# 9.8. Exposure scenario 8: Use at industrial sites - Intermediate use of palladium dichloride for the production of inks and paints

**Market sector:** Inks and paints
**Sector of use:** SU 9: Manufacture of fine chemicals

| | | |
|---|---|---|
| **Environment contributing scenario(s):** | | |
| CS 1 | Intermediate use of palladium dichloride for the production of inks and paints | ERC 6a |
| **Worker contributing scenario(s):** | | |
| CS 2 | Handling of dusty materials | PROC 26 |
| CS 3 | Laboratory analyses | PROC 15 |
| CS 4 | Open or semi-closed wet chemical process | PROC 4 |
| CS 5 | Wet cleaning | PROC 8a |
| CS 6 | 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.

## 9.8.1. Env CS 1: Intermediate use of palladium dichloride for the production of inks and paints (ERC 6a)

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

### 9.8.1.1. Conditions of use

| |
|---|
| Amount used, frequency and duration of use (or from service life) |
| • Annual use amount at site: <= 2.4 tonnes/year<br>*4.00 tonnes palladium dichloride (2.40 tonnes Pd equivalent)* |
| • Daily use amount at site: <= 0.016 tonnes/day<br>*Based on 150 days per year (SpERC)* |
| Conditions and measures related to biological sewage treatment plant |
| • Biological STP: Site specific [Effectiveness Water: 73.4%] |
| • Discharge rate of STP: >= 2E3 m3/day |
| • Application of the STP sludge on agricultural soil: No<br>*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<br>*Dihydrogen tetrachloropalladate- and other Pd -containing waste suitable for recycling may be recycled either internally or at licensed recycling facility.*<br>*The sludge from the on-site treatment plant is processed for metal reclamation (recycling).* |
| Other conditions affecting environmental exposure |
| • Receiving surface water flow rate: >= 1.8E4 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.

### 9.8.1.2. 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 9.85. Local releases to the environment**

| Release | Assessment entity | Release estimation method | Explanations |
|---|---|---|---|
| Water | Pd dissolved | Estimated release factor | **Release factor before on site RMM:** 0.01%<br>**Release factor after on site RMM:** 0.01%<br>**Local release rate:** 1.6E-3 kg/day<br>**Explanation:**<br>On-site wastewater treatment by chemical precipitation, sedimentation, electrolysis, reverse osmosis, ion exchange and/or filtration.<br>Efficiency >99% (typical values reported in SpERC for 'Formulation of metal compounds in pigments, paints and coating industry sector')<br>Release factor after on-site treatment: 100 g/T (SpERC RF for wastewater) |
| Air | Pd dissolved | Estimated release factor | **Release factor before on site RMM:** 5E-3%<br>**Release factor after on site RMM:** 5E-3%<br>**Local release rate:** 8E-4 kg/day<br>**Explanation:**<br>Treatment of air emissions by cyclones, filters (e.g. fabric, bag, HEPA or ceramic), electrostatic precipitators and/or wet scrubbers.<br>Efficiency 95 to >99% (typical values reported in SpERC for 'Formulation of metal compounds in pigments, paints and coating industry sector')<br>Release factor after on-site treatment: 50 g/T (SpERC RF for air) |
| Non agricultural soil | Pd dissolved | Estimated release factor | **Release factor after on site RMM:** 0%<br>**Explanation:**<br>No direct emissions to soil. |

### 9.8.1.3. 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 9.86. 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:** 2.07E-5 mg/L<br>RCR = 0.46 | Final RCR = 0.46 |

| Protection target | Assessment entity | Exposure concentration | Risk quantification |
|---|---|---|---|
| Sediment (freshwater) | Pd dissolved | **Local PEC:** 0.051 mg/kg dw<br>RCR = 0.186 | Final RCR = 0.186 |
| Sewage Treatment Plant | Pd dissolved | **Local PEC:** 2.13E-4 mg/L<br>RCR = 4.05E-4 | Final RCR < 0.01 |
| Agricultural soil | Pd dissolved | **Local PEC:** 1.89E-3 mg/kg dw<br>RCR = 0.096 | Final RCR = 0.096 |

## 9.8.2. Worker CS 2: Handling of dusty materials (PROC 26)

Assessment entity group used for the assessment of this contributing scenario: Palladium dichloride for OCC assessment

### 9.8.2.1. 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: Intermittent | MEASE 1 |
| • Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%]<br>Inhalation explanation: *Efficiency for industrial use* | 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 (high hazard) | |
| • Eye protection: Eye protection to be worn to protect from adverse effects to the eyes | |

### 9.8.2.2. Exposure and risks for workers

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

**Table 9.87. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Assessment entity | Exposure concentration | Risk quantification |
|---|---|---|---|
| Inhalation, systemic, long term | Palladium dichloride | 2.2E3 µg/m³ (MEASE 1)<br>RCR = 0.037 | Final RCR = 0.037 |
| Dermal, systemic, long term | Palladium dichloride | 141.4 µg/kg bw/day (MEASE 1)<br>RCR = 8.4E-3 | Final RCR < 0.01 |
| Combined routes, systemic, long-term | | | Final RCR = 0.045 |

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

**MEASE 1** for Palladium dichloride:

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.

