

6. ES 6: Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing inorganic pigments

6.1. Title section

Sector of use: Manufacture of fine chemicals (SU 9)

| Environment | |
|---|---------------------------------|
| 1: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Discharge to fresh water via municipal sewage treatment plant | ERC 6a |
| 2: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to fresh water | ERC 6a |
| 3: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to marine water | ERC 6a |
| Worker | |
| 4: Raw material handling | PROC 26 |
| 5: Closed mixing and transfer process | PROC 2 |
| 6: Automated transfer process | PROC 8b |
| 7: Drying and calcining | PROC 22, PROC 4, PROC 2, PROC 9 |
| 8: Wet cleaning | PROC 28 |
| 9: Cleaning/removal of dust | PROC 28 |

6.2. Conditions of use affecting exposure

6.2.1. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

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|---|
| Amount used, frequency and duration of use (or from service life) |
| Daily amount per site <= 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.) |
| Annual amount per site <= 156 tonnes/year |
| Emission days >= 340 days/year |
| Technical and organisational conditions and measures |
| Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber |
| Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange |
| Conditions and measures related to biological sewage treatment plant |
| Municipal sewage treatment plant is assumed. |
| Assumed domestic sewage treatment plant flow >= 2E3 m3/day |
| Conditions and measures related to external treatment of waste (including article waste) |
| Dispose of waste product or used containers according to local regulations. |

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| Other conditions affecting environmental exposure |
| Receiving surface water flow $\geq 1.8E4$ m ³ /day |
| No discharge to marine water assumed |
| Receiving water dilution (fresh or marine) ≥ 10 |

6.2.2. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to fresh water (ERC 6a)

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|---|
| Amount used, frequency and duration of use (or from service life) |
| Daily amount per site ≤ 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.) |
| Annual amount per site ≤ 156 tonnes/year |
| Emission days ≥ 340 days/year |
| Technical and organisational conditions and measures |
| Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber |
| Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange |
| Conditions and measures related to external treatment of waste (including article waste) |
| Dispose of waste product or used containers according to local regulations. |
| Other conditions affecting environmental exposure |
| Receiving surface water flow $\geq 2.97E4$ m ³ /day |
| No discharge to marine water assumed |
| Receiving water dilution (fresh or marine) ≥ 100 |
| Assumed effluent discharge flow from site ≥ 225 m ³ /day |

6.2.3. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to marine water (ERC 6a)

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|---|
| Amount used, frequency and duration of use (or from service life) |
| Daily amount per site ≤ 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.) |
| Annual amount per site ≤ 156 tonnes/year |
| Emission days ≥ 340 days/year |
| Technical and organisational conditions and measures |
| Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber |
| Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange |
| Conditions and measures related to external treatment of waste (including article waste) |
| Dispose of waste product or used containers according to local regulations. |
| Other conditions affecting environmental exposure |
| No discharge to freshwater assumed |
| Assumed effluent discharge flow from site ≥ 225 m ³ /day |
| Local marine water dilution factor 100 |

6.2.4. Control of worker exposure: Raw material handling (PROC 26)

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| Product (article) characteristics |
| Physical form of product; Solid, high dustiness |
| Amount used (or contained in articles), frequency and duration of use/exposure |
| Frequency of task: Once per shift. |
| Technical and organisational conditions and measures |
| Local exhaust ventilation |

6.2.5. Control of worker exposure: Closed mixing and transfer process (PROC 2)

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|---|
| Product (article) characteristics |
| Physical form of product: Damp solid. |
| Technical and organisational conditions and measures |
| Automated task |
| Use in closed process |

6.2.6. Control of worker exposure: Automated transfer process (PROC 8b)

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|---|
| Product (article) characteristics |
| Physical form of product; Solid, high dustiness |
| Amount used (or contained in articles), frequency and duration of use/exposure |
| Covers daily exposures up to 8 hours |
| Technical and organisational conditions and measures |
| Ensure automation of the process as far as technically feasible |
| Ensure segregation of worker from the source. |
| Use of an integrated local exhaust ventilation is required. |

