TransFurans Chemicals bvba
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EU SAFETY DATA SHEET

according to Regulation (EC) N°1907/2006

tetrahydrofurfurylalcohol

Date of first version:

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name	tetrahydrofurfuryl alcohol
Chemical name	tetrahydrofurfuryl alcohol
Synonyms	THFA, Tetrahydro-2furanmethanol; Tetrahydro-2-furancarbinol; Tetrahydro-2-furylmethanol; 2-Hydroxymethyltetrahydrofuran
Formula	$C_5H_{10}O_2$
Molecular mass	102.13 g/mol
CAS-N°.	97-99-4
EC-N°.	202-625-6
► **Registration number**	01-2119968921-26-XXXX

1.2 Relevant identified uses of the substance or mixture and uses advised against

►	Identified use	Use as an intermediate (ES 1) Formulation of agrochemicals (ES 2) Use in agrochemicals (ES 3) Formulation of agrochemicals (ES 4) Adhesives, sealants; Resins (prepolymers) -industrial use (ES 5) Adhesives, sealants; Resins (prepolymers) - professional use (ES 6) Use as laboratory reagent (ES 7)
	Use advised against	Consumer uses

1.3 Details of the supplier of the safety data sheet

Manufacturer	TransFurans Chemicals bvba
Address	Industriepark, Leukaard 2, B-2440 Geel
Telephone number	+32(0)14 57 87 47
Telefax number	+32(0)14 57 87 67
E-mail address	info@transfurans.be

1.4 Emergency telephone number

+32(0)14 58 45 45 (24h/24 h)
Information centre on dangerous goods (BIG)) (NL, FR, GB, DE)
Technische Schoolstraat 43 A, B-2440 Geel, Belgium

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

***According to Regulation (EC) No.*1272/2008 (EU-GHS/CLP)**
Hazard Class(es) / Hazard Class and Category Code(s)

	Eye irritation	Eye irrit.2, H319
►	Reproductive Toxicity	Repr. 1B, H360FD

2.2 Label elements

***According to Regulation (EC) No.*1272/2008 (EU-GHS/CLP)**
Hazard pictogram(s)

► **Signal word** Danger
Hazard statement(s)
H319 Causes serious eye irritation

►	H360FD	May damage the unborn child. May damage fertility.
	Precautionary statements	
	P201	Obtain special instructions before use.
►	P264	Wash hands thoroughly after handling.
	P280	Wear protective gloves/protective clothing/eye protection/face protection
	P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
	P337+P313	If eye irritation persists: Get medical advice/attention.
	P308+P313	IF exposed or concerned: Get medical advice/attention.

2.3 Other hazards
No information available.

SECTION 3. Composition/information on ingredients
3.1 Substances

Main constituent	**Identity**		**Percentage**
tetrahydrofurfuryl alcohol	CAS-N°.	97-99-4	>98 %
	EC N°.	202-625-6	

SECTION 4: First aid measures
4.1 Description of first aid measures

Inhalation
Remove victim into fresh air. Consult a doctor/medical service if breathing problems develop.

Skin contact
Rinse with water. Soap may be used. Remove contaminated clothes before washing. Consult a doctor/medical service if irritation persists.

Eye contact
First rinse with plenty of water (remove lenses if possible). If eye irritation persists: Get medical advice / attention.
Do not apply neutralizing agents.

Ingestion
Rinse mouth with water. Immediately give lots of water to drink. Never give water to an unconscious person. Do not induce vomiting. Give activated charcoal. Consult a doctor/medical service if you feel unwell.

4.2 Most important symptoms and effects, both acute and delayed

Acute Symptoms and effects
After eye contact: redness of the eye tissue. Irritation.
After ingestion: irritation to mouth, throat and stomach.

Delayed symptoms and effects
Prolonged exposure to vapours may cause central nervous system depression and decreased male fertility Repeated or prolonged dermal contact my cause decreased male fertility.
Inflammation/damage of the eye tissue. Ingestion may cause developmental effects.

4.3 Indication of any immediate medical attention and special treatment needed
After absorption of high quantities:
Gastrointestinal tract irritation, nausea, diarrhoea, dizziness, vomiting,
After exposure to high concentrations:
CNS depression
Dizziness
Vomiting or headaches.

SECTION 5: Firefighting measures
5.1 Extinguishing media

Suitable extinguishing media
Water, Water spray, Alcohol-resistant foam, BC powder, carbon dioxide.
Unsuitable extinguishing media
No data available.

5.2 Special hazards arising from the substance
Hazardous combustion product
Material presenting a fire hazard. On burning: CO and CO_2 can be formed.
Additional hazards
Not applicable.

5.3 Advice for firefighters
Protective actions
Cool tanks/drums with water spray/remove them into safety.
Special protective equipment
Eye/face protection.
Protective clothing for exposure to chemicals.
Self contained breathing apparatus.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
High gas/vapour concentration: compressed air/oxygen apparatus.
Gas mask with filter type AX.
Gloves.
Protective goggles.
Head/skin protection.
Heatproof clothing .

6.2 Environmental precautions
Contain released substance, pump over in suitable containers.
Plug the lead, cut off the supply.

6.3 Methods and material for containment and cleaning up
Advice on spillage containment
Take up liquid spill into a non combustible material e.g.: dry sand/earth/vermiculite or kieselguhr.
Scoop absorbed substance into closing containers.
Appropriate clean up procedures
Clean contaminates surfaces with an excess of water.
Wash clothing and equipment after handling.
Inappropriate containment or clean-up techniques
None known/

6.4 Reference to other sections
See also the sections 8 and 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Recommendations for safe handling
► Observe label precautions.
Use only with adequate ventilation.
Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Wear appropriate respirator when ventilation is inadequate. Use earthed

equipment. Remove contaminated clothing immediately.
Clean contaminated clothing.

Advice on occupational hygiene
Do not eat drink or smoke in work areas.

7.2 Conditions for safe storage, including any incompatibilities

Protection against incompatible substances

► Keep container tightly closed.
Ventilation at floor level.
Keep away from: heat sources, oxidizing agents, acids, ignition sources.
Materials for packaging: steel aluminium, glass, polypropylene.
Material for packaging to avoid: no information available.

Protection against ambient influences

► Store in a cool and well ventilated area.
Recommended storage temperature: 20 ºC.

Maintenance of the integrity of the substance
Not required.

7.3 Specific end use(s)

See information supplied by the manufacturer.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

No control parameters available.

► **DNEL**	DNEL worker (long term, inhalation - systemic)	DNEL = 1.4mg/m³
	DNEL worker (long term, dermal, systemic)	DNEL = 1 mg/kg bw/day
► **PNEC**		
Aquatic		
Fresh water	PNEC aquatic (freshwater)	PNEC=1.9mg/l
Marine water	PNEC aquatic (marine water)	PNEC=0.19mg/l
Intermittant release	PNEC aquatic (intermittent release)	PNEC=0.917 mg/l
STP	PNEC stp	PNEC=10mg/l
Sedimentary		
Fresh water sediment	PNEC sediment	PNEC= 8.6mg/kg sediment dw
Marine water sediment	PNEC marine-sediment	PNEC= 0.86mg/kg sediment dw
Terrestrial		
Soil	PNEC soil	PNEC =0.6 mg/kg soil dw
Secondary Poisoning		
Food chain	No potential for bioaccumulation.	

8.2 Exposure controls

8.2.1 Appropriate engineering controls

Ventilation and local exhaust.
Measure the concentration in the air regularly.

8.2.2 Individual protection measures, such as personal protective

a) Eye/face protection

Face shield.(EN 166)

b) Skin protection

Hand protection

Chemical resistant gloves
butyl rubber, break through time > 480min, 0.7mm (EN 374)

neoprene, break through time > 480 min, 0.4 mm (EN 374)

Body protection Protective clothing.

c) Respiratory protection

In case of insufficient local exhaust: High gas/vapour concentration: gas mask with filter type A. (EN 14387)

d) Thermal hazards

Not applicable.

8.2.3 Environmental exposure controls

Direct polluted air of the local exhaust ventilation out of the plant in a manner in accordance with environmental regulations.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

	Appearance (at 20°C)	Liquid
	Odour:	Characteristic
	Colour:	Colourless to Light-yellow
	Odour Treshold	N.D.
	pH value	5-6 (250g/lwater)
►	**Melting point/melting range**	< -120°C
	Boiling point/boiling range	178°C
►	**Flashpoint (tag closed cup)**	73 °C
	Evaporation rate	
	-ratio to butyl acetate	0.03
	-ratio to ether	N.D.
	Upper/lower explosive limits	1.5%-9.7%
►	**Vapour pressure (at 25°C)**	1.42 hPa
	Vapour pressure (at 50°C)	N.D.
	Relative density(at 20°C)	1.05
►	**Water solubility(at 20°C)**	Completely; 250g/L
	Soluble in	ethanol, ether, chloroform, methanol, 1-propanol, iso-amylalcohol, ethylacetate
►	**Partition coefficient n-octanol/water (24,7°C)**	-0.14 (Log Pow)
	Relative vapour density	3.4
	Auto-ignition temperature	282°C
	Decomposition temperature	N.D.
►	**Viscosity(at 20°C)**	6.4 mPa.s
►	**Explosive properties**	None
►	**Oxidising properties**	None

9.2 Other information

Saturation concentration	1.3g/m³

SECTION 10: Stability and Reactivity

10.1 Reactivity

Not reactive.

10.2 Chemical stability

Stable under normal temperatures and pressures.

10.3 Possibility of hazardous reactions

Reactive with oxidizing agents.

10.4 Conditions to avoid

Keep away from: heat sources, oxidizing agents, acids and sources of ignition . Keep containers tightly closed.

10.5 Incompatible materials

Reactive with oxidizing agents.

10.6 Hazardous decomposition products

Upon decomposition emits carbon monoxide, carbon dioxide..

SECTION 11: Toxicological information

11.1	**Information on toxicological effects**	
11.1.1	**Acute toxicity**	
	LD50 (oral, rat) (mg/kg)	>2000
	LD50 (dermal, rat) (mg/kg)	>2000
	LD50 (dermal, rabbit) (mg/kg)	657
	LC50 (inhalation, rat, 4 hours) (mg/l)	Not determined.
11.1.2	**Skin corrosion/irritation**	Not irritating to skin
11.1.3	**Serious eye damage/irritation**	Irritating to eyes
11.1.4	**Respiratory or skin sensitization**	Considered to be a non sensitizer
11.1.5	**Germ cell mutagenicity**	Considered non genotoxic in vitro.
11.1.6	**Carcinogenicity**	No information available
11.1.7	**Reproductive toxicity**	Suspected of damaging fertility or the unborn child for reproductive toxicity. Specific effect: Males: lower prostate, epididymal and testes weights, necrosis of the seminiferous tubular epithelium and lower sperm production. Females: prolonged oestrus cycle and gestation length. Foetal resorption or mummification and dead pups on PND 1. Route of exposure: Oral
11.1.8	**STOT single exposure**	No information available
11.1.9	**STOT- repeated exposure**	No information available
11.1.10	**Aspiration hazard**	No information available
11.1.2	**Subchronic exposures (oral/ dermal and inhalation)**	Subchronic exposures at relatively high levels, have demonstrated systemic toxicity and central nervous depression in ether rats, rabbits or dogs.

SECTION 12: Ecological information

12.1 Toxicity

LC50 (Oryzias latipes) (mg/l)	>101
EC50 (bacteria, 15min) (mg/l)	1600
EC50 (Daphnia Magna, 48 hours) (mg/l)	>91.7
EC50 (Pseudokirchnerella subcaptitata 72 hours static) (mg/l)	>98.9

12.2 Persistence and degradability

Biodegradability — Readily biodegradable in water, sludge and soil.

12.3 Bioaccumulative potential

Bioaccumulative potential — Slightly or not bio-accumulative

► **Partition coefficient: n-octanol water (conc in organisms / conc. in water)** — -0.14

12.4 Mobility in soil

Adsorption coefficient (Koc) solid phase / liquid phase	N.D.

12.5 Results of PBT and vPvB assessment N.D.

12.6 Other adverse effects

Effect on the Ozone layer	Not dangerous for the ozone layer (Council Regulation (EC) No 2037/2000 O.J. L244 of 29/09/2000)
Photochemical ozone creation potential (C_2H_4 = 1)	Not available.
Global warming potential (GWP) (CO_2 = 1)	Not available.
Water hazard class (WGK Germany)	3
Effect on waste water purification	No data available.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Substance	Recycling by distillation. Removal to an authorized waste incinerator for solvents. Obtain the consent of pollution control authorities before discharging to wastewater treatment plant. or as chemical waste in accordance with local regulations. Do not discharge into surface water.
European waste list (EURAL)	07 01 04* (other organic solvents, washing liquids and mother liquors)
LWCA(The Netherlands)	KGA category 03
Packaging/container	15 01 10* (packaging containing residues of or contaminated by dangerous substances)

SECTION 14: Transport information

Not classified as dangerous good under transport regulations.

14.1 UN Number	Not regulated
14.2 UN proper shipping name	-
14.3 Transport hazard class(es) code	-
14.4 Packing group	-
14.5 Environmental hazards	
Marine pollutant	No
14.6 Specials precautions for user	None

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code

Not applicable

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance

Regulation (EC) 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals and amendments. EU Regulation (EC) No. 1907/2006 (Reach) Annex XVII, Restrictions on the manufacturing, placing on the market, and use of dangerous substances, mixtures and article: Entry 3; 28, 29 and 30(restricted to industrial/professional users and not supplied to the general public) applicable
Regulation (EC) 1272/2008 on classification, labelling and packaging of substances and mixtures and amendments.
Refer to the relevant EU/national regulation for details of any actions or restrictions required by the above Regulation(s).

