2-Methyltetrahydrofuran

Date of first version: 2022-09-27 *Date of print 2022-09-27*

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

1.1 Product identifier

Product name:	2-Methyltetrahydrofuran
Chemical name	2-Methyltetrahydrofuran
Synonyms	Tetrahydro-2-methylfuran, 2-methyloxolane
Formula	$C_5H_{10}O$
Molecular mass	86,13 g/mol
CAS-No.	96-47-9
EC-No.	202-507-4
Type of product	Liquid
Registration number	01-2119968920-28-XXXX

1.2 Relevant identified uses of the substance and uses advised against

Relevant identified uses of the substance or mixture	**Exposure scenario**
Use as solvent in chemical synthesis	ES 1
Solvent recovery	ES 1a
Use as a laboratory agent.	ES 2

Uses advised against

None

1.3 Details of the supplier of the safety data sheet

Supplier	International Furan Chemicals B.V.
Address	Rotterdam Airportplein 33, 3045 AP Rotterdam, The Netherlands
Telephone number	+31 10 238 05 55
E-mail address	sales@furan.com

1.4 Emergency telephone number

+32(0)14 58 45 45 (24h/24 h)
Information centre on dangerous goods (BIG)
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 (CLP)

Hazard Classes/Hazard Class-, Category- and Statement Codes

Flammable liquid	Flam. Liq. 2, H225
Acute toxicity	Acute Tox. 4, H302
Skin irritation	Skin Irrit. 2, H315
Serious damage to eyes	Eye Dam.1, H318

2.2 Label elements

According to Regulation (EC) No. 1272/2008 (CLP)

Hazard pictogram(s)

Signal word Danger

Hazard statements

H225	Highly flammable liquid and vapour
H302	Harmful if swallowed
H315	Causes skin irritation
H318	Causes serious eye damage.

PrecautionaryStatements

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233	Keep container tightly closed.
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.
P310	Immediately call a POISON CENTER or doctor/physician.
P403+R235	Store in a well-ventilated place. Keep cool. .

2.3. Other Hazards

- PBT and/or vPvB: no
- Endocrine disruptor properties: not identified to have endocrine disrupting properties according to Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 nor is included in the Candidate List of substances of very high concern according to EU REACH Article 59 for having endocrine disrupting properties.

SECTION 3. Composition/information on ingredients

3.1 Substances

Main constituent	Identity		Percentage
2-methyltetrahydrofuran	CAS-N°.	96-47-9	≥99.5%
	EC N°	202-507-4	

SECTION 4: First aid measures

4.1 Description of first aid measures

Inhalation	Breath fresh air. Give artificial respiration if required. Give oxygen and consult a doctor if breathing is difficult.
Skin contact	Immediately wash skin with soap and water. Continue flushing with plenty of water for at least 15 minutes. Remove contaminated clothes, shoes and leather goods immediately, and launder before reuse. If irritation develops, consult a doctor.
Eye contact	Flush immediately under running water for at least 15 minutes while holding eyelids open and seek medical attention. Remove lenses if possible.
Ingestion	Rinse mouth. Remove victim to fresh air and keep at rest in a position comfortable for breathing. Never give water to an unconscious person. Do not induce vomiting. Consult a doctor if you feel unwell.

4.2 Most important symptoms and effects, both acute and delayed

See section 2. Further symptoms are possible.

4.3 Indication of any immediate medical attention and special treatment needed

Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media: Dry chemical, carbon dioxide (CO_2), water spray (fog) or foam.
Unsuitable extinguishing media: Waterjet

5.2 Special hazards arising from the substance or mixture

Highly flammable liquid and vapor.
In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.
In case of fire toxic gases are formed (carbon monoxide and/or carbon dioxide).
May form explosive peroxides.Form explosive mixtures with air at ambient temperatures.
Vapours are heavier than air and may spread along floors. Vapours may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard

5.3 Advice for firefighters

Special precautions: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
Special protective equipment: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus with a full face-piece operated in positive pressure mode.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Restrict access to area as appropriate until cleanup operations are complete. Only trained personnel should conduct cleanup. Remove sources of ignition. Ventilate spill area if possible. Wear appropriate respirator when ventilation is inadequate. Avoid substance contact and breathing mist or vapour. Put on appropriate personal protective equipment. Stop or reduce leaks if safe to do so. Dispose of spent material in accordance with all applicable local requirements.

6.2 Environmental precautions

Do not discharge into sewers, drains, surface water or soil.
Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

6.3 Methods and material for containment and cleaning up

Small spills	Stop leak if without risk. Soak up spill with absorbent material. Place residues in a suitable, covered, properly labelled container. Wash affected area thoroughly. Use spark-proof tools and explosion-proof equipment.. Dispose of spent material in accordance with all applicable local requirements.
Large spills	Stop leak if without risk . Move containers from spill area. Contain liquid using absorbent material, by digging trenches or by diking.

Prevent entry into sewers, water courses, basements or confined areas.
Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Wash site of spillage thoroughly with water. Contaminated absorbent material may pose the same hazard as the spilt product.
Dispose of spent material in accordance with all applicable local requirements. Notify appropriate government, occupational health and safety, and environmental authorities

6.4 Reference to other sections

See also the section 7, 8 and 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

(see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene
Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

7.2 Conditions for safe storage, including any incompatibilities

Store in a cool well-ventilated area away from direct sunlight. Store away from heat and sources of ignition. Use proper grounding procedures. Store the containers tightly closed. Store separately from acids and oxidizing agents.
Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination.

7.3 Specific end use(s)

Not applicable.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational exposure limits: Not listed/not available

DNEL values:

Workers short term exposition

DNEL $_{\text{worker}}$ (acute, inhalation -	DNEL = 0.46mg/m^3

	systemic)	
	DNEL worker (acute, dermal, systemic)	DNEL = 0.13mg/kg bw/day
Workers long term exposition		
	DNEL worker (long term, inhalation - systemic)	DNEL = 0.46mg/m^3
	DNEL worker (long term, dermal, systemic)	DNEL = 0.13mg/kg bw/day
Consumers short term exposition		
	DNEL general population (acute, oral - systemic)	DNEL = 0