6.2.7. Control of worker exposure: Drying and calcining (PROC 22, PROC 4, PROC 2, PROC 9)

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|---|
| Product (article) characteristics |
| Maximum emission potential covered in this ES: Low. |
| Physical form of product: Damp solid. |
| Technical and organisational conditions and measures |
| Local exhaust ventilation |
| Semi-closed system |
| Elevated temperature |

6.2.8. Control of worker exposure: Wet cleaning (PROC 28)

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|---|
| Product (article) characteristics |
| Maximum emission potential covered in this ES: Very low. |
| Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered. |
| Amount used (or contained in articles), frequency and duration of use/exposure |
| Covers daily exposures up to 8 hours |

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| Technical and organisational conditions and measures |
| Cleaning machines such as power sweeper, no direct manual cleaning. |
| Covers use at ambient temperatures. |
| Conditions and measures related to personal protection, hygiene and health evaluation |
| APF of RPE = 10 (90% respiratory protection). |

6.2.9. Control of worker exposure: Cleaning/removal of dust (PROC 28)

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| Product (article) characteristics |
| Physical form of product: Residual dust. |
| Amount used (or contained in articles), frequency and duration of use/exposure |
| Covers daily exposures up to 8 hours |
| Technical and organisational conditions and measures |
| Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted. |
| Conditions and measures related to personal protection, hygiene and health evaluation |
| APF of RPE = 20 (95% respiratory protection). For further specification, refer to section 8 of the SDS. |

6.3. Exposure estimation and reference to its source

6.3.1. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

| Release route | Release rate | Release estimation method |
|---------------|--------------|---------------------------|
| Water | 0.021 kg/day | Estimated release factor |
| Air | 0.021 kg/day | Estimated release factor |
| Soil | 0 kg/day | Estimated release factor |

| Protection target | Exposure estimate | RCR |
|------------------------|--|-------|
| Fresh water | 3.34E-3 mg/L (EUSES 2.1.2) | 0.471 |
| Sediment (freshwater) | 45.2 mg/kg dw (PEC sediment calculation method for metals) | 0.415 |
| Sewage Treatment Plant | 6.2E-3 mg/L (EUSES 2.1.2) | 0.019 |
| Agricultural soil | 16.37 mg/kg dw (EUSES 2.1.2) | 0.548 |

6.3.2. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to fresh water (ERC 6a)

| Release route | Release rate | Release estimation method |
|---------------|--------------|---------------------------|
| Water | 0.021 kg/day | Estimated release factor |
| Air | 0.021 kg/day | Estimated release factor |
| Soil | 0 kg/day | Estimated release factor |

| Protection target | Exposure estimate | RCR |
|-----------------------|--|-------|
| Fresh water | 3.39E-3 mg/L (EUSES 2.1.2) | 0.478 |
| Sediment (freshwater) | 46.5 mg/kg dw (PEC sediment calculation method for metals) | 0.427 |
| Agricultural soil | 16.20 mg/kg dw (EUSES 2.1.2) | 0.542 |

6.3.3. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to marine water (ERC 6a)

| Release route | Release rate | Release estimation method |
|---------------|--------------|---------------------------|
| Water | 0.021 kg/day | Estimated release factor |
| Air | 0.021 kg/day | Estimated release factor |
| Soil | 0 kg/day | Estimated release factor |

| Protection target | Exposure estimate | RCR |
|-------------------------|--|-------|
| Marine water | 9.58E-4 mg/L (EUSES 2.1.2) | 0.111 |
| Sediment (marine water) | 33.2 mg/kg dw (PEC sediment calculation method for metals) | 0.305 |
| Agricultural soil | 16.20 mg/kg dw (EUSES 2.1.2) | 0.542 |