15.2 Chemical safety assessment
A chemical safety assessment is performed.

SECTION 16: OTHER INFORMATION

16.1 Changes to the previous version.
Changes to the template.
Implementation of classification for reproductive toxicity according to the Reach Registration Dossier addition of exposure scenarios.
►Indicates changes in content from previously issued version.
Date of revision: 16-01-2020
Version: 008
Date of previous version: 01-03-2016

16.2. Abbreviations and acronyms

BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
EC50	Effect Concentration, 50 percent
GHS / CLP	Globally Harmonised System / Classification, Labelling and Packaging
IC50	Inhibitory Concentration, 50 percent
LC50	Lethal Concentration, 50 percent
LD50	Lethal Dose, 50 percent
N.D.	Not Determined
PBT	Persistent, Bioaccumulative and Toxic
vPvB	very Persistent and very Bioaccumulative

16.3 Relevant hazard statements not written out in full in section 2-15
►

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Extended safety data sheet

Overview of the exposure scenarios

Number	Title
ES 1	-Use as an intermediate
ES 2	Formulation of agrochemicals
ES 3	Use in agrochemicals
ES 4	Formulation of agrochemicals
ES 5	Adhesives, sealants; Resins (prepolymers)
ES 6	Adhesives, sealants; Resins (prepolymers)
ES 7	Use as laboratory reagent

General information on risk management related to toxicological hazard:

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2)

Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered mitigated by the use of eye protection measures.

For formulated products, the hazard will depend on the concentration and other substances present. The available data are not sufficient to determine a threshold concentration for eye irritation, so no DN(M)EL can be derived. There are no specific concentration limits for this substance.
Handling and use of tetrahydrofurfuryl alcohol including formulated products containing tetrahydrofurfuryl alcohol at a concentration of ≥10% would be considered a low hazard according to ECHA REACH Guidance on information requirements and chemical safety assessment Part E (Risk Characterisation).

Risk management measures are therefore required:
·Implementation of basic standards of occupational hygiene;
·Avoid direct contact with product;
·Wear gloves (North Safety Products, Silver Shield) (tested to EN374) if direct hand contact with the substance is likely; wash off skin contamination immediately;
·Wear protective gloves (North Safety Products, Silver Shield) and suitable eye protection at all times when handling the substance
·Avoid splashes and spills;
·Avoid of contact with contaminated tools and objects;
·Clean up contamination/spills as soon as they occur;
·Regular cleaning of equipment and work area;
·Ensure suitable management/supervision is in place to check that the RMMs in place are being used correctly and OCs followed;
·Train staff on good practice to prevent / minimise exposures and to report any eye problems that may develop;
·Adopt good standards of personal hygiene.
·Where activities may lead to aerosol release e.g. spraying, then additional skin and eye protection measures such as impervious suits and face shields may be required.

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Exposure scenario 1: Use at industrial sites - Use as an intermediate

Market sector: Use as an intermediate
Sector of use: SU 8: Manufacture of bulk, large scale chemicals (including petroleum products); SU 9: Manufacture of fine chemicals

Environment contributing scenario(s):		
CS 1	Use as an intermediate	ERC 6a
Worker contributing scenario(s):		
CS 2	General exposures; Closed systems	PROC 1
CS 3	General exposures; Closed systems	PROC 2
CS 4	General exposures; Closed systems	PROC 3
CS 5	General exposures; Open systems	PROC 4
CS 6	Process sampling	PROC 9
CS 7	Laboratory activities	PROC 15
CS 8	Bulk transfers; Closed systems	PROC 8b
CS 9	Bulk transfers; Open systems	PROC 8b
CS 10	Bulk transfers; Open systems	PROC 8b
CS 11	Equipment cleaning and maintenance	PROC 8a, PROC 28
CS 12	Storage	PROC 1
CS 13	Storage	PROC 2

Further description of the use:

Tetrahydrofurfuryl alcohol is used as a synthetic intermediate in the manufacture of fine chemicals and pharmaceuticals. Tetrahydrofurfuryl alcohol reacts during the process of synthesis and does not remain in the finished product; therefore the life cycle subsequent to the synthesis of the end products does not need to be covered in the chemical safety assessment.

Waste from use as an intermediate
Industrial use of tetrahydrofurfuryl alcohol as a synthetic intermediate may give rise to waste in the form of residues on empty packaging.

1.1 Env CS 1: Use as an intermediate (ERC 6a)

1.1.1 Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 2.0 tonnes/day *ESIG ESVOC SpERC assume that 5000 kg/day of substance is used at installation; substance specific information: 2000 kg/day* • Annual use amount at site: <= 40.0 tonnes/year
Technical and organisational conditions and measures

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• On-site treatment of off-air: Typical measures to maintain workplace concentrations or airborne VOCs and particulates below respective OELS *e.g. thermal wet scrubber - gas removal and/or air filtration - particle removal and/or thermal oxidation and/or vapour recovery - adsorption* • On-site treatment of off-air: Upgrade of the system in place or additional air treatment measures [Effectiveness Air: 50%] *Upgrade of the system in place or additional air treatment measures, such as wet scrubber and/or air filtration and/or thermal oxidation and/or vapour recovery systems, in order to achieve a reduction of the air emissions.* *50% is the arbitrary default of this determinant value to be overwritten by the assessor according to the required removal efficiency (assessment outcome)* Air explanation: *Arbitrary values, overwritten according to the assessment outcome* • Equipment cleaning: No release to wastewater from process as such, wastewater emissions limited to release generated from final equipment cleaning step using water • On-site treatment of wastewater: Acclimated biological treatment [Effectiveness Water: 70%] *For readily and inherently biodegradable substances, the removal efficiency for acclimated biological treatment may be significantly higher than SimpleTreat estimates; thus, SimpleTreat estimates can serve as a conservative lower bound.* *Substance-specific efficiencies can be considered and can be used to overwrite the arbitrary default of this determinant value, which is set to 70%* Water explanation: *For readily and inherently biodegradable substances, the removal efficiency for acclimated biological treatment may be significantly higher than SimpleTreat estimates; thus, SimpleTreat estimates can serve as a conservative lower bound.* *Substance-specific efficiencies can be considered and can be used to overwrite the arbitrary default of this determinant value, which is set to 70 %.* • Indoor/outdoor use: Indoor Use • Process efficiency: Process optimized for highly efficient use of raw materials (very minimal environmental release)
Conditions and measures related to biological sewage treatment plant
• Application of the STP sludge on agricultural soil: Yes • Biological STP: Standard [Effectiveness Water: 87.36%] • Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations

1.1.2 Releases

The releases have been estimated on the basis of SPERC ESVOC 6.1a.v1: Use as an Intermediate (industrial): solvent-borne - ESVOC 6.1a.o.v1
(ESVOC 6.1a.o.v1: VP 100-1000 Pa; WS >1000 mg/L)

Description of activities/processes covered by the SPERC

Intermediate use of manufactured solvents encompasses a wide range of activities such as material recycling/ recovery, transfers, storage, etc. Substance losses are reduced through use of general and site-specific risk management measures to maintain workplace concentrations of airborne VOCs and particulates below respective OELs; and through use of closed or covered equipment/processes to minimize evaporative losses of VOCs. Substance losses to waste water are generally restricted to equipment cleaning as processes operate without contact with water. Such uses and substance properties result in limited to no discharge to wastewater, to air or to soil from the industrial site.
Product/substance domain: Use of substance as an intermediate (not related to Strictly Controlled Conditions).

Includes recycling/ recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).
Substance Domain: Applicable to petroleum substances (e.g., aliphatic and aromatic hydrocarbons) and petrochemicals (e.g., ketones, alcohols, acetates, glycols, glycol ethers, and glycol ether acetates).
Size of installation: Assumed that 5000kg/day of substance is used at installation
Processing conditions: Dry process
The local releases to the environment are reported in the following table.

Table 1 Local releases to the environment

Release	**Explanations**
Water	**Release factor:** 1% **Local release rate:** 20 kg/day **Explanation:** Emission factors to wastewater are conservatively calculated from equipment cleaning and substance aqueous solubility. Assumption of 10 m3 of wastewater generated per 1 tonne ofsubstance used is relatively conservative. Example: 1 mg/L x 10 m3/tonne use x 1000 L/m3 x 1tonne/10^9mg = 0.00001 tonnes/tonne used. For WS range (e.g., 1-10 mg/L), the geometric mean (i.e., 3.2 mg/L) is used to calculate the fraction released
Air	**Release factor:** 0.1% **Local release rate:** 2 kg/day **Explanation:** European Commission Technical Guidance Document on Risk Assessment (EUTGD) Part 2 – 2nd Edition (2003). Appendix 1, Table A3.1 (MC=1c; UC=33).
Non agricultural soil	**Release factor:** 0.1% **Local release rate:** - kg/day **Explanation:** ERC6a default

(sub)-SPERC ESVOC 6.1a.o.v1

Explanation for the release factor to water:

Emission factors to wastewater are conservatively calculated from equipment cleaning and substance aqueous solubility. Assumption of 10 m3 of wastewater generated per 1 tonne of substance used is relatively conservative.
Example: 1 mg/L x 10 m3/tonne use x 1000 L/m3 x 1tonne/10^9mg = 0.00001 tonnes/tonne used. For WS range (e.g., 1-10 mg/L), the geometric mean (i.e., 3.2 mg/L) is used to calculate the fraction released

Explanation for the release factor to air:

European Commission Technical Guidance Document on Risk Assessment (EUTGD) Part 2 – 2nd Edition (2003). Appendix 1, Table A3.1 (MC=1c; UC=33).

Explanation for the release factor to soil:

ERC6a default

Releases to waste

Release factor to external waste: 0 %
This will be assessed at a later stage.

1.1.3 Exposure and risks for the environment and man via the environment

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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 2 Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.127 mg/L	RCR = 0.067
Sediment (freshwater)	**Local PEC:** 0.569 mg/kg dw	RCR = 0.066
Marine water	**Local PEC:** 0.013 mg/L	RCR = 0.067
Sediment (marine water)	**Local PEC:** 0.057 mg/kg dw	RCR = 0.066
Sewage Treatment Plant	**Local PEC:** 1.264 mg/L	RCR = 0.126
Agricultural soil	**Local PEC:** 0.023 mg/kg dw	RCR = 0.038
Man via environment - Inhalation	**Concentration in air:** 3.35E-5 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 7.43E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

1.2 Worker CS 2: General exposures; Closed systems (PROC 1)

1.2.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

1.3 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

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Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.043 mg/m³ (TRA Workers)	RCR = 0.03
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.034
Combined routes, systemic, long-term		RCR = 0.064

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

1.4 Worker CS 3: General exposures; Closed systems (PROC 2)

1.4.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

1.4.2 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

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.027 mg/kg bw/day (TRA Workers)	RCR = 0.027

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Combined routes, systemic, long-term		RCR = 0.331

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

1.5 Worker CS 4: General exposures; Closed systems (PROC 3)

1.5.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed batch process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

1.5.2 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

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.894 mg/m³ (TRA Workers)	RCR = 0.638
Dermal, systemic, long term	0.014 mg/kg bw/day (TRA Workers)	RCR = 0.014
Combined routes, systemic, long-term		RCR = 0.652

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Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

1.6 Worker CS 5: General exposures; Open systems (PROC 4)

1.6.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

1.6.2 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

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.894 mg/m³ (TRA Workers)	RCR = 0.638
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.137
Combined routes, systemic,long term		RCR = 0.776

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

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Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

1.7 Worker CS 6: Process sampling (PROC 9)

1.7.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 0.25 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

1.7.2 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

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.149 mg/m³ (TRA Workers)	RCR = 0.106
Dermal, systemic, long term	0.686 mg/kg bw/day (TRA Workers)	RCR = 0.686
Combined routes, systemic, long-term		RCR = 0.792

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

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In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

1.8 Worker CS 7: Laboratory activities (PROC 15)

1.8.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

1.8.2 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

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	6.8E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.311

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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1.9 Worker CS 8: Bulk transfers; Closed systems (PROC 8b)

1.9.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 95%, Dermal: 95%] *LEV exposure reduction efficiency represents exposure reduction efficiency of a "predominantly closed system with extract ventilation."* • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%] • Handle substance within a predominantly closed system provided with extract ventilation.: = 95.0 % *Handle substance within a predominantly closed system provided with extract ventilation.*
• Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C Skin surface potentially exposed: Two hands (960 cm2)

1.9.2 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

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.064 mg/m³ (TRA Workers)	RCR = 0.76
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.137
Combined routes, systemic, long-term		RCR = 0.897

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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1.10 Worker CS 9: Bulk transfers; Open systems (PROC 8b)

1.10.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 95%, Dermal: 95%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal

protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

1.10.2 Exposure and risks for workers

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

Table 10. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.638 mg/m³ (TRA Workers)	RCR = 0.456
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.137
Combined routes, systemic, long-term		RCR = 0.593

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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1.11 Worker CS 10: Bulk transfers; Open systems (PROC 8b)

1.11.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

1.11.2 Exposure and risks for workers

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

Table 11. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.298 mg/m³ (TRA Workers)	RCR = 0.213
Dermal, systemic, long term	0.685 mg/kg bw/day (TRA Workers)	RCR = 0.685
Combined routes, systemic, long-term		RCR = 0.898

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

1.12 Worker CS 11: Equipment cleaning and maintenance (PROC 8a, PROC 28)

1.12.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] *LEV efficiency applied in the CSA as substitution for draining and flushing* • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%] Drain down and flush system prior to equipment break-in or maintenance (industrial) [Effectiveness Inhalation: 90%] *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* Inhalation explanation: *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* *As conservative approach a default value of 90% was chosen, although experimentally the minimum and mean efficiency was 93.2% and 95.2%, respectively.*
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

1.12.2 Exposure and risks for workers

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

Table 12. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers)	RCR = 0.274
Combined routes, systemic, long-term		RCR = 0.578

Remarks on exposure dataset obtained with ECETOC TRA

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The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

1.13 Worker CS 12: Storage (PROC 1)

1.13.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

1.13.2 Exposure and risks for workers

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

Table 13. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.043 mg/m³ (TRA Workers)	RCR = 0.03
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.034
Combined routes, systemic, long-term		RCR = 0.064

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of

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the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

1.14 Worker CS 13: Storage (PROC 2)

1.14.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

1.14.2 Exposure and risks for workers

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

Table 14. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.596 mg/m³ (TRA Workers)	RCR = 0.426
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers)	RCR = 0.274
Combined routes, systemic, long-term		RCR = 0.7

Risk characterisation

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In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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Exposure scenario 2: Formulation or re-packing - Formulation or re-packing; Use in agrochemicals

Market sector: Use in agrochemicals
Product category formulated: PC 12: Fertilizers; PC 27: Plant Protection Products

Environment contributing scenario(s):		
CS 1	Formulation of agrochemicals	ERC 2
Worker contributing scenario(s):		
CS 2	General exposures; Closed systems	PROC 1
CS 3	General exposures; Closed systems	PROC 2
CS 4	General exposures; Closed systems	PROC 3
CS 5	General exposures; Open systems	PROC 4
CS 6	Batch process; Elevated temperature; Use in contained systems	PROC 3
CS 7	Process sampling	PROC 9
CS 8	Laboratory activities	PROC 15
CS 9	Bulk transfers; Dedicated facility	PROC 8b
CS 10	Mixing operations; Open systems	PROC 5
CS 11	Manual; Transfer from/pouring from containers; Non-dedicated facility	PROC 8a
CS 12	Drum/batch transfers; Dedicated facility	PROC 8b
CS 13	Tabletting, compression, extrusion or pelletisation	PROC 14
CS 14	Drum and small package filling	PROC 9
CS 15	Equipment cleaning and maintenance	PROC 8a, PROC 28
CS 16	Storage	PROC 1
CS 17	Storage	PROC 2

Further description of the use:
Tetrahydrofurfuryl alcohol is present at not more than 10% w/w in the finished formulation. However, as a conservative approach up to 25% is assessed.

