately, before drying. Please refer to the introduction for more detailed information on how clean work environments are ensured and on how to contamination is avoided in the platinum industry.</p>	
<ul style="list-style-type: none">• Dermal exposure pattern:<ul style="list-style-type: none">- Pattern of use: Non-dispersive use- Pattern of exposure control: Non-direct handling- Contact level: Intermittent	Analogous data

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	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• 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.	
<ul style="list-style-type: none">• Eye protection: 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.	
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

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9.0.4.2. Exposure and risks for workers

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

Table 3. Exposure concentrations and risks for workers

	CI Pt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	0.68 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	APF = 10: 0.07 µg solPt/m ³
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	<1 µg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CI Pt manufacturers wet processing)

- Inhalation, systemic, long-term:
Number of measured data points: 21

The estimated exposure level represents the 90th percentile of the exposure distribution for estimate #09 (GSD=2.5).

Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:

Number of measured data points: 7

The estimated exposure level represents the 90th percentile of the exposure distribution for NNI in consideration of appropriate use of gloves.

Conclusion on risk characterisation

Further information on the risk characterisation for all qualitative hazard conclusions is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is maintained at a very low level and the risk for any adverse health effects is minimised to the technically feasible level. Therefore, risks are adequately controlled.

9.0.5. Worker contributing scenario 4: Fully contained process (PROC 1)

9.0.5.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: not relevant (fully contained systems)	Analogous data
• Maximum emission potential of the substance: not relevant (fully contained systems)	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data
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%]	Analogous data

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	Method
Technical and organisational conditions and measures	
<ul style="list-style-type: none">• Level of containment:<ul style="list-style-type: none">- Full containment	
<ul style="list-style-type: none">• Dermal exposure pattern:<ul style="list-style-type: none">- Pattern of use: Closed system without breaches- Pattern of exposure control: Non-direct handling- Contact level: None	Analogous data
<ul style="list-style-type: none">• Potential for contamination: Although the process as such is fully contained, exposure from adjacent workplaces may lead to contamination. Please consider the need for personal protective equipment in these cases.	

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	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• Gloves as precautionary measure: 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.	
<ul style="list-style-type: none">• Eye protection: 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.	
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

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9.0.5.2. 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

	CI Pt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	0.01 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	not required
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	0.004 mg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CI Pt manufacturers separation/filtration)

- Inhalation, systemic, long-term:
Number of measured data points: 8

The estimated exposure level represents the 95th percentile value of the exposure distribution for the static estimate #14 (GSD=2.3).

Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:
Number of measured data points: 12

The estimated exposure level represents 1/10 of the 90th percentile of the exposure distribution for NNI (without gloves)

Conclusion on risk characterisation

Further information on the risk characterisation for all qualitative hazard conclusions is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is maintained at a very low level and the risk for any adverse health effects is minimised to the technically feasible level. Therefore, risks are adequately controlled.

9.0.6. Worker contributing scenario 5: Reaction process (furnace operation) (PROC 22)

9.0.6.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: not relevant	Analogous data
• Maximum emission potential of the substance: Low (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if platinum substances of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data

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	Method
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%]	Analogous data

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	Method
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> • Process temperature: below melting point 	Analogous data
<ul style="list-style-type: none"> • The following type of exhaust ventilation is appropriate for processes at elevated temperature: <ul style="list-style-type: none"> - Integrated exhaust ventilation A minimum efficiency of 90 % has to be assured. 	Analogous data
<ul style="list-style-type: none"> • Level of containment: <ul style="list-style-type: none"> - Chloroplatinates have to be handled in at least partly enclosed systems. - The level of containment should be as high as possible, easy maintenance should be allowed by system design. 	
<ul style="list-style-type: none"> • Level of automation: <p>The level of automation should be as high as possible in order to reduce potential for exposure. This is inherently covered in the dermal exposure assessment by the reflection of an “incidental or intermittent” contact level (please refer to the dermal exposure pattern below).</p> 	
<ul style="list-style-type: none"> • Removal of residuals: <p>Removal of dusty residuals is considered to be part of regular work. Dust may not be blown off with compressed air. Please refer to the introduction for more detailed information on how clean work environments are ensured and on how to contamination is avoided in the platinum industry.</p> 	
<ul style="list-style-type: none"> • Dermal exposure pattern: <ul style="list-style-type: none"> - Pattern of use: Non-dispersive use - Pattern of exposure control: Non-direct handling - Contact level: Intermittent 	Analogous data

dipotassium hexachloroplatinate

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• 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.	
<ul style="list-style-type: none">• Eye protection: 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.	
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

dipotassium hexachloroplatinate

9.0.6.2. 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

	CIPt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	1.35 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	APF = 20: 0.07 µg solPt/m ³
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	<1 µg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CIPt manufacturers calcination)

- Inhalation, systemic, long-term:
Number of measured data points: 4

The estimated exposure level represents the maximum value of the exposure distribution for estimate #17 (GSD=2.6).

Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:
Number of measured data points: 7

The estimated exposure level represents the 90th percentile of the exposure distribution for NNI in consideration of appropriate use of gloves.

Conclusion on risk characterisation

Further information on the risk characterisation for all qualitative hazard conclusions is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is maintained at a very low level and the risk for any adverse health effects is minimised to the technically feasible level. Therefore, risks are adequately controlled.

9.0.7. Worker contributing scenario 6: Hot powder production (PROC 27a)

9.0.7.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: molten / powder (already other substance)	Analogous data
• Maximum emission potential of the substance: Medium (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if platinum substances of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data

dipotassium hexachloroplatinate

	Method
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%]	Analogous data

dipotassium hexachloroplatinate

	Method
Technical and organisational conditions and measures	
• Process temperature: Slightly above melting point	Analogous data
• The following type of exhaust ventilation is appropriate for processes at elevated temperature: <ul style="list-style-type: none">- Integrated exhaust ventilation A minimum efficiency of 90 % has to be assured.	Analogous data
• Level of containment: <ul style="list-style-type: none">- Chloroplatinates have to be handled in at least partly-contained systems with only limited manual interventions.- The level of containment should be as high as possible, easy maintenance should be allowed by system design.	
• Level of automation: The level of automation should be as high as possible in order to reduce potential for exposure. This is inherently covered in the dermal exposure assessment by the reflection of an “incidental or intermittent” contact level (please refer to the dermal exposure pattern below).	
• Removal of residuals: Removal of dusty residuals is considered to be part of regular work. Dust may not be blown off with compressed air. Please refer to the introduction for more detailed information on how clean work environments are ensured and on how to contamination is avoided in the platinum industry.	
• Dermal exposure pattern: <ul style="list-style-type: none">- Pattern of use: Non-dispersive use- Pattern of exposure control: Non-direct handling- Contact level: Intermittent	Analogous data

dipotassium hexachloroplatinate

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• 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.	
<ul style="list-style-type: none">• Eye protection: 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.	
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

dipotassium hexachloroplatinate

9.0.7.2. 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

	CIPt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	1.35 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	APF = 20: 0.07 µg solPt/m ³
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	<1 µg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CIPt manufacturer calcination)

- Inhalation, systemic, long-term:
Number of measured data points: 4

The estimated exposure level represents the maximum value of the exposure distribution for estimate #17 (GSD=2.6).

dipotassium hexachloroplatinate

Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:

Number of measured data points: 7

The estimated exposure level represents the 90th percentile of the exposure distribution for NNI in consideration of appropriate use of gloves.

Conclusion on risk characterisation

Further information on the risk characterisation for all qualitative hazard conclusions is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is maintained at a very low level and the risk for any adverse health effects is minimised to the technically feasible level. Therefore, risks are adequately controlled.

9.0.8. Worker contributing scenario 7: Wet powder production (PROC 27b)

9.0.8.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: Wetted, solutions, suspensions	Analogous data
• Maximum emission potential of the substance: Low (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if platinum substances of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data

dipotassium hexachloroplatinate

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> The following type of exhaust ventilation is appropriate: <ul style="list-style-type: none"> Integrated exhaust ventilation A minimum efficiency of 80 % has to be assured. 	Analogous data
<ul style="list-style-type: none"> Level of containment: <ul style="list-style-type: none"> Chloroplatinates have to be handled in at least partly enclosed systems. The level of containment should be as high as possible, easy maintenance should be allowed by system design. 	
<ul style="list-style-type: none"> Level of automation: <p>The level of automation should be as high as possible in order to reduce potential for exposure. This is inherently covered in the dermal exposure assessment by the reflection of an “incidental or intermittent” contact level (please refer to the dermal exposure pattern below).</p>	
<ul style="list-style-type: none"> Removal of residuals: <p>Removal of dusty residuals is considered to be part of regular work. Dust may not be blown off with compressed air. Please refer to the introduction for more detailed information on how clean work environments are ensured and on how contamination is avoided in the platinum industry.</p>	
<ul style="list-style-type: none"> Dermal exposure pattern: <ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Non-direct handling Contact level: Intermittent 	Analogous data

dipotassium hexachloroplatinate

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• 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.	
<ul style="list-style-type: none">• Eye protection: 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.	
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

dipotassium hexachloroplatinate

9.0.8.2. 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

	CIPt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	1.04 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	APF = 20: 0.05 µg solPt/m ³
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	<1 µg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CIPt manufacturers separation/filtration)

- Inhalation, systemic, long-term:
Number of measured data points: 3

The estimated exposure level represents the maximum value of the exposure distribution for estimate #012 (GSD=3.4).

Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:
Number of measured data points: 7

The estimated exposure level represents the 90th percentile of the exposure distribution for NNI in consideration of the use of appropriate gloves.