6.3.4. Worker exposure: Raw material handling (PROC 26)

| Route of exposure and type of effects | Exposure estimate | RCR |
|---------------------------------------|---|--------|
| Inhalation, systemic, long term | 0.028 mg/m ³ (Measured data) | 0.56 |
| Inhalation, local, long term | 0.028 mg/m ³ (Measured data) | 0.56 |
| Inhalation, local, acute | 0.111 mg/m ³ (Measured data) | < 0.01 |
| Dermal, local, long term | 0.76 µg/cm ² (Measured data) | 0.063 |
| Combined, systemic, long term | | 0.56 |

6.3.5. Worker exposure: Closed mixing and transfer process (PROC 2)

| Route of exposure and type of effects | Exposure estimate | RCR |
|---------------------------------------|--|--------|
| Inhalation, systemic, long term | 6E-3 mg/m ³ (Measured data) | 0.12 |
| Inhalation, local, long term | 6E-3 mg/m ³ (Measured data) | 0.12 |
| Inhalation, local, acute | 0.017 mg/m ³ (Measured data) | < 0.01 |
| Dermal, local, long term | 0.076 µg/cm ² (Measured data) | < 0.01 |
| Combined, systemic, long term | | 0.12 |

6.3.6. Worker exposure: Automated transfer process (PROC 8b)

| Route of exposure and type of effects | Exposure estimate | RCR |
|---------------------------------------|---|--------|
| Inhalation, systemic, long term | 0.031 mg/m ³ (Measured data) | 0.62 |
| Inhalation, local, long term | 0.031 mg/m ³ (Measured data) | 0.62 |
| Inhalation, local, acute | 0.093 mg/m ³ (Measured data) | < 0.01 |
| Dermal, local, long term | 1 µg/cm ² (Measured data) | 0.083 |

| Route of exposure and type of effects | Exposure estimate | RCR |
|---------------------------------------|-------------------|------|
| Combined, systemic, long term | | 0.62 |

6.3.7. Worker exposure: Drying and calcining (PROC 22, PROC 4, PROC 2, PROC 9)

| Route of exposure and type of effects | Exposure estimate | RCR |
|---------------------------------------|---|--------|
| Inhalation, systemic, long term | 5E-3 mg/m ³ (Measured data) | 0.1 |
| Inhalation, local, long term | 5E-3 mg/m ³ (Measured data) | 0.1 |
| Inhalation, local, acute | 0.016 mg/m ³ (Measured data) | < 0.01 |
| Dermal, local, long term | 0.76 µg/cm ² (Measured data) | 0.063 |
| Combined, systemic, long term | | 0.1 |

6.3.8. Worker exposure: Wet cleaning (PROC 28)

| Route of exposure and type of effects | Exposure estimate | RCR |
|---------------------------------------|---|--------|
| Inhalation, systemic, long term | 6E-3 mg/m ³ (Measured data) | 0.12 |
| Inhalation, local, long term | 6E-3 mg/m ³ (Measured data) | 0.12 |
| Inhalation, local, acute | 0.026 mg/m ³ (Measured data) | < 0.01 |
| Dermal, local, long term | 0.76 µg/cm ² (Measured data) | 0.063 |
| Combined, systemic, long term | | 0.12 |

6.3.9. Worker exposure: Cleaning/removal of dust (PROC 28)

| Route of exposure and type of effects | Exposure estimate | RCR |
|---------------------------------------|---|-------|
| Inhalation, systemic, long term | 0.032 mg/m ³ (Measured data) | 0.64 |
| Inhalation, local, long term | 0.032 mg/m ³ (Measured data) | 0.64 |
| Inhalation, local, acute | 0.189 mg/m ³ (Measured data) | 0.01 |
| Dermal, local, long term | 0.76 µg/cm ² (Measured data) | 0.063 |
| Combined, systemic, long term | | 0.64 |

6.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Guidance: Please refer to Section 0.3 of this "ES for Communication".