2.1 Env CS 1: Formulation of agrochemicals (ERC 2)

2.1.1 Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 4.2 tonnes/day *ESIG ESVOC SpERC assume that 100 t/day of substance is used at installation; substance specific information: 4.2 t/day* • Annual use amount at site: <= 425.0 tonnes/year
Technical and organisational conditions and measures

Indoor/Outdoor use: Indoor use On-site treatment of off-air: Typical measures to maintain workplace concentrations or airborne VOCs and particulates below respective OELS Equipment cleaning: No release to wastewater from process as such, wastewater emissions limited to release generated from final equipment cleaning step using water Process efficiency: Process optimized for highly efficient use of raw materials (very minimal environmental release)
Conditions and measures related to biological sewage treatment plant
• Discharge rate of STP: >= 2000 m3/day • Biological STP: Standard [Effectiveness Water: 87.36%] • Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations

2.1.2 Releases

The releases have been estimated on the basis of SPERC ESVOC 2.2.v1: Formulation & (re)packing of substances and mixtures (industrial): solvent-borne
(ESVOC 2.2.j.v1: VP 100 - 1000 Pa and WS > 1000 mg/L;Vapour pressure 100 - 1000 Pa and water solubility > 1000 mg/L)

Description of activities/processes covered by the SPERC

Formulation of solvent-borne substances encompasses a wide range of activities such as transfers, mixing, tabletting, compression, pelletisation and sampling. Substance losses are reduced through use of general and site-specific risk management measures to maintain workplace concentrations of airborne VOCs and particulates below respective OELs; and through use of closed or covered equipment/processes to minimize evaporative losses of VOCs.
Substance losses to waste water are generally restricted to equipment cleaning as processes operate without contact with water Such uses and substance properties result in limited to no discharge to wastewater or to soil from the industrial site.
Product/substance domain: Formulation, packing and re-packing of the substance and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, tabletting, compression, pelletisation, extrusion, large and small scale packing, sampling, maintenance and associated laboratory activities.
Substance Domain: Applicable to petroleum substances (e.g., aliphatic and aromatic hydrocarbons) and petrochemicals (e.g., ketones, alcohols, acetates, glycols, glycol ethers, and glycol ether acetates).
Size of installation: Use rate assumed to be 100 t/d
Processing conditions: Dry process
The local releases to the environment are reported in the following table.

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Table 15. Local releases to the environment

Release	Explanations
Water	**Release factor:** 0.5% **Local release rate:** 21.25 kg/day **Explanation:** Emission factors to wastewater are conservatively calculated based on wastewater volume generated from cleaning operations and substance aqueous solubility Assumption of 5 m3 of wastewater generated per 1 tonne of substance used is relatively conservative (Data from OECD Lubricants & Lubricant Additives ESD (2004) suggest a reasonable worst case estimate of wastewater discharge for a blending plant (formulation) is 0.1 m3/tonne lubricant (-> OECD Series on Emission Scenario Documents, Number 10. November 2004. Emission Scenario Document on Lubricants and Lubricant Additives); thus, assumed value of 5 m3/tonne represents a conservative estimate.). Example: 1 mg/L x 5 m3/tonne use x 1000 L/m3 x 1tonne/109mg = 0.000005 tonnes/tonne used. For WS range (e.g., 1-10 mg/L), the geometric mean (i.e., 3.2 mg/L) is used to calculate the fraction released. OECD Coatings ESD4 reports no releases of volatile substances to water. The values used here are consistent with those reported for dust.
Air	**Release factor:** 1%
	Local release rate: 42.5 kg/day **Explanation:** Estimates on the basis of substance vapor pressure taken from EUTGD (2003) Appendix 1 (European Commission Technical Guidance Document on Risk Assessment (EUTGD) Part 2 – 2nd Edition (2003). Appendix 1 Polymers Industry, Table 2.1 (MC = 3)). These values are consistent with the range of emissions reported in OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes)) and consistent with EU Solvent Emissions Directive after typical RMMs as further documented in Coatings SPERC Factsheet.
Non agricultural soil	**Release factor:** 0.01% **Local release rate:** - kg/day **Explanation:** ERC 2 default (ECHA Guidance on information requirements and chemical safety assessment, Chapter R.16: Environmental Exposure Estimation, Appendix R.16-1 – Environmental Release Categories)

(sub)-SPERC ESVOC 2.2.j.v1

Explanation for the release factor to water:

Emission factors to wastewater are conservatively calculated based on wastewater volume generated from cleaning operations and substance aqueous solubility Assumption of 5 m3 of wastewater generated per 1 tonne of substance used is relatively conservative (Data from OECD Lubricants & Lubricant Additives ESD (2004) suggest a reasonable worst case estimate of wastewater discharge for a blending plant (formulation) is 0.1 m3/tonne lubricant (-> OECD Series on Emission Scenario Documents, Number 10. November 2004. Emission Scenario Document on Lubricants and Lubricant Additives); thus, assumed value of 5 m3/tonne represents a conservative estimate.).
Example: 1 mg/L x 5 m3/tonne use x 1000 L/m3 x 1tonne/109mg = 0.000005 tonnes/tonne used. For WS range (e.g., 1-10 mg/L), the geometric mean (i.e., 3.2 mg/L) is used to calculate the fraction released.
OECD Coatings ESD4 reports no releases of volatile substances to water. The values used here are consistent with those reported for dust.

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Explanation for the release factor to air:

Estimates on the basis of substance vapor pressure taken from EUTGD (2003) Appendix 1 (European Commission Technical Guidance Document on Risk Assessment (EUTGD) Part 2 – 2nd Edition (2003). Appendix 1 Polymers Industry, Table 2.1 (MC = 3)).
These values are consistent with the range of emissions reported in OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 200 Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes)) and consistent with EU Solvent Emissions Directive after typical RMMs as further documented in Coatings SPERC Factsheet.

Explanation for the release factor to soil:

ERC 2 default (ECHA Guidance on information requirements and chemical safety assessment, Chapter R.16: Environmental Exposure Estimation, Appendix R.16-1 – Environmental Release Categories)

Releases to waste

Release factor to external waste: 0 %
This will be addressed at a later stage

2.1.3 Exposure and risks for the environment and man via the environment

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

Table 16. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.135 mg/L	RCR = 0.071
Sediment (freshwater)	**Local PEC:** 0.604 mg/kg dw	RCR = 0.07

Protection target	Exposure concentration	Risk quantification
Marine water	**Local PEC:** 0.013 mg/L	RCR = 0.071
Sediment (marine water)	**Local PEC:** 0.06 mg/kg dw	RCR = 0.07
Sewage Treatment Plant	**Local PEC:** 1.344 mg/L	RCR = 0.134
Agricultural soil	**Local PEC:** 0.025 mg/kg dw	RCR = 0.041
Man via environment - Inhalation	**Concentration in air:** 3.24E-3 mg/m³	RCR = 0.013
Man via environment - Oral	**Exposure via food consumption:** 6E-3 mg/kg bw/day	RCR = 0.034
Man via environment - combined routes		RCR = 0.047

2.2 Worker CS 2: General exposures; Closed systems (PROC 1)

2.2.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure

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• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

2.2.2 Exposure and risks for workers

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

Table 17. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.026 mg/m³ (TRA Workers)	RCR = 0.018
Dermal, systemic, long term	0.02 mg/kg bw/day (TRA Workers)	RCR = 0.02
Combined routes, systemic, long-term		RCR = 0.039

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.3 Worker CS 3: General exposures; Closed systems (PROC 2)

2.3.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures

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• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

2.3.2 Exposure and risks for workers

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

Table 18. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	0.016 mg/kg bw/day (TRA Workers)	RCR = 0.016
Combined routes, systemic, long-term		RCR = 0.199

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.4 Worker CS 4: General exposures; Closed systems (PROC 3)

2.4.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day

Technical and organisational conditions and measures

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• Closed batch process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

2.4.2 Exposure and risks for workers

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

Table 19. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.766 mg/m³ (TRA Workers)	RCR = 0.547
Dermal, systemic, long term	8.28E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.555

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.5 Worker CS 5: General exposures; Open systems (PROC 4)

2.5.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures

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• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes

Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

2.5.2 Exposure and risks for workers

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

Table 20. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.766 mg/m³ (TRA Workers)	RCR = 0.547
Dermal, systemic, long term	0.082 mg/kg bw/day (TRA Workers)	RCR = 0.082
Combined routes, systemic, long-term		RCR = 0.629

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.6 Worker CS 6: Batch process; Elevated temperature; Use in contained systems (PROC 3)

2.6.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures

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• Closed batch process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 80.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

2.6.2 Exposure and risks for workers

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

Table 21. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.072 mg/m³ (TRA Workers)	RCR = 0.766
Dermal, systemic, long term	4.97E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.771

Remarks on exposure dataset obtained with ECETOC TRA

Explanations:
At 50°C a vapour pressure of 600 Pa has been measured. Thus, it is reasonable to assume that at 80°C the vapour pressure is below 10,000 Pa.
The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.
The vapour pressure at operating temperature used for the calculation has been set by the assessor to 1E4 Pa.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.7 Worker CS 7: Process sampling (PROC 9)

2.7.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 0.25 h/day

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Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

2.7.2 Exposure and risks for workers

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

Table 22. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.089 mg/m³ (TRA Workers)	RCR = 0.064
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers)	RCR = 0.823

Route of exposure and type of effects	Exposure concentration	Risk quantification
Combined routes, systemic, long-term		RCR = 0.887

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.8 Worker CS 8: Laboratory activities (PROC 15)

2.8.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures

• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

2.8.2 Exposure and risks for workers

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

Table 23. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.277 mg/m³ (TRA Workers)	RCR = 0.912
Dermal, systemic, long term	4.08E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.916

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.9 Worker CS 9: Bulk transfers; Dedicated facility (PROC 8b)

2.9.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures

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• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 95%, Dermal: 95%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

2.9.2 Exposure and risks for workers

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

Table 24. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.149 mg/m³ (TRA Workers)	RCR = 0.106
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.137
Combined routes, systemic, long-term		RCR = 0.244

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.10 Worker CS 10: Mixing operations; Open systems (PROC 5)

2.10.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day

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Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

2.10.2 Exposure and risks for workers

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

Table 25. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.766 mg/m³ (TRA Workers)	RCR = 0.547
Dermal, systemic, long term	0.165 mg/kg bw/day (TRA Workers)	RCR = 0.165
Combined routes, systemic, long-term		RCR = 0.712

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.11 Worker CS 11: Manual; Transfer from/pouring from containers; Non-dedicated facility (PROC 8a)

2.11.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures

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• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]

• Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

2.11.2 Exposure and risks for workers

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

Table 26. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers)	RCR = 0.274
Combined routes, systemic, long-term		RCR = 0.457

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.12 Worker CS 12: Drum/batch transfers; Dedicated facility (PROC 8b)

2.12.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures

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• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 95%, Dermal: 95%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

2.12.2 Exposure and risks for workers

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

Table 27. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.638 mg/m³ (TRA Workers)	RCR = 0.456
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.137
Combined routes, systemic, long-term		RCR = 0.593

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.13 Worker CS 13: Tabletting, compression, extrusion or pelletisation (PROC 14)

2.13.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures

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• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

2.13.2 Exposure and risks for workers

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

Table 28. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.277 mg/m³ (TRA Workers)	RCR = 0.912
Dermal, systemic, long term	0.041 mg/kg bw/day (TRA Workers)	RCR = 0.041
Combined routes, systemic, long-term		RCR = 0.953

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.14 Worker CS 14: Drum and small package filling (PROC 9)

2.14.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures

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• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

2.14.2 Exposure and risks for workers

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

Table 29. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.277 mg/m³ (TRA Workers)	RCR = 0.912
Dermal, systemic, long term	0.041 mg/kg bw/day (TRA Workers)	RCR = 0.041
Combined routes, systemic, long-term		RCR = 0.953

