



9.8. Exposure scenario 8: Use at industrial sites - Use of disilver oxide as catalyst

Sector of use: SU 9: Manufacture of fine chemicals

Environment contributing scenario(s):		
CS 1	Use of disilver oxide as catalyst	ERC 6b
Worker contributing scenario(s):		
CS 2	Raw material handling	PROC 26 , PROC 21
CS 3	Reaction	PROC 4 , PROC 1, PROC 15, PROC 3
CS 4	Packaging	PROC 8b , PROC 21
CS 5	Cleaning and maintenance	PROC 28 , PROC 8a

9.8.1. Env CS 1: Use of disilver oxide as catalyst (ERC 6b)

Assessment entity group used for the assessment of this contributing scenario: ERA
Use as catalyst not becoming part of an article

9.8.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Annual use amount at site: ≤ 1 tonnes/year <i>Modelled site tonnage 1 tpa demonstrates safe use. In the event this modelled tonnage is exceeded scaling of the conditions is allowed.</i> <i>All the amounts are expressed as Ag as this is the driver for the environmental risk assessment.</i> Daily use amount at site: ≤ 1 tonnes/day <i>Loading/unloading of the catalyst occurs only a few times per year or less.</i>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> The substance should not be released to air <i>Emissions to air are not allowed in this scenario</i> The substance should not be released to water <i>Emissions to surface water or to the sewage system are not allowed in this scenario</i>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
<ul style="list-style-type: none"> Particular considerations on the waste treatment operations: No (low concentration) <i>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 silver content of the waste is elevated enough, internal or external recovery/recycling might be considered.</i> <i>Appropriate waste codes: 06 05 02*, 08 01 11, 08 03 12*, 09 01 01*, 09 01 03*, 09 01 04*, 09 01 05*, 09 01 06*, 09 01 13*, 10 06 06*, 10 07 01, 10 07 02, 10 07 03, 10 07 04, 10 07 05, 11 01 09*, 15 01 10*, 15 02 02*, 16 01 18, 16 03 03*, 16 08 01, 16 11 04</i> <i>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 silver is recycled for almost a 100%</i> <i>A detailed assessment has been performed on modelled and measured data and is reported in the Waste report (ARCHE, 2013)</i>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> Receiving surface water flow rate: $\geq 1.8E4$ m³/day Discharge rate of effluent: $\geq 2E3$ m³/day



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 9.51. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Ag dissolved	Estimated release factor	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Closed or semi-closed, semi-automated transfers to reactor. Closed use in reactor with no opportunity for exposure. Closed or semi-closed, semi-automated discharge from reactor No water used in catalyst transfer, use or discharge, except in a closed-loop system. Water should not be used in cleaning and maintenance activities
Air	Ag dissolved	Estimated release factor	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Closed or semi-closed, semi-automated transfers to reactor. Closed use in reactor with no opportunity for exposure. Closed or semi-closed, semi-automated discharge from reactor No releases to air. No extraction or ventilation equipment is installed on reactors.
Non agricultural soil	Ag dissolved	Estimated release factor	Release factor after on site RMM: 0% Explanation: No direct release 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 9.52. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 6.06E-6 mg/L RCR = 0.132	Final RCR = 0.132
Sediment (freshwater)	Ag dissolved	Local PEC: 1.155 mg/kg dw RCR = 2.64E-3	Final RCR < 0.01
Marine water	Ag dissolved	Local PEC: 1.91E-6 mg/L RCR = 2.22E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.364 mg/kg dw RCR = 8.31E-4	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 0 mg/L RCR = 0	Final RCR < 0.01



Protection target	Assessment entity	Exposure concentration	Risk quantification
Agricultural soil	Ag dissolved	Local PEC: 0.096 mg/kg dw RCR = 0.091	Final RCR = 0.091
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 8.53E-8 mg/m ³ RCR = 5.69E-7	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day (Measured data: See section 9.0.3.6) RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

See section 9.0.3.6 for Ag dissolved:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food (section 9.0.3.6) was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

9.8.2. Worker CS 2: Raw material handling (PROC 26, PROC 21)

Assessment entity group used for the assessment of this contributing scenario: HHRA manual handling