## 9.8.3. Worker CS 3: Laboratory analyses (PROC 15)

Assessment entity group used for the assessment of this contributing scenario: Palladium dichloride for OCC assessment

### 9.8.3.1. 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: High | MEASE 1 |
| • Physical form of substance: Solid, powder / dust | 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 (high hazard) | |
| • Eye protection: Eye protection to be worn to protect from adverse effects to the eyes | |

### 9.8.3.2. Exposure and risks for workers

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

**Table 9.88. Exposure concentrations and risks for workers**

| **Route of exposure and type of effects** | **Assessment entity** | **Exposure concentration** | **Risk quantification** |
|---|---|---|---|
| Inhalation, systemic, long term | Palladium dichloride | 5E3 µg/m³ (MEASE 1)<br>RCR = 0.084 | Final RCR = 0.084 |
| Dermal, systemic, long term | Palladium dichloride | 17.14 µg/kg bw/day (MEASE 1)<br>RCR = 1.02E-3 | Final RCR < 0.01 |
| Combined routes, systemic, long-term | | | Final RCR = 0.085 |

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

**MEASE 1** for Palladium dichloride:

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.

## 9.8.4. Worker CS 4: Open or semi-closed wet chemical process (PROC 4)

Assessment entity group used for the assessment of this contributing scenario: Palladium dichloride for OCC assessment

### 9.8.4.1. 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: High | MEASE 1 |
| • Physical form of substance: Solid, powder / dust | 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 |
| • Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%]<br>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 (high hazard) | |
| • Eye protection: Eye protection to be worn to protect from adverse effects to the eyes | |

### 9.8.4.2. Exposure and risks for workers

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

**Table 9.89. Exposure concentrations and risks for workers**

| **Route of exposure and type of effects** | **Assessment entity** | **Exposure concentration** | **Risk quantification** |
|---|---|---|---|
| Inhalation, systemic, long term | Palladium dichloride | 5.5E3 µg/m³ (MEASE 1)<br>RCR = 0.093 | Final RCR = 0.093 |
| Dermal, systemic, long term | Palladium dichloride | 3.43 µg/kg bw/day (MEASE 1)<br>RCR = 2.04E-4 | Final RCR < 0.01 |
| Combined routes, | | | Final RCR = 0.093 |

| Route of exposure and type of effects | Assessment entity | Exposure concentration | Risk quantification |
|---|---|---|---|
| systemic, long-term | | | |

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

**MEASE 1** for Palladium dichloride:
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.

## 9.8.5. Worker CS 5: Wet cleaning (PROC 8a)

Assessment entity group used for the assessment of this contributing scenario: Palladium dichloride for OCC assessment

### 9.8.5.1. 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 | |

### 9.8.5.2. Exposure and risks for workers

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

**Table 9.90. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Assessment entity | Exposure concentration | Risk quantification |
|---|---|---|---|
| Inhalation, systemic, long term | Palladium dichloride | 50 µg/m³ (MEASE 1)<br>RCR = 8.42E-4 | Final RCR < 0.01 |

| Route of exposure and type of effects | Assessment entity | Exposure concentration | Risk quantification |
|---|---|---|---|
| Dermal, systemic, long term | Palladium dichloride | 34.29 µg/kg bw/day (MEASE 1)<br>RCR = 2.04E-3 | Final RCR < 0.01 |
| Combined routes, systemic, long-term | | | Final RCR < 0.01 |

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

**MEASE 1** for Palladium dichloride:
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.

## 9.8.6. Worker CS 6: Vacuum cleaning (PROC 26)

Assessment entity group used for the assessment of this contributing scenario: Palladium dichloride for OCC assessment

### 9.8.6.1. 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%]<br>*Surrogate exposure determinant used to reflect the efficiency of a vacuum cleaner.*<br>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): RPE with minimum APF = 20 [Effectiveness Inhalation: 95%] | MEASE 1 |
| • 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 | |

## 9.8.6.2. Exposure and risks for workers

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

**Table 9.91. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Assessment entity | Exposure concentration | Risk quantification |
|---|---|---|---|
| Inhalation, systemic, long term | Palladium dichloride | 80 µg/m³ (MEASE 1)<br>RCR = 1.35E-3 | Final RCR < 0.01 |
| Dermal, systemic, long term | Palladium dichloride | 1.41 µg/kg bw/day (MEASE 1)<br>RCR = 8.37E-5 | Final RCR < 0.01 |
| Combined routes, systemic, long-term | | | Final RCR < 0.01 |

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

**MEASE 1** for Palladium dichloride:
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.