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.15 Worker CS 15: Equipment cleaning and maintenance (PROC 8a, PROC 28)

2.15.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures

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Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] *LEV efficiency applied in the CSA as substitution for draining and flushing* • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%] Drain down and flush system prior to equipment break-in or maintenance (industrial) [Effectiveness Inhalation: 90%] *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* Inhalation explanation: *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* *As conservative approach a default value of 90% was chosen, although experimentally the minimum and mean efficiency was 93.2% and 95.2%, respectively.*
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

2.15.2 Exposure and risks for workers

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

Table 30. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers)	RCR = 0.274
Combined routes, systemic, long-term		RCR = 0.457

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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2.16 Worker CS 16: Storage (PROC 1)

2.16.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

2.16.2 Exposure and risks for workers

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

Table 31. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.026 mg/m³ (TRA Workers)	RCR = 0.018
Dermal, systemic, long term	0.02 mg/kg bw/day (TRA Workers)	RCR = 0.02
Combined routes, systemic, long-term		RCR = 0.039

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

2.17 Worker CS 17: Storage (PROC 2)

2.17.1 Conditions of use

Product (Article) characteristics

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• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced

• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

2.17.2 Exposure and risks for workers

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

Table 32. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.511 mg/m³ (TRA Workers)	RCR = 0.365
Dermal, systemic, long term	0.164 mg/kg bw/day (TRA Workers)	RCR = 0.164
Combined routes, systemic, long-term		RCR = 0.529

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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Exposure scenario 3: Widespread use by professional workers - Use in agrochemicals

Market sector: Use in agrochemicals
Product category used: PC 12: Fertilizers; PC 27: Plant Protection Products
Sector of use: SU 1: Agriculture, forestry, fishery

Environment contributing scenario(s):		
CS 1	Use in agrochemicals	ERC 8d, ERC 8a
Worker contributing scenario(s):		
CS 2	Transfer from/pouring from containers; Dedicated facility	PROC 8b
CS 3	Mixing operations; Open systems	PROC 4
CS 4	Spraying or fogging; Manual	PROC 11
CS 5	Spraying or fogging; Tractor delivery/dispersal	PROC 11
CS 6	Ad hoc manual application via trigger sprays, dipping, etc.	PROC 13
CS 7	Equipment cleaning and maintenance	PROC 8a, PROC 28
CS 8	Storage	PROC 1
CS 9	Storage	PROC 2

Further description of the use:

Tetrahydrofurfuryl alcohol is used as a solvent in agrochemical products. The formulated product is supplied at concentrations ranging from 0.05 to 10% w/w. As a conservative assumption an actual concentration of 25% in the exposure assessment.

Waste from use in agrochemicals

Wastes expected to arise from formulation of tetrahydrofurfuryl alcohol in agrochemicals might include filter residues which would be expected to be disposed of by incineration.

Professional use of agrochemicals containing tetrahydrofurfuryl alcohol may give rise to waste in the form of residues on empty packaging.

3.1 Env CS 1: Use in agrochemicals (ERC 8d)

3.1.1 Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.095 tonnes/day *Use of tetrahydrofurfuryl alcohol in agrochemicals in the EU is as a co-solvent or water-dispersant in pesticide formulations. An application rate of 420-1191 g THFA/ha is reported in the USDA NOP petition (2002) and this has been taken to be typical.* *According to the German Model (WHO - IPCS, 2014, which was also used for the exposure assessment) the average treated area using tractor mounted spraying is 20 ha/day. This would result in an upper daily application of 23.8 kg THFA. As conservative assumption this value was multiplied by a factor of 4 to account for a possible higher THFA application rate and/or a large area treated. Thus, a conservative application rate of 95.2 kg/day was used for the assessment.* *USDA NOP petition (2002), United States Department of Agriculture - National Organic Program petition, Date Petition Received: 04/02/02, online available via: https://www.ams.usda.gov/sites/default/files/media/Tetrahyrdofurfuyrl.pdf (accessed 4th October 2017)* *WHO - IPCS (2014) Environmental Health Criteria 242 - DERMAL EXPOSURE ISBN 978 92 4 157242 2*

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Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 87.36%]
Conditions and measures related to external treatment of waste (including article waste)

• Particular considerations on the waste treatment operations

3.1.2 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 33. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC based	**Release factor before on site RMM:** 100% **Release factor after on site RMM:** 100% **Local release rate:** 95.2 kg/day
Air	ERC based	**Release factor before on site RMM:** 100% **Release factor after on site RMM:** 100%
Non agricultural soil	ERC based	**Release factor after on site RMM:** 20%

3.1.3 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 34 Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.602 mg/L	RCR = 0.317
Sediment (freshwater)	**Local PEC:** 2.701 mg/kg dw	RCR = 0.314
Marine water	**Local PEC:** 0.06 mg/L	RCR = 0.317
Sediment (marine water)	**Local PEC:** 0.27 mg/kg dw	RCR = 0.314
Sewage Treatment Plant	**Local PEC:** 6.019 mg/L	RCR = 0.602
Agricultural soil	**Local PEC:** 0.107 mg/kg dw	RCR = 0.179
Man via environment - Inhalation	**Concentration in air:** 6.04E-6 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 0.019 mg/kg bw/day	RCR = 0.109
Man via environment - combined routes		RCR = 0.109

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3.2 Worker CS 2: Transfer from/pouring from containers; Dedicated facility (PROC 8b)

3.2.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 0.25 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] • Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training)

and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

3.2.2 Exposure and risks for workers

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

Table 35. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.179 mg/m³ (TRA Workers)	RCR = 0.128
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers)	RCR = 0.823
Combined routes, systemic, long-term		RCR = 0.95

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

3.3 Worker CS 3: Mixing operations; Open systems (PROC 4)

3.3.1 Conditions of use

Product (Article) characteristics

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• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

3.3.2 Exposure and risks for workers

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

Table 36. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.358 mg/m³ (TRA Workers)	RCR = 0.255

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	0.412 mg/kg bw/day (TRA Workers)	RCR = 0.412
Combined routes, systemic, long-term		RCR = 0.667

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

3.4 Worker CS 4: Spraying or fogging; Manual (PROC 11)

3.4.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure

• Duration of activity: <= 1.0 h/day • Application rate: Low application rate (0.03 - 0.3 l/minute) *Examples:* *Pest control operations* • Spray technique: Spraying with no or low compressed air use *Examples:* *Paint spraying using HVLP or airless techniques* *Pest control operations using backpack* • Dose applied: = 4.8 kg/ha *Dose applied (kg substance/ha)* *Use of tetrahydrofurfuryl alcohol in agrochemicals in the EU is as a co-solvent or water-dispersant in pesticide formulations. An application rate of 420-1191 g THFA/ha is reported in the USDA NOP petition (2002) and this has been taken to be typical.* *According to the German Model (WHO - IPCS, 2014, which was also used for the exposure assessment) the average treated area using tractor mounted spraying is 20 ha/day. This would result in an upper daily application of 23.8 kg THFA. As conservative assumption this value was multiplied by a factor of 4 to account for a possible higher THFA application rate and/or a larger area treated. Thus, a conservative application rate of 95.2 kg/day (or 4.76 kg/ha) was used for the assessment.* *USDA NOP petition (2002), United States Department of Agriculture - National Organic Program petition, Date Petition Received: 04/02/02, online available via: https://www.ams.usda.gov/sites/default/files/media/Tetrahyrdofurfuyrl.pdf (accessed 4th October 2017)* *WHO - IPCS (2014) Environmental Health Criteria 242 - DERMAL EXPOSURE ISBN 978 92 4 157242 2*
Technical and organisational conditions and measures
• Fugitive Emission Sources: No • Housekeeping practices: Yes *Demonstrable and effective housekeeping practices (examples include daily cleaning using appropriate methods (eg vacuum), preventive maintenance of machinery and control measures, and use of protective clothing that will repel spills and reduce personal cloud).* • Occupational Health and Safety Management System: Basic
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Body protection: Use coverall and sturdy footwear • Use of eye protection: Yes

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Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C • Application Method: Hand-held sprayer: hydraulic nozzles. Outdoor, high level target • Is the primary emission source located in the breathing zone of the worker?: Yes *Primary emission source located in the breathing zone of the worker (i.e. the volume of air within 1 metre in any direction of the worker's head)* • Is the source located close to buildings?: No *Both the source and the worker are located outdoors. It is assumed there are two situations outdoors where the scenario may be located: close to buildings or away from buildings or other obstructions.* • Activity Class: Spray application of liquids *Spray application of liquids* • Activity Subclass - Spray application of liquids: Surface spraying of liquids *Example Activities* *Spray application of paints on e.g. ships (using HVLP or airless techniques)* *Pest control operations (using backpack)* *Spraying cleaning agents onto surfaces* *Foaming* *Tractor mounted spraying* • What is the spray direction?: Spraying in any direction (including upwards) • Skin surface potentially exposed: Two hands and upper wrists (1500 cm2)

3.4.2 Exposure and risks for workers

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

Table 37. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.55 mg/m³ (ART: 1.5) **Supportive exposure (not used for RC):** 0.045 mg/m³ (The German Model (BBA): 1992)	RCR = 0.393
Dermal, systemic, long term	0.246 mg/kg bw/day (The German Model (BBA): 1992)	RCR = 0.246
Combined routes, systemic, long-term		RCR = 0.639

Remarks on exposure data from external estimation tools:

The German Model (BBA) 1992
Explanations: For the estimation of the dermal route The German Model was used (BBA, 1992). The model is listed in the current WHO International Programme on Chemical Safety (IPCS) report on dermal exposure assessment (WHO, 2014). The model was designed for active substances in agrochemical formulations, but was used here for the solvent fraction in this formulation. Considering that the solvent is usually much more volatile than the active ingredient, it was considered that the model is not conservative for the inhalation route. However, for the dermal route the volatility is of less importance (compare with ECETOC TRA model that does not consider the VP in the dermal assessment at all) and consequently is was considered that the model is applicable to the solvent fraction of the mixture for the dermal route as well. In fact, as a solvent usually also volatilizes to a much higher degree than the active ingredient, the prediction of the model for the dermal route can be considered even more conservative for a solvent compared to an active substance.
75th percentile exposure prediction of The German Model (BBA, 1992) for full shift: 118.3 mg/day
Operator body weight according to The German Model: 60 kg

Adjusted 75th percentile exposure prediction for 1 hour: 0.246 mg/kg/day
Although not directly used in the risk assessment (see explanation above), the results of the inhalation route are also presented as supportive information:
75th percentile exposure prediction of The German Model (BBA, 1992) for full shift: 3.922 mg/day
Operator inhalation rate: 22.9 l/minute (ConsExpo default, 60 kg person, light exercise, equal to 11m3 per shift)
Adjusted 75th percentile exposure prediction for 1 hour: 0.0446 mg/m3
WHO - IPCS (2014) Environmental Health Criteria 242 - DERMAL EXPOSURE ISBN 978 92 4 157242 2
ART 1.5 Explanations: Inhalation exposure: long term concentration corresponds to the 75th percentile prediction of the ART model for an 8-hour working day (1 hours exposed, 7 hours unexposed)
Inhalation exposure: short term concentration corresponds to the 95th percentile prediction of the ART model for a 15-minute working period (15 minutes exposed)
Both values are considered reasonable worst-case and are based on the ECETOC TRA approach for choosing short-term and long-term exposure estimates.
For the inhalation route in addition a respirator with APF of 20 is considered in the ART prediction.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

3.5 Worker CS 5: Spraying or fogging; Tractor delivery/dispersal (PROC 11)

3.5.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure

• Duration of activity: <= 8.0 h/day
• Application rate: Moderate application rate (0.3 - 3 l/minute)
Examples:
Paint spraying of e.g. ships
Deviated from the default value for tractor mounted spraying (ie more than 3 litres per minute), because the maximum allowable dose of THFA per day (4.76 kg/ha) limits the maximum application rate. Thus, a moderate application rate was chosen.
• Spray technique: Spraying with high compressed air use
Examples:
Air blast pesticide spraying of e.g. tree nursery
• Spray direction: Downward only
• Dose applied: = 4.8 kg/ha
Dose applied (kg substance/ha)
Use of tetrahydrofurfuryl alcohol in agrochemicals in the EU is as a co-solvent or water-dispersant in pesticide formulations. An application rate of 420-1191 g THFA/ha is reported in the USDA NOP petition (2002) and this has been taken to be typical.
According to the German Model (WHO - IPCS, 2014, which was also used for the exposure assessment) the average treated area using tractor mounted spraying is 20 ha/day. This would result in an upper daily application of 23.8 kg THFA. As conservative assumption this value was multiplied by a factor of 4 to account for a possible higher THFA application rate and/or a larger area treated. Thus, a conservative application rate of 95.2 kg/day (or 4.76 kg/ha) was used for the assessment.
USDA NOP petition (2002), United States Department of Agriculture - National Organic Program petition, Date Petition Received: 04/02/02, online available via: https://www.ams.usda.gov/sites/default/files/media/Tetrahyrdofurfuyrl.pdf (accessed 4th October 2017)
WHO - IPCS (2014) Environmental Health Criteria 242 - DERMAL EXPOSURE ISBN 978 92 4 157242 2

Technical and organisational conditions and measures

Primary Localised Controls: No localised controls
No control measures in close proximity of the source.
• Primary Emission Source — Segregation: No segregation
The source is not isolated from the work environment.
Primary Emission Source — Personal Enclosure: Complete personal enclosure without ventilation
Worker resides inside an enclosed cabin or room (door & windows closed) for the entire duration of the activity. The air within the separate room is not actively ventilated.
• Fugitive Emission Sources: No

• Housekeeping practices: Yes
Demonstrable and effective housekeeping practices (examples include daily cleaning using appropriate methods (eg vacuum), preventive maintenance of machinery and control measures, and use of protective clothing that will repel spills and reduce personal cloud).
• Occupational Health and Safety Management System: Basic