9.8.2.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of the used product: Solid (material with high dustiness)	MEASE 1.02.01
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] <i>Standard efficiency</i> Inhalation explanation: <i>Efficiency for industrial use</i>	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Face/eye protection: Eye protection	
• Respiratory protection: Yes (APF >= 10)	MEASE 1.02.01
Other conditions affecting workers exposure	
• Place of use: Indoor	



9.8.2.2. Exposure and risks for workers

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

Table 9.53. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Disilver oxide	0.22 mg/m ³ (MEASE 1.02.01) RCR = 0.169	Final RCR = 0.169
Dermal, systemic, long term	Disilver oxide	0.141 mg/kg bw/day (MEASE 1.02.01) RCR = 0.307	Final RCR = 0.307
Combined routes, systemic, long-term			Final RCR = 0.476

Risk characterisation

Qualitative risk characterisation (Eye, local):
See section 9.0.4.2

9.8.3. Worker CS 3: Reaction (PROC 4, PROC 1, PROC 15, PROC 3)

Assessment entity group used for the assessment of this contributing scenario: HHRA mixing

9.8.3.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>'Aqueous solution' was selected in MEASE to reflect the very low fugacity.</i>	MEASE 1.02.01
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
• Local exhaust ventilation: No	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Face/eye protection: Eye protection	
• Respiratory protection: No	MEASE 1.02.01
Other conditions affecting workers exposure	
• Place of use: Indoor	

9.8.3.2. Exposure and risks for workers

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

Table 9.54. Exposure concentrations and risks for workers



Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Disilver oxide	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.038	Final RCR = 0.038
Dermal, systemic, long term	Disilver oxide	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.075	Final RCR = 0.075
Combined routes, systemic, long-term			Final RCR = 0.113

Risk characterisation

Qualitative risk characterisation (Eye, local):
See section 9.0.4.2

9.8.4. Worker CS 4: Packaging (PROC 8b, PROC 21)

Assessment entity group used for the assessment of this contributing scenario: HHRA dispatch

9.8.4.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of the used product: Liquid, including paste/slurry/suspension 'Aqueous solution' was selected in MEASE to reflect the very low fugacity.	MEASE 1.02.01
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
• Local exhaust ventilation: No	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: No	MEASE 1.02.01
• Face/eye protection: Eye protection	
• Respiratory protection: No	MEASE 1.02.01
Other conditions affecting workers exposure	
• Place of use: Indoor	

9.8.4.2. Exposure and risks for workers

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

Table 9.55. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Disilver oxide	0.01 mg/m ³ (MEASE 1.02.01) RCR = 7.69E-3	Final RCR < 0.01
Dermal, systemic, long term	Disilver oxide	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.075	Final RCR = 0.075



Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Combined routes, systemic, long-term			Final RCR = 0.082

Risk characterisation

Qualitative risk characterisation (Eye, local):
See section 9.0.4.2

9.8.5. Worker CS 5: Cleaning and maintenance (PROC 28, PROC 8a)

Assessment entity group used for the assessment of this contributing scenario: HHRA manual cleaning, repair and maintenance operations, removal of residuals from e.g. filters/overspill or as waste

9.8.5.1. Conditions of use

	Method
Product (article) characteristics	
• Physical form of the used product: Solid (material with high dustiness) <i>Dust with high emission potential has been selected as a worst case (compared to aqueous solution).</i>	MEASE 1.02.01
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] <i>Standard efficiency</i> Inhalation explanation: <i>Efficiency for industrial use</i>	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Face/eye protection: Eye protection	
• Respiratory protection: Yes (APF >= 20)	MEASE 1.02.01
Other conditions affecting workers exposure	
• Place of use: Indoor	

9.8.5.2. Exposure and risks for workers

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

Table 9.56. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Disilver oxide	0.55 mg/m ³ (MEASE 1.02.01) RCR = 0.423	Final RCR = 0.423
Dermal, systemic, long term	Disilver oxide	0.069 mg/kg bw/day (MEASE 1.02.01) RCR = 0.149	Final RCR = 0.149



Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Combined routes, systemic, long-term			Final RCR = 0.572

Remarks on exposure data from external estimation tools:

MEASE 1.02.01 for Disilver oxide:

Explanation:

As the MEASE 1.02.01 exposure estimation tool for workers does not provide exposure estimates for PROC 28, PROC 8a has been used instead as the input parameter assuming that there are similarities in the exposure.

Risk characterisation

Qualitative risk characterisation (Eye, local):

See section 9.0.4.2