Conclusion on risk characterisation

Further information on the risk characterisation for all qualitative hazard conclusions is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is maintained at a very low level and the risk for any adverse health effects is minimised to the technically feasible level. Therefore, risks are adequately controlled.

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

9.0.9.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: liquid (solution, suspension)	Analogous data
• Maximum emission potential of the substance: Very low	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data
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%]	Analogous data

dipotassium hexachloroplatinate

	Method
Technical and organisational conditions and measures	
<ul style="list-style-type: none">• Removal of residuals: Removal of residuals is considered to be part of regular work. Splashes are to be removed immediately, before drying. Please refer to the introduction for more detailed information on how clean work environments are ensured and on how to contamination is avoided in the platinum industry. Workplaces are to be cleaned before any maintenance work starts.	
<ul style="list-style-type: none">• Dermal exposure pattern:<ul style="list-style-type: none">- Pattern of use: Non-dispersive use- Pattern of exposure control: Direct handling- Contact level: Extensive	Analogous data

dipotassium hexachloroplatinate

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• 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.	
<ul style="list-style-type: none">• Eye protection: 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.	
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

dipotassium hexachloroplatinate

9.0.9.2. 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

	CI Pt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	2.96 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	APF = 40: 0.07 µg solPt/m ³
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	0.29 mg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CI Pt manufacturers cleaning and maintenance)

- Inhalation, systemic, long-term:
Number of measured data points: 17

The estimated exposure level represents the maximum value of the exposure distribution for estimate #27 (GSD=5.1).

dipotassium hexachloroplatinate

Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:
Number of measured data points: 17

The estimated exposure level represents the 90th percentile of the exposure distribution for NDE in consideration of appropriate use of gloves.

Conclusion on risk characterisation

Further information on the risk characterisation for all qualitative hazard conclusions is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is maintained at a very low level and the risk for any adverse health effects is minimised to the technically feasible level. Therefore, risks are adequately controlled.

9.0.10. Worker contributing scenario 9: Vacuum cleaning (PROC 26)

9.0.10.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of substance: dusty residuals	Analogous data
• Maximum emission potential of the substance: High (Only the highest emission potential (EP) is reported. Lower EPs (e.g. if platinum substances of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.)	Analogous data
• Content in preparation: Not restricted [Effectiveness Inhal: 0%; Dermal: 0%]	Analogous data

dipotassium hexachloroplatinate

	Method
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%]	Analogous data

dipotassium hexachloroplatinate

	Method
Technical and organisational conditions and measures	
<ul style="list-style-type: none">• Removal of dusty residuals: A highly efficient vacuum cleaner is to be used. No direct manual removal of dust. Removal of dusty residuals is considered to be part of regular work. Dust may not be blown off with compressed air. Please refer to the introduction for more detailed information on how clean work environments are ensured and on how to contamination is avoided in the platinum industry. Workplaces are to be cleaned before any maintenance work starts.	
<ul style="list-style-type: none">• Dermal exposure pattern:<ul style="list-style-type: none">- Pattern of use: Non-dispersive use- Pattern of exposure control: Non-direct handling- Contact level: Extensive	Analogous data
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none">• 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.	
<ul style="list-style-type: none">• Eye protection: 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.	

dipotassium hexachloroplatinate

	Method
<ul style="list-style-type: none">• 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.) Please note that higher APFs may be required as reported in exposure and risk section for this sub-contributing exposure scenario.	

dipotassium hexachloroplatinate

9.0.10.2. Exposure and risks for workers

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

Table 9. Exposure concentrations and risks for workers

	CI Pt
RC inhalation route	qualitative
EC inhalation, long-term, systemic	2.96 µg solPt/m ³ (Analogous data)
EC inhalation, long-term, systemic in consideration of APF	APF = 40: 0.07 µg solPt/m ³
RC inhalation, long-term, systemic	risk adequately controlled
RC dermal route	qualitative
EC dermal, long-term, systemic	0.01 mg/kg bw/day (Analogous data)
RC dermal, long-term, systemic	risk adequately controlled
RC combined long-term, systemic	risk adequately controlled

Remarks on exposure data

Inhalation

Analogous data (CI Pt manufacturers cleaning and maintenance)

- Inhalation, systemic, long-term:
Number of measured data points: 17

The estimated exposure level represents the maximum value of the exposure distribution for estimate #27 (GSD=5.1).

Dermal

Analogous data (Ni)

- Dermal, systemic, long-term:
Number of measured data points: 7

The estimated exposure level represents the 90th percentile of the exposure distribution for NNE in consideration of the use of appropriate gloves.

Conclusion on risk characterisation

Further information on the risk characterisation for all qualitative hazard conclusions is given in Section 9.0.2.3.

Under the prescribed conditions of use, exposure is maintained at a very low level and the risk for any adverse health effects is minimised to the technically feasible level. Therefore, risks are adequately controlled.