Conditions and measures related to personal protection, hygiene and health evaluation

Respiratory Protection: No [Effectiveness Inhalation: 0%]
Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%]
• Body protection: Use coverall and sturdy footwear
• Use of eye protection: Yes

Other conditions affecting workers exposure

• Operating temperature: <= 40.0 °C
• Place of use: Outdoor
• Activity Class: Spray application of liquids
Spray application of liquids
• Activity Subclass - Spray application of liquids: Surface spraying of liquids
Example Activities
Spray application of paints on e.g. ships (using HVLP or airless techniques)
Pest control operations (using backpack)
Spraying cleaning agents onto surfaces
Foaming
Tractor mounted spraying
• Is the source located close to buildings?: No
Both the source and the worker are located outdoors. It is assumed there are two situations outdoors where the scenario may be located: close to buildings or away from buildings or other obstructions.
• Is the worker located further than 4 meters from this far field source?: yes
• Is the primary emission source located in the breathing zone of the worker?: No
Primary emission source located outside the breathing zone of the worker (i.e. the volume of air outside 1 metre in any direction of the worker's head)
• Application Method: Tractor-mounted/trailed boom sprayer: hydraulic nozzles
• Skin surface potentially exposed: Two hands and upper wrists (1500 cm2)

3.5.2 Exposure and risks for workers

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

Table 38. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.3 mg/m³ (ART: v1.5) **Supportive exposure (not used for RC):** 0.031 mg/m³ (The German Model (BBA): 1992)	RCR = 0.214
Dermal, systemic, long term	0.337 mg/kg bw/day (The German Model (BBA): 1992)	RCR = 0.337
Combined routes, systemic, long-term		RCR = 0.551

Remarks on exposure data from external estimation tools:

ART v1.5
Explanations: Inhalation exposure: long term concentration corresponds to the 75th percentile prediction of the ART model for an 8-hour working day
Inhalation exposure: short term concentration corresponds to the 95th percentile prediction of the ART model for a 15-minute working period (15 minutes exposed)
Both values are considered reasonable worst-case and are based on the ECETOC TRA approach for choosing short-term and long-term exposure estimates.
The German Model (BBA) 1992
Explanations: For the estimation of the dermal route The German Model was used (BBA, 1992). The model is

listed in the current WHO International Programme on Chemical Safety (IPCS) report on dermal exposure assessment (WHO, 2014).
The model was designed for active substances in agrochemical formulations, but was used here for the solvent fraction in this formulation. Considering that the solvent is usually much more volatile than the active ingredient, it was considered that the model is not conservative for the inhalation route. However, for the dermal route the volatility is of less importance (compare with ECETOC TRA model that does not consider the VP in the dermal assessment at all) and consequently is was considered that the model is applicable to the solvent fraction of the mixture for the dermal route as well. In fact, as a solvent usually also volatilizes to a much higher degree than the active ingredient, the prediction of the model for the dermal route can be considered even more conservative for a solvent compared to an active substance.
75th percentile exposure prediction of The German Model (BBA, 1992) for full shift: 69.76 mg/day
Operator body weight according to The German Model: 60 kg
Adjusted 75th percentile exposure prediction for 8 hours: 1.16 mg/kg/day
Additionally, the operator is separated from the source through an enclosure (ie driving cabin). It was not possible to locate a source that has measured the exposure reduction efficiency of such an RMM. However, for the inhalation route reduction factor of 71% have been reported (Fransman et al), which - considering that the worker is physically separated from the source that excludes any splashes, etc. - also a conservative value for the dermal route. Consequently, the predicted 75th percentile dermal exposure was estimated with 0.337 mg/kg/day
Although not directly used in the risk assessment (see explanation above), the results of the inhalation route are also presented as supportive information:
75th percentile exposure prediction of The German Model (BBA, 1992) for full shift: 0.345 mg/day
Operator inhalation rate: 22.9 l/minute (ConsExpo default, 60 kg person, light exercise, equal to 11m3 per shift) Adjusted 75th percentile exposure prediction for 8 hours: 0.031 mg/m3
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FRANSMAN, W.; SCHINKEL, J.; MEIJSTER, T.; VAN HEMMEN, J.; TIELEMANS, E.; GOEDE, H.,(2008): Development and evaluation of an exposure control efficacy library (ECEL). In: Ann Occup Hyg. 52(7), 567-575.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

3.6 Worker CS 6: Ad hoc manual application via trigger sprays, dipping, etc. (PROC 13)

3.6.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 0.5 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic
Conditions and measures related to personal protection, hygiene and health evaluation

Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

• Contact Rate: 46.0 mg/min *ConsExpo default contact rate: 46 mg/min*

3.6.2 Exposure and risks for workers

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

Table 39. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.358 mg/m³ (TRA Workers)	RCR = 0.255
Dermal, systemic, long term	0.58 mg/kg bw/day (ConsExpo Web: 1.0.1)	RCR = 0.58
Combined routes, systemic, long-term		RCR = 0.835

Remarks on exposure data from external estimation tools:

ConsExpo Web 1.0.1
Explanations: ConsExpo Fact Sheet used:
Pest control products - Targeted spot
Default model setting used: Constant rate model
Exposed skin area according to ECETOC TRA for this PROC

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

3.7 Worker CS 7: Equipment cleaning and maintenance (PROC 8a, PROC 28)

3.7.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 0.25 h/day
Technical and organisational conditions and measures

Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 80%] *LEV efficiency applied in the CSA as substitute for draining and flushing* • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%] Drain down and flush system prior to equipment break-in or maintenance (professional) [Effectiveness Inhalation: 80%] *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* Inhalation explanation: *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* *As conservative approach a default value of 80% was chosen, although experimentally the minimum and mean efficiency was 93.2% and 95.2%, respectively. This low number should also represent reasonable worst case conditions in professional settings*

Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

3.7.2 Exposure and risks for workers

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

Table 40. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.128 mg/m³ (TRA Workers)	RCR = 0.091
Dermal, systemic, long term	0.165 mg/kg bw/day (TRA Workers)	RCR = 0.165
Combined routes, systemic, long-term		RCR = 0.256

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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3.8 Worker CS 8: Storage (PROC 1)

3.8.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Basic • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

3.8.2 Exposure and risks for workers

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

Table 41. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.043 mg/m³ (TRA Workers)	RCR = 0.03
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.034
Combined routes, systemic, long-term		RCR = 0.064

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

3.9 Worker CS 9: Storage (PROC 2)

3.9.1 Conditions of use

Product (Article) characteristics

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• Percentage (w/w) of substance in mixture/article: <= 25.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 0.25 h/day
Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Basic • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

3.9.2 Exposure and risks for workers

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

Table 42. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.894 mg/m³ (TRA Workers)	RCR = 0.638
Dermal, systemic, long term	0.164 mg/kg bw/day (TRA Workers)	RCR = 0.164
Combined routes, systemic, long-term		RCR = 0.803

Risk characterization

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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Exposure scenario 4: Formulation or re-packing - Formulation or re-packing; Adhesives, sealants; Resins (prepolymers)

Market sector: Adhesives, sealants; Resins (prepolymers)
Product category formulated: PC 1: Adhesives, Sealants

Environment contributing scenario(s):		
CS 1	Formulation of agrochemicals	ERC 2
Worker contributing scenario(s):		
CS 2	General exposures; Closed systems	PROC 1
CS 3	General exposures; Closed systems	PROC 2
CS 4	General exposures; Closed systems	PROC 3
CS 5	General exposures; Open systems	PROC 4
CS 6	Batch process; Elevated temperature; Use in contained systems	PROC 3
CS 7	Process sampling	PROC 9
CS 8	Laboratory activities	PROC 15
CS 9	Bulk transfers; Dedicated facility	PROC 8b
CS 10	Mixing operations; Open systems	PROC 5
CS 11	Manual; Transfer from/pouring from containers; Non-dedicated facility	PROC 8a
CS 12	Drum/batch transfers; Dedicated facility	PROC 8b
CS 13	Tabletting, compression, extrusion or pelletisation	PROC 14
CS 14	Drum and small package filling	PROC 9
CS 15	Equipment cleaning and maintenance	PROC 8a, PROC 28
CS 16	Storage	PROC 1
CS 17	Storage	PROC 2

Further description of the use:

Tetrahydrofurfuryl alcohol is used as a reactive diluent in epoxy resin systems.

4.1 Env CS 1: Formulation of agrochemicals (ERC 2)

4.1.1 Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 2.0 tonnes/day *ESIG ESVOC SpERC assume that 100 t/day of substance is used at installation; substance specific information: 2 t/day* • Annual use amount at site: <= 20.0 tonnes/year
Technical and organisational conditions and measures

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Indoor/Outdoor use: Indoor use On-site treatment of off-air: Typical measures to maintain workplace concentrations or airborne VOCs and particulates below respective OELS Equipment cleaning: No release to wastewater from process as such, wastewater emissions limited to release generated from final equipment cleaning step using water • Process efficiency: Process optimized for highly efficient use of raw materials (very minimal environmental

release)
Conditions and measures related to biological sewage treatment plant
• Discharge rate of STP: >= 2000 m3/day • Biological STP: Standard [Effectiveness Water: 87.36%] • Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations

4.1.2 Releases

The releases have been estimated on the basis of SPERC ESVOC 2.2.v1: Formulation & (re)packing of substances and mixtures (industrial): solvent-borne
(ESVOC 2.2.j.v1: VP 100 - 1000 Pa and WS > 1000 mg/L;Vapour pressure 100 - 1000 Pa and water solubility > 1000 mg/L)

Description of activities/processes covered by the SPERC

Formulation of solvent-borne substances encompasses a wide range of activities such as transfers, mixing, tabletting, compression, pelletisation and sampling. Substance losses are reduced through use of general and site-specific risk management measures to maintain workplace concentrations of airborne VOCs and particulates below respective OELs; and through use of closed or covered equipment/processes to minimize evaporative losses of VOCs.
Substance losses to waste water are generally restricted to equipment cleaning as processes operate without contact with water Such uses and substance properties result in limited to no discharge to wastewater or to soil from the industrial site.
Product/substance domain: Formulation, packing and re-packing of the substance and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, tabletting, compression, pelletisation, extrusion, large and small scale packing, sampling, maintenance and associated laboratory activities.
Substance Domain: Applicable to petroleum substances (e.g., aliphatic and aromatic hydrocarbons) and petrochemicals (e.g., ketones, alcohols, acetates, glycols, glycol ethers, and glycol ether acetates).
Size of installation: Use rate assumed to be 100 t/d
Processing conditions: Dry process
The local releases to the environment are reported in the following table.

Table 43. Local releases to the environment

Release	Explanations

Water	**Release factor:** 0.5% **Local release rate:** 10 kg/day **Explanation:** Emission factors to wastewater are conservatively calculated based on wastewater volume generated from cleaning operations and substance aqueous solubility Assumption of 5 m3 of wastewater generated per 1 tonne of substance used is relatively conservative (Data from OECD Lubricants & Lubricant Additives ESD (2004) suggest a reasonable worst case estimate of wastewater discharge for a blending plant (formulation) is 0.1 m3/tonne lubricant (-> OECD Series on Emission Scenario Documents, Number 10. November 2004. Emission Scenario Document on Lubricants and Lubricant Additives); thus, assumed value of 5 m3/tonne represents a conservative estimate.). Example: 1 mg/L x 5 m3/tonne use x 1000 L/m3 x 1tonne/109mg = 0.000005 tonnes/tonne used. For WS range (e.g., 1-10 mg/L), the geometric mean (i.e., 3.2 mg/L) is used to calculate the fraction released. OECD Coatings ESD4 reports no releases of volatile substances to water. The values used here are consistent with those reported for dust.
Air	**Release factor:** 1% **Local release rate:** 20 kg/day **Explanation:** Estimates on the basis of substance vapor pressure taken from EUTGD (2003) Appendix 1 (European Commission Technical Guidance Document on Risk Assessment (EUTGD) Part 2 – 2nd Edition (2003). Appendix 1 Polymers Industry, Table 2.1 (MC = 3)). These values are consistent with the range of emissions reported in OECD Coatings ESD

Release	**Explanations**
	(OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes)) and consistent with EU Solvent Emissions Directive after typical RMMs as further documented in Coatings SPERC Factsheet.
Non agricultural soil	**Release factor:** 0.01% **Local release rate:** - kg/day **Explanation:** ERC 2 default (ECHA Guidance on information requirements and chemical safety assessment, Chapter R.16: Environmental Exposure Estimation, Appendix R.16-1 – Environmental Release Categories)

(sub)-SPERC ESVOC 2.2.j.v1

Explanation for the release factor to water:

Emission factors to wastewater are conservatively calculated based on wastewater volume generated from cleaning operations and substance aqueous solubility Assumption of 5 m3 of wastewater generated per 1 tonne of substance used is relatively conservative (Data from OECD Lubricants & Lubricant Additives ESD (2004) suggest a reasonable worst case estimate of wastewater discharge for a blending plant (formulation) is 0.1 m3/tonne lubricant (-> OECD Series on Emission Scenario Documents, Number 10. November 2004. Emission Scenario Document on Lubricants and Lubricant Additives); thus, assumed value of 5 m3/tonne represents a conservative estimate.).
Example: 1 mg/L x 5 m3/tonne use x 1000 L/m3 x 1tonne/109mg = 0.000005 tonnes/tonne used. For WS range (e.g., 1-10 mg/L), the geometric mean (i.e., 3.2 mg/L) is used to calculate the fraction released.
OECD Coatings ESD4 reports no releases of volatile substances to water. The values used here are consistent with those reported for dust.

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Explanation for the release factor to air:

Estimates on the basis of substance vapor pressure taken from EUTGD (2003) Appendix 1 (European Commission Technical Guidance Document on Risk Assessment (EUTGD) Part 2 – 2nd Edition (2003). Appendix 1 Polymers Industry, Table 2.1 (MC = 3)).
These values are consistent with the range of emissions reported in OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes)) and consistent with EU Solvent Emissions Directive after typical RMMs as further documented in Coatings SPERC Factsheet.

Explanation for the release factor to soil:

ERC 2 default (ECHA Guidance on information requirements and chemical safety assessment, Chapter R.16: Environmental Exposure Estimation, Appendix R.16-1 – Environmental Release Categories)

Releases to waste

Release factor to external waste: 0 %
This will be addressed at a later stage

4.1.3 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 44. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.064 mg/L	RCR = 0.033
Sediment (freshwater)	**Local PEC:** 0.285 mg/kg dw	RCR = 0.033
Marine water	**Local PEC:** 6.36E-3 mg/L	RCR = 0.033
Sediment (marine water)	**Local PEC:** 0.029 mg/kg dw	RCR = 0.033
Sewage Treatment Plant	**Local PEC:** 0.632 mg/L	RCR = 0.063
Agricultural soil	**Local PEC:** 0.011 mg/kg dw	RCR = 0.019

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation	**Concentration in air:** 1.55E-4 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 5.78E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

4.2 Worker CS 2: General exposures; Closed systems (PROC 1)

4.2.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure

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• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

4.2.2 Exposure and risks for workers

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

Table 45. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	8.51E-3 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	6.8E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.013

4.3 Worker CS 3: General exposures; Closed systems (PROC 2)

4.3.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation

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Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

4.3.2 Exposure and risks for workers

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

Table 46. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.085 mg/m³ (TRA Workers)	RCR = 0.061
Dermal, systemic, long term	5.48E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.066

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

4.4 Worker CS 4: General exposures; Closed systems (PROC 3)

4.4.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed batch process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure

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• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

4.4.2 Exposure and risks for workers

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

Table 47. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	2.76E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.185

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

4.5 Worker CS 5: General exposures; Open systems (PROC 4)

4.5.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

4.5.2 Exposure and risks for workers

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

Table 48. Exposure concentrations and risks for workers

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Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	0.027 mg/kg bw/day (TRA Workers)	RCR = 0.027
Combined routes, systemic, long-term		RCR = 0.21

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

4.6 Worker CS 6: Batch process; Elevated temperature; Use in contained systems (PROC 3)

4.6.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed batch process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 80.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

4.6.2 Exposure and risks for workers

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

Table 49. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.596 mg/m³ (TRA Workers)	RCR = 0.426
Dermal, systemic, long term	2.76E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01

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Combined routes, systemic, long-term		RCR = 0.428

Remarks on exposure dataset obtained with ECETOC TRA

Explanations:
At 50°C a vapour pressure of 600 Pa has been measured. Thus, it is reasonable to assume that at 80°C the vapour pressure is below 10,000 Pa.
The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.
The vapour pressure at operating temperature used for the calculation has been set by the assessor to 1E4 Pa.

4.7 Worker CS 7: Process sampling (PROC 9)

4.7.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]

Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

4.7.2 Exposure and risks for workers

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

Table 50. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.596 mg/m³ (TRA Workers)	RCR = 0.426
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers)	RCR = 0.274
Combined routes, systemic, long-term		RCR = 0.7

4.8 Worker CS 8: Laboratory activities (PROC 15)

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4.8.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

4.8.2 Exposure and risks for workers

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

Table 51. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	1.36E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01

Route of exposure and type of effects	Exposure concentration	Risk quantification
Combined routes, systemic, long-term		RCR = 0.305

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

4.9 Worker CS 9: Bulk transfers; Dedicated facility (PROC 8b)

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4.9.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 95%, Dermal: 95%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

4.9.2 Exposure and risks for workers

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

Table 52. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.149 mg/m³ (TRA Workers)	RCR = 0.106
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.137
Combined routes, systemic, long-term		RCR = 0.244

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

4.10 Worker CS 10: Mixing operations; Open systems (PROC 5)

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4.10.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

4.10.2 Exposure and risks for workers

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

Table 53. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	0.055 mg/kg bw/day (TRA Workers)	RCR = 0.055
Combined routes, systemic, long-term		RCR = 0.237

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

4.11 Worker CS 11: Manual; Transfer from/pouring from containers;

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Non-dedicated facility (PROC 8a)

4.11.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal

protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

4.11.2 Exposure and risks for workers

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

Table 54. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers)	RCR = 0.274
Combined routes, systemic, long-term		RCR = 0.457

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

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4.12 Worker CS 12: Drum/batch transfers; Dedicated facility (PROC 8b)

4.12.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 95%, Dermal: 95%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

4.12.2 Exposure and risks for workers

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

Table 54. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.638 mg/m³ (TRA Workers)	RCR = 0.456
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.137
Combined routes, systemic, long-term		RCR = 0.593

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

4.13 Worker CS 13: Tabletting, compression, extrusion or pelletisation (PROC 14)

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4.13.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

4.13.2 Exposure and risks for workers

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

Table 55. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.014 mg/kg bw/day (TRA Workers)	RCR = 0.014
Combined routes, systemic, long-term		RCR = 0.318

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

4.14 Worker CS 14: Drum and small package filling (PROC 9)

4.14.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day

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Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

4.14.2 Exposure and risks for workers

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

Table 56. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.014 mg/kg bw/day (TRA Workers)	RCR = 0.014
Combined routes, systemic, long-term		RCR = 0.318

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

4.15 Worker CS 15: Equipment cleaning and maintenance (PROC 8a, PROC 28)

4.15.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] *LEV efficiency applied in the CSA as substitute for draining and flushing*

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General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%] Drain down and flush system prior to equipment break-in or maintenance (industrial) [Effectiveness Inhalation: 90%] *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* Inhalation explanation: *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* *As conservative approach a default value of 90% was chosen, although experimentally the minimum and mean efficiency was 93.2% and 95.2%, respectively.*
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

4.15.2 Exposure and risks for workers

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

Table 57. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers)	RCR = 0.274
Combined routes, systemic, long-term		RCR = 0.457

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2). Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.

4.16 Worker CS 16: Storage (PROC 1)

4.16.1 Conditions of use

Product (Article) characteristics

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• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure

• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

4.16.2 Exposure and risks for workers

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

Table 58. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	8.51E-3 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	6.8E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.013

4.17 Worker CS 17: Storage (PROC 2)

4.17.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]

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Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

4.17.2 Exposure and risks for workers

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

Table 58. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.17 mg/m³ (TRA Workers)	RCR = 0.122
Dermal, systemic, long term	0.055 mg/kg bw/day (TRA Workers)	RCR = 0.055
Combined routes, systemic, long-term		RCR = 0.176

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Exposure scenario 5: Use at industrial sites - Adhesives, sealants; Resins (prepolymers)

Market sector: Adhesives, sealants; Resins (prepolymers)
Product category used: PC 1: Adhesives, Sealants
Sector of use: SU 11: Manufacture of rubber products; SU 12: Manufacture of plastics products, including compounding and conversion; SU 18: Manufacture of furniture; SU 6a: Manufacture of wood and wood products; SU 6b: Manufacture of pulp, paper and paper products

Environment contributing scenario(s):		
CS 1	Adhesives, sealants; Resins (prepolymers)	ERC 4
Worker contributing scenario(s):		
CS 2	General exposures; Closed systems	PROC 1
CS 3	General exposures; Closed systems; Use in contained systems; With sample collection	PROC 2
CS 4	Film formation - force drying, stoving and other technologies; Use in contained systems; Elevated temperature	PROC 2
CS 5	Film formation - air drying; Open systems	PROC 4
CS 6	Mixing operations; Closed systems; Batch process; Use in contained systems	PROC 3
CS 7	Preparation of material for application; Mixing operations; Open systems	PROC 5
CS 8	Spraying; Automated task	PROC 7
CS 9	Spraying; Manual	PROC 7
CS 10	Material transfers; Non-dedicated facility	PROC 8a
CS 11	Material transfers; Dedicated facility	PROC 8b
CS 12	Roller, spreader, flow application	PROC 10
CS 13	Dipping, immersion and pouring	PROC 13
CS 14	Laboratory activities	PROC 15
CS 15	Equipment cleaning and maintenance	PROC 8a, PROC 28
CS 16	Storage	PROC 1
CS 17	Material transfers; Drum/batch transfers; Transfer from/pouring from containers; Dedicated facility	PROC 9
CS 18	Tabletting, compression, extrusion or pelletisation	PROC 14

Further description of the use:

Tetrahydrofurfuryl alcohol is used as a reactive diluent in epoxy resin systems. These are used in resins and adhesives for industrial and
professional use. A proportion of the tetrahydrofurfuryl alcohol present is likely to volatilise in use, and the remainder is understood to react during the curing of the resin / adhesive and does not remain in the cured product in a form liable to leach or be released during the service life. Therefore, the life cycle subsequent to the stage at which the resin / adhesive is applied does not require consideration.
Waste from use in resins and adhesives

Industrial or professional use of resins and adhesives containing tetrahydrofurfuryl alcohol may give rise to waste in the form of residues on empty packaging. Waste cured resin or adhesive and end of life products do not contain tetrahydrofurfuryl alcohol due to its reactivity in use.

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5.1 Env CS 1: Adhesives, sealants; Resins (prepolymers) (ERC 4)

5.1.1 Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 0.1 tonnes/day *ESIG ESVOC SpERC assume that 50000 kg/d of substance is used at installation; substance specific information: <100 kg/day* • Annual use amount at site: <= 2.0 tonnes/year
Technical and organisational conditions and measures
Indoor/Outdoor use: Indoor use On-site treatment of off-air: Typical measures to maintain workplace concentrations or airborne VOCs and particulates below respective OELS Equipment cleaning: No release to wastewater from process as such, wastewater emissions limited to release generated from final equipment cleaning step using water • Process efficiency: Process optimized for efficient use of raw materials
Conditions and measures related to biological sewage treatment plant
• Discharge rate of STP: >= 2000 m3/day • Biological STP: Standard [Effectiveness Water: 87.36%] • Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations

5.1.2 Releases

The releases have been estimated on the basis of SPERC ESVOC 4.3a.v1: Uses in Coatings (industrial): solvent-borne
(ESVOC 4.3a.e.v1: WS > 1000 mg/L;Water solubility > 1000 mg/L)

Description of activities/processes covered by the SPERC

Industrial use of solvent-borne coatings encompasses a wide range of activities such as spraying, brushing, cleaning, etc. Substance losses are reduced through use of general and site-specific risk management measures to maintain workplace concentrations of airborne VOCs and particulates below respective OELs; and through use of closed or covered equipment/processes to minimize evaporative losses of VOCs.
Substance losses to waste water are generally restricted to equipment cleaning as processes operate without contact with water. Such uses and substance properties result in limited to no discharge to wastewater or to soil from the industrial site.
Product/substance domain: Covers the use in coatings (paints, inks, adhesives, etc.) including exposures during use (including materials receipt, storage, preparation and transfer from bulk and semi-bulk, application by spray, roller, spreader, dip, flow, fluidized bed on production lines and film formation) and equipment cleaning, maintenance and associated laboratory activities.
Substance Domain: Applicable to petroleum substances (e.g., aliphatic and aromatic hydrocarbons) and petrochemicals (e.g., ketones, alcohols, acetates, glycols, glycol ethers, and glycol ether acetates).
Size of installation: Substance use rate assumed to be 50000 kg/d
Processing conditions: Dry process

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The local releases to the environment are reported in the following table.

Table 59. Local releases to the environment

Release	Explanations
Water	**Release factor:** 2% **Local release rate:** 2 kg/day **Explanation:** Emission factors to wastewater are conservatively calculated based on wastewater volume generated from blanket wash and cleaning of printing machines and substance aqueous solubility Assumption of 20 m3 of wastewater generated per 1 tonne of substance used is relatively conservative (Data from Ecoinvent 2.0 database suggest water use for offset printing and gravure printing are 1.14 and 3.54 m3/tonne solvent, respectively (original reference: Hischier R. 2007. Life cycle inventories of packaging and graphical paper. Final report ecoinvent data v2.0. Volume 11. Swiss Centre for LCI, Empa – TSL. Dubendorf, CH.); thus,

Release	Explanations
	assumed value of 20 m3/tonne represents a conservative estimate). Example: 1 mg/L x 20 m3/tonne use x 1000 L/m3 x 1tonne/109mg = 0.00002 tonnes/tonne used. For WS range (e.g., 1-10 mg/L), the geometric mean (i.e., 3.2 mg/L) is used to calculate the fraction released.
Air	**Release factor:** 98% **Local release rate:** 98 kg/day **Explanation:** OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes).)
Non agricultural soil	**Release factor:** 0% **Local release rate:** - kg/day **Explanation:** OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes))

(sub)-SPERC ESVOC 4.3a.e.v1

Explanation for the release factor to water:

Emission factors to wastewater are conservatively calculated based on wastewater volume generated from blanket wash and cleaning of printing machines and substance aqueous solubility
Assumption of 20 m3 of wastewater generated per 1 tonne of substance used is relatively conservative (Data from Ecoinvent 2.0 database suggest water use for offset printing and gravure printing are 1.14 and 3.54 m3/tonne solvent, respectively (original reference: Hischier R. 2007. Life cycle inventories of packaging and graphical paper. Final report ecoinvent data v2.0. Volume 11. Swiss Centre for LCI, Empa – TSL. Dubendorf, CH.); thus, assumed value of 20 m3/tonne represents a conservative estimate).
Example: 1 mg/L x 20 m3/tonne use x 1000 L/m3 x 1tonne/109mg = 0.00002 tonnes/tonne used. For WS range (e.g., 1-10 mg/L), the geometric mean (i.e., 3.2 mg/L) is used to calculate the fraction released.

Explanation for the release factor to air:

OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes).)

Explanation for the release factor to soil:

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OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes))

Releases to waste

Release factor to external waste: 0 %
This will be addressed at a later stage

5.1.3 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 60. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.013 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 0.058 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.3E-3 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 5.84E-3 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0.126 mg/L	RCR = 0.013
Agricultural soil	**Local PEC:** 2.58E-3 mg/kg dw	RCR < 0.01
Man via environment -	**Concentration in air:** 1.5E-3 mg/m³	RCR < 0.01

Protection target	Exposure concentration	Risk quantification
Inhalation		
Man via environment - Oral	**Exposure via food consumption:** 2.29E-3 mg/kg bw/day	RCR = 0.013
Man via environment - combined routes		RCR = 0.019

5.2 Worker CS 2: General exposures; Closed systems (PROC 1)

5.2.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation

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• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

5.2.2 Exposure and risks for workers

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

Table 61. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	8.51E-3 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	6.8E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.013

5.3 Worker CS 3: General exposures; Closed systems; Use in contained systems; With sample collection (PROC 2)

5.3.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures

• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

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5.3.2 Exposure and risks for workers

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

Table 62. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.851 mg/m³ (TRA Workers)	RCR = 0.608
Dermal, systemic, long term	0.055 mg/kg bw/day (TRA Workers)	RCR = 0.055
Combined routes, systemic, long-term		RCR = 0.663

5.4 Worker CS 4: Film formation - force drying, stoving and other technologies; Use in contained systems; Elevated temperature (PROC 2)

5.4.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 80.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

5.4.2 Exposure and risks for workers

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

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Table 63. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	5.48E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.309

Remarks on exposure dataset obtained with ECETOC TRA

Explanations:
At 50°C a vapour pressure of 600 Pa has been measured. Thus, it is reasonable to assume that at 80°C the vapour pressure is below 10,000 Pa.
The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.
The vapour pressure at operating temperature used for the calculation has been set by the assessor to 1E4 Pa.

5.5 Worker CS 5: Film formation - air drying; Open systems (PROC 4)

5.5.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

5.5.2 Exposure and risks for workers

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

Table 64. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification

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Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.027 mg/kg bw/day (TRA Workers)	RCR = 0.027
Combined routes, systemic, long-term		RCR = 0.331

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.6 Worker CS 6: Mixing operations; Closed systems; Batch process; Use in contained systems (PROC 3)

5.6.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed batch process with occasional controlled exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

5.6.2 Exposure and risks for workers

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

Table 65. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.255 mg/m³ (TRA Workers)	RCR = 0.182
Dermal, systemic, long term	2.76E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.185

Remarks on exposure dataset obtained with ECETOC TRA

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The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.7 Worker CS 7: Preparation of material for application; Mixing operations; Open systems (PROC 5)

5.7.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation

Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

5.7.2 Exposure and risks for workers

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

Table 66. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.055 mg/kg bw/day (TRA Workers)	RCR = 0.055
Combined routes, systemic, long-term		RCR = 0.359

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.8 Worker CS 8: Spraying; Automated task (PROC 7)

5.8.1 Conditions of use

Product (Article) characteristics

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• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 95%, Dermal: 95%] General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands and upper wrists (1500 cm2)

5.8.2 Exposure and risks for workers

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

Table 67. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.766 mg/m³ (TRA Workers)	RCR = 0.547
Dermal, systemic, long term	0.086 mg/kg bw/day (TRA Workers)	RCR = 0.086
Combined routes, systemic, long-term		RCR = 0.633

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.9 Worker CS 9: Spraying; Manual (PROC 7)

5.9.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure

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• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] General ventilation: Enhanced general ventilation (5-10 air changes per hour) [Effectiveness Inhalation: 70%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands and upper wrists (1500 cm2)

5.9.1.1 Exposure and risks for workers

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

Table 68. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.766 mg/m³ (TRA Workers)	RCR = 0.547
Dermal, systemic, long term	0.429 mg/kg bw/day (TRA Workers)	RCR = 0.429
Combined routes, systemic, long-term		RCR = 0.976

5.10 Worker CS 10: Material transfers; Non-dedicated facility (PROC 8a)

5.10.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid

Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation

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Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

5.10.2 Exposure and risks for workers

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

Table 69. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.851 mg/m³ (TRA Workers)	RCR = 0.608
Dermal, systemic, long term	0.055 mg/kg bw/day (TRA Workers)	RCR = 0.055
Combined routes, systemic, long-term		RCR = 0.663

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.11 Worker CS 11: Material transfers; Dedicated facility (PROC 8b)

5.11.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 95%, Dermal: 95%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

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5.11.2 Exposure and risks for workers

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

Table 70. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.213 mg/m³ (TRA Workers)	RCR = 0.152
Dermal, systemic, long term	0.027 mg/kg bw/day (TRA Workers)	RCR = 0.027
Combined routes, systemic, long-term		RCR = 0.179

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.12 Worker CS 12: Roller, spreader, flow application (PROC 10)

5.12.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

5.12.2 Exposure and risks for workers

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

Table 71. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.511 mg/m³ (TRA Workers)	RCR = 0.365

Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers)	RCR = 0.274
Combined routes, systemic, long-term		RCR = 0.639

5.13 Worker CS 13: Dipping, immersion and pouring (PROC 13)

5.13.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

5.13.2 Exposure and risks for workers

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

Table 72. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.851 mg/m³ (TRA Workers)	RCR = 0.608
Dermal, systemic, long term	0.055 mg/kg bw/day (TRA Workers)	RCR = 0.055
Combined routes, systemic, long-term		RCR = 0.663

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.14 Worker CS 14: Laboratory activities (PROC 15)

5.14.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor

• Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

5.14.2 Exposure and risks for workers

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

Table 73. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	1.36E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.305

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.15 Worker CS 15: Equipment cleaning and maintenance (PROC 8a, PROC 28)

5.15.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure

• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] *LEV efficiency applied in the CSA as substitution for draining and flushing* • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%] Drain down and flush system prior to equipment break-in or maintenance (industrial) [Effectiveness Inhalation: 90%] *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* Inhalation explanation: *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* *As conservative approach a default value of 90% was chosen, although experimentally the minimum and mean efficiency was 93.2% and 95.2%, respectively.*
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

5.15.2 Exposure and risks for workers

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

Table 74. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.511 mg/m³ (TRA Workers)	RCR = 0.365
Dermal, systemic, long term	0.055 mg/kg bw/day (TRA Workers)	RCR = 0.055
Combined routes, systemic, long-term		RCR = 0.42

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.16 Worker CS 16: Storage (PROC 1)

5.16.1 Conditions of use

Product (Article) characteristics

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• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

5.16.2 Exposure and risks for workers

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

Table 75. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	8.51E-3 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	6.8E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.013

5.17 Worker CS 17: Material transfers; Drum/batch transfers; Transfer from/pouring from containers; Dedicated facility (PROC 9)

5.17.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation

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Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

5.17.1.1 Exposure and risks for workers

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

Table 76. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.027 mg/kg bw/day (TRA Workers)	RCR = 0.027
Combined routes, systemic, long-term		RCR = 0.331

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

5.18 Worker CS 18: Tabletting, compression, extrusion or pelletisation (PROC 14)

5.18.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure

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- Place of use: Indoor
- Operating temperature: <= 40.0 °C
- Skin surface potentially exposed: Two hands face (480 cm2)

5.18.2 Exposure and risks for workers

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

Table 76. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.014 mg/kg bw/day (TRA Workers)	RCR = 0.014
Combined routes, systemic, long-term		RCR = 0.318

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

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Exposure scenario 6: Widespread use by professional workers - Adhesives, sealants; Resins (prepolymers)

Market sector: Adhesives, sealants; Resins (prepolymers)
Product category used: PC 1: Adhesives, Sealants
Sector of use: SU 11: Manufacture of rubber products; SU 12: Manufacture of plastics products, including compounding and conversion; SU 18: Manufacture of furniture; SU 6a: Manufacture of wood and wood products; SU 6b: Manufacture of pulp, paper and paper products

Environment contributing scenario(s):		
CS 1	Adhesives, sealants; Resins (prepolymers)	ERC 8d, ERC 8a
Worker contributing scenario(s):		
CS 2	General exposures; Closed systems	PROC 1
CS 3	General exposures; Closed systems; Use in contained systems	PROC 2
CS 4	Filling of equipment from drums or containers; Use in contained systems	PROC 2
CS 5	Preparation of material for application; Batch process; Use in contained systems	PROC 3
CS 6	Preparation of material for application; Indoor use	PROC 5
CS 7	Preparation of material for application; Outdoor use	PROC 5
CS 8	Material transfers; Drum/batch transfers; Non-dedicated facility	PROC 8a
CS 9	Material transfers; Drum/batch transfers; Dedicated facility	PROC 8b
CS 10	Roller, spreader, flow application; Indoor use	PROC 10
CS 11	Roller, spreader, flow application; Indoor use	PROC 4
CS 12	Roller, spreader, flow application; Outdoor use	PROC 10
CS 13	Spraying; Manual; Indoor use	PROC 11
CS 14	Spraying; Manual; Outdoor use	PROC 11
CS 15	Dipping, immersion and pouring; Indoor use	PROC 13
CS 16	Dipping, immersion and pouring; Outdoor use	PROC 13
CS 17	Laboratory activities	PROC 15
CS 18	Hand application - fingerpaints, pastels, adhesives; Indoor use	PROC 19
CS 19	Hand application - fingerpaints, pastels, adhesives; Outdoor use	PROC 19
CS 20	Equipment cleaning and maintenance	PROC 8a, PROC 28
CS 21	Storage	PROC 1

Further description of the use:

Tetrahydrofurfuryl alcohol is used as a reactive diluent in epoxy resin systems. These are used in resins and adhesives for industrial and professional use. A proportion of the tetrahydrofurfuryl alcohol present is likely to volatilise in use, and the remainder is understood to react during the curing of the resin / adhesive and does not remain in the cured product in a form liable to leach or be released during the service life. Therefore, the life cycle subsequent to the stage at which the resin / adhesive is applied does not require consideration.
Waste from use in resins and adhesives

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Industrial or professional use of resins and adhesives containing tetrahydrofurfuryl alcohol may give rise to waste in the form of residues on empty packaging. Waste cured resin or adhesive and end of life products do not contain tetrahydrofurfuryl alcohol due to its reactivity in use.

6.1 Env CS 1: Adhesives, sealants; Resins (prepolymers) (ERC 8d)

6.1.1 Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.02 tonnes/day
Technical and organisational conditions and measures
• Indoor/Outdoor use: Covers indoor and outdoor use
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 87.36%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations

6.1.2 Releases

The releases have been estimated on the basis of SPERC ESVOC 8.3c.v1: Uses in Coatings (wide dispersive use): solvent-borne
(ESVOC 8.3c.v1: Uses in Coatings (wide dispersive use): solvent-borne ;Uses in Coatings (wide dispersive use): solvent-borne)

Description of activities/processes covered by the SPERC

Uses in Coatings (wide dispersive use): solvent-borne
Product/substance domain: Covers the use in coatings (paints, inks, adhesives, etc.) including exposures during use (including materials receipt, storage, preparation and transfer from bulk and semi-bulk, application by spray, roller, brush, spreader by hand or similar methods, and film formation) and equipment cleaning, maintenance and associated laboratory activities.
Substance Domain: Applicable to petroleum substances (e.g., aliphatic and aromatic hydrocarbons) and petrochemicals (e.g., ketones, alcohols, acetates, glycols, glycol ethers, and glycol ether acetates).
Size of installation: applicable to professional and consumer use with assumed use rate of 0.05% of regional volume
Processing conditions: Assumes some disposal via wastewater
The local releases to the environment are reported in the following table.

Table 77. Local releases to the environment

Release	Explanations
Water	**Release factor:** 1% **Local release rate:** 0.2 kg/day **Explanation:** OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes))

Air	**Release factor:** 98.5% **Local release rate:** - kg/day **Explanation:** OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes)). Suggested in ESD that losses may range from 98 – 100%. Assumption is made that professional users will utilize the most efficient practices.
Non agricultural soil	**Release factor:** 0.5% **Local release rate:** - kg/day **Explanation:** 100% of substance is assumed to be released to the environment. Values derived on basis of mass conservation.

(sub)-SPERC ESVOC 8.3c.v1

Explanation for the release factor to water:

OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes))

Explanation for the release factor to air:

OECD Coatings ESD (OECD Series on Emission Scenario Documents, Number 22. July 2009. Emission Scenario Documents on Coating Industry (Paint, Lacquers and Varnishes)).
Suggested in ESD that losses may range from 98 – 100%. Assumption is made that professional users will utilize the most efficient practices.

Explanation for the release factor to soil:

100% of substance is assumed to be released to the environment. Values derived on basis of mass conservation.

Releases to waste

Release factor to external waste: 0 %
This will be addressed at a later stage

6.1.3 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 78. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.66E-3 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 7.43E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.63E-4 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 7.32E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0.013 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 3.31E-4 mg/kg dw	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 3.06E-6 mg/m³	RCR < 0.01

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Man via environment - Oral	**Exposure via food consumption:** 5.87E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

6.2 Worker CS 2: General exposures; Closed systems (PROC 1)

6.2.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Basic • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

6.2.2 Exposure and risks for workers

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

Table 79. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	8.51E-3 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	6.8E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.013

6.3 Worker CS 3: General exposures; Closed systems; Use in contained systems (PROC 2)

6.3.1 Conditions of use

Product (Article) characteristics

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• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 80%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

6.3.2 Exposure and risks for workers

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

Table 80. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.851 mg/m³ (TRA Workers)	RCR = 0.608
Dermal, systemic, long term	0.011 mg/kg bw/day (TRA Workers)	RCR = 0.011
Combined routes, systemic, long-term		RCR = 0.619

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

6.4 Worker CS 4: Filling of equipment from drums or containers; Use in contained systems (PROC 2)

6.4.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day

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Technical and organisational conditions and measures
• Closed continuous process with occasional controlled exposure • Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 80%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

6.4.2 Exposure and risks for workers

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

Table 81. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.851 mg/m³ (TRA Workers)	RCR = 0.608
Dermal, systemic, long term	0.011 mg/kg bw/day (TRA Workers)	RCR = 0.011
Combined routes, systemic, long-term		RCR = 0.619

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

6.5 Worker CS 5: Preparation of material for application; Batch process; Use in contained systems (PROC 3)

6.5.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Closed batch process with occasional controlled exposure • Occupational Health and Safety Management System: Basic • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]

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Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

6.5.2 Exposure and risks for workers

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

Table 82. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.511 mg/m³ (TRA Workers)	RCR = 0.365
Dermal, systemic, long term	0.028 mg/kg bw/day (TRA Workers)	RCR = 0.028
Combined routes, systemic, long-term		RCR = 0.392

6.6 Worker CS 6: Preparation of material for application; Indoor use (PROC 5)

6.6.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

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6.6.2 Exposure and risks for workers

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

Table 83. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.511 mg/m³ (TRA Workers)	RCR = 0.365

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	0.548 mg/kg bw/day (TRA Workers)	RCR = 0.548
Combined routes, systemic, long-term		RCR = 0.913

6.7 Worker CS 7: Preparation of material for application; Outdoor use (PROC 5)

6.7.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

6.7.2 Exposure and risks for workers

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

Table 84. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.358 mg/m³ (TRA Workers)	RCR = 0.255

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Dermal, systemic, long term	0.548 mg/kg bw/day (TRA Workers)	RCR = 0.548
Combined routes, systemic, long-term		RCR = 0.804

6.8 Worker CS 8: Material transfers; Drum/batch transfers; Non-dedicated facility (PROC 8a)

6.8.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic

• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

6.8.2 Exposure and risks for workers

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

Table 85. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.426 mg/m³ (TRA Workers)	RCR = 0.304
Dermal, systemic, long term	0.548 mg/kg bw/day (TRA Workers)	RCR = 0.548
Combined routes, systemic, long-term		RCR = 0.852

6.9 Worker CS 9: Material transfers; Drum/batch transfers; Dedicated facility (PROC 8b)

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6.9.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 80%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

6.9.2 Exposure and risks for workers

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

Table 86. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.851 mg/m³ (TRA Workers)	RCR = 0.608
Dermal, systemic, long term	0.11 mg/kg bw/day (TRA Workers)	RCR = 0.11
Combined routes, systemic, long-term		RCR = 0.718

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

6.10 Worker CS 10: Roller, spreader, flow application; Indoor use (PROC 10)

6.10.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure

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• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 0%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

6.10.2 Exposure and risks for workers

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

Table 87. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.596 mg/m³ (TRA Workers)	RCR = 0.426
Dermal, systemic, long term	0.549 mg/kg bw/day (TRA Workers)	RCR = 0.549
Combined routes, systemic, long-term		RCR = 0.974

6.11 Worker CS 11: Roller, spreader, flow application; Indoor use (PROC 4)

6.11.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 %
• Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 80%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation

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Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

6.11.2 Exposure and risks for workers

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

Table 88. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.34 mg/m³ (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	0.055 mg/kg bw/day (TRA Workers)	RCR = 0.055
Combined routes, systemic, long-term		RCR = 0.298

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

6.12 Worker CS 12: Roller, spreader, flow application; Outdoor use (PROC 10)

6.12.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C

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• Skin surface potentially exposed: Two hands (960 cm2)

6.12.2 Exposure and risks for workers

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

Table 89. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.298 mg/m³ (TRA Workers)	RCR = 0.213
Dermal, systemic, long term	0.549 mg/kg bw/day (TRA Workers)	RCR = 0.549
Combined routes, systemic, long-term		RCR = 0.761

6.13 Worker CS 13: Spraying; Manual; Indoor use (PROC 11)

6.13.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 80%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands and upper wrists (1500 cm2)

6.13.2 Exposure and risks for workers

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

Table 90. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.715 mg/m³ (TRA Workers)	RCR = 0.511
Dermal, systemic, long term	0.429 mg/kg bw/day (TRA Workers)	RCR = 0.429

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Combined routes, systemic, long-term		RCR = 0.939

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

6.14 Worker CS 14: Spraying; Manual; Outdoor use (PROC 11)

6.14.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day • Exposure frequency: = 1.0 Per day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C • Exposed area : 430.0 cm2 • Contact Rate: 100.0 mg/min

6.14.2 Exposure and risks for workers

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

Table 91. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.596 mg/m³ (TRA Workers)	RCR = 0.426
Dermal, systemic, long term	0.43 mg/kg bw/day (ConsExpo Web: 1.0.1)	RCR = 0.43
Combined routes, systemic, long-term		RCR = 0.856

Remarks on exposure data from external estimation tools:

ConsExpo Web 1.0.1

6.15 Worker CS 15: Dipping, immersion and pouring; Indoor use (PROC 13)

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6.15.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 80%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes

Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

6.15.2 Exposure and risks for workers

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

Table 92. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.021 mg/m³ (TRA Workers)	RCR = 0.73
Dermal, systemic, long term	0.11 mg/kg bw/day (TRA Workers)	RCR = 0.11
Combined routes, systemic, long-term		RCR = 0.839

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

6.16 Worker CS 16: Dipping, immersion and pouring; Outdoor use (PROC 13)

6.16.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure

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• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Outdoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands face (480 cm2)

6.16.2 Exposure and risks for workers

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

Table 93. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.358 mg/m³ (TRA Workers)	RCR = 0.255
Dermal, systemic, long term	0.548 mg/kg bw/day (TRA Workers)	RCR = 0.548
Combined routes, systemic, long-term		RCR = 0.804

6.17 Worker CS 17: Laboratory activities (PROC 15)

6.17.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 80%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure

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• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

6.17.2 Exposure and risks for workers

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

Table 94. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.851 mg/m³ (TRA Workers)	RCR = 0.608
Dermal, systemic, long term	2.72E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.611

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

6.18 Worker CS 18: Hand application - fingerpaints, pastels, adhesives; Indoor use (PROC 19)

6.18.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 0.25 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%] • Risk of Derm choice of process: Immersion *Immersing object in chemicals, where the exposure is to the chemicals in which the product is immersed and*

not to substances coming from the object
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure

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• Place of use: Indoor • Operating temperature: <= 40.0 °C • Body Weight: = 60.0 kg • How far is the source from the worker?: Up to 1 metre • Skin surface potentially exposed: Hands (240 cm2)

6.18.2 Exposure and risks for workers

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

Table 95. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.149 mg/m³ (TRA Workers)	RCR = 0.106
Dermal, systemic, long term	0.891 mg/kg bw/day (Riskofderm: 2.1)	RCR = 0.891
Combined routes, systemic, long-term		RCR = 0.997

Remarks on exposure data from external estimation tools:

Riskofderm 2.1
Explanations: RiskOfDerm prediction: 10,700 uL (90th percentile)
ROD prediction divided by body weight (60 kg) and multiplied by the fraction of the substance in the mixture (0.05) and the dermal protection efficiency of gloves (0.1)

6.19 Worker CS 19: Hand application - fingerpaints, pastels, adhesives; Outdoor use (PROC 19)

6.19.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 0.25 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Basic • Risk of Derm choice of process: Immersion *Immersing object in chemicals, where the exposure is to the chemicals in which the product is immersed and not to substances coming from the object*
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] • Use of eye protection: Yes
Other conditions affecting workers exposure

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• Place of use: Outdoor • Operating temperature: <= 40.0 °C

• Body Weight: = 60.0 kg • How far is the source from the worker?: Up to 1 metre • Skin surface potentially exposed: Hands (240 cm2)

6.19.2 Exposure and risks for workers

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

Table 96. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.149 mg/m³ (TRA Workers)	RCR = 0.106
Dermal, systemic, long term	0.891 mg/kg bw/day (Riskofderm: 2.1)	RCR = 0.891
Combined routes, systemic, long-term		RCR = 0.997

Remarks on exposure data from external estimation tools:

Riskofderm 2.1
Explanations: RiskOfDerm prediction: 10,700 uL (90th percentile)
ROD prediction divided by body weight (60 kg) and multiplied by the fraction of the substance in the mixture (0.05) and the dermal protection efficiency of gloves (0.1)

6.20 Worker CS 20: Equipment cleaning and maintenance (PROC 8a, PROC 28)

6.20.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 1.0 h/day
Technical and organisational conditions and measures

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Occupational Health and Safety Management System: Basic • Local exhaust ventilation: Yes [Effectiveness Inhalation: 80%, Dermal: 80%] *LEV efficiency applied in the CSA as substitution for draining and flushing* • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%] Drain down and flush system prior to equipment break-in or maintenance (professional) [Effectiveness Inhalation: 80%] *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* Inhalation explanation: *Exposure reduction efficiency for solvents when draining down and flushing system prior to equipment break-in or maintenance is carried out according to the ESIG Generic Exposure Scenarios. Values have been experimentally verified by Fraunhofer ITEM (Final Report - Verifying the effectiveness of Solvent RMMs), online available at www.esig.org (accessed 10/09/2017).* *As conservative approach a default value of 80% was chosen, although experimentally the minimum and mean efficiency was 93.2% and 95.2%, respectively. This low number should also represent reasonable worst case conditions in professional settings*
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%] • Use of eye protection: Yes
Other conditions affecting workers exposure

• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: Two hands (960 cm2)

6.20.2 Exposure and risks for workers

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

Table 97. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.596 mg/m³ (TRA Workers)	RCR = 0.426
Dermal, systemic, long term	0.11 mg/kg bw/day (TRA Workers)	RCR = 0.11
Combined routes, systemic, long-term		RCR = 0.535

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

6.21 Worker CS 21: Storage (PROC 1)

6.21.1 Conditions of use

Product (Article) characteristics

• Percentage (w/w) of substance in mixture/article: <= 5.0 % • Physical form of the used product: Liquid
Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 8.0 h/day
Technical and organisational conditions and measures
• Closed process without likelihood of exposure • Occupational Health and Safety Management System: Basic • Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] • General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]
Conditions and measures related to personal protection, hygiene and health evaluation
• Respiratory Protection: No [Effectiveness Inhalation: 0%] • Dermal protection: No [Effectiveness Dermal: 0%] • Use of eye protection: Yes
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

6.21.2 Exposure and risks for workers

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

Table 98. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	8.51E-3 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	6.8E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.013

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Exposure scenario 7: Use at industrial sites - Use as laboratory reagent

Market sector: Use as laboratory reagent
Product category used: PC 21: Laboratory Chemicals
Sector of use: SU 24: Scientific research and development

Environment contributing scenario(s):		
CS 1	Use as laboratory reagent	ERC 4
Worker contributing scenario(s):		
CS 2	Laboratory activities	PROC 15

Further description of the use:

Tetrahydrofurfuryl alcohol is used in small quantities in industrial laboratories, for example in use as a solvent at bench-scale and for quality analysis of small samples.
Waste from use as laboratory agent
Laboratory use would be well controlled. It is assumed any tetrahydrofurfuryl alcohol wastes will be disposed of along with other waste chemicals under license.

7.1 Env CS 1: Use as laboratory reagent (ERC 4)

7.1.1 Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 0.05 tonnes/day • Annual use amount at site: <= 1.0 tonnes/year
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 87.36%] • Discharge rate of STP: >= 2000 m3/day • Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

7.1.2 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.

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Website: www.transfurans.be

Table 99. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC based	**Release factor before on site RMM:** 100% **Release factor after on site RMM:** 100% **Local release rate:** 50 kg/day
Air	ERC based	**Release factor before on site RMM:** 100% **Release factor after on site RMM:** 100% **Local release rate:** 50 kg/day
Non agricultural	ERC based	**Release factor after on site RMM:** 5%

Release	Release estimation method	Explanations
soil		

7.1.3 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 100. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.317 mg/L	RCR = 0.167
Sediment (freshwater)	**Local PEC:** 1.42 mg/kg dw	RCR = 0.165
Marine water	**Local PEC:** 0.032 mg/L	RCR = 0.167
Sediment (marine water)	**Local PEC:** 0.142 mg/kg dw	RCR = 0.165
Sewage Treatment Plant	**Local PEC:** 3.161 mg/L	RCR = 0.316
Agricultural soil	**Local PEC:** 0.057 mg/kg dw	RCR = 0.094
Man via environment - Inhalation	**Concentration in air:** 7.65E-4 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 2.84E-3 mg/kg bw/day	RCR = 0.016
Man via environment - combined routes		RCR = 0.019

7.2 Worker CS 2: Laboratory activities (PROC 15)

7.2.1 Conditions of use

Product (Article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 100.0 % • Physical form of the used product: Liquid

Amount used (or contained in articles), frequency and duration of use/exposure
• Duration of activity: <= 4.0 h/day
Technical and organisational conditions and measures
• Occupational Health and Safety Management System: Advanced • General ventilation: Good general ventilation (3-5 air changes per hour) [Effectiveness Inhalation: 30%] • Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 90%]
Conditions and measures related to personal protection, hygiene and health evaluation
Respiratory Protection: No [Effectiveness Inhalation: 0%] Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%]
Other conditions affecting workers exposure
• Place of use: Indoor • Operating temperature: <= 40.0 °C • Skin surface potentially exposed: One hand face only (240 cm2)

7.2.2 Exposure and risks for workers

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

Table 101. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.894 mg/m³ (TRA Workers)	RCR = 0.638
Dermal, systemic, long term	3.4E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.642

Remarks on exposure dataset obtained with ECETOC TRA

The local exhaust ventilation effectiveness has been taken into account for dermal exposure as well.

Risk characterisation

In respect of human health, tetrahydrofurfuryl alcohol is irritating to eyes (Category 2) Qualitatively, in view of the use of eye protection by workers and in view of the dilutions used in end products, significant eye exposure of workers to tetrahydrofurfuryl alcohol is not anticipated, and risks are considered acceptable by the use of eye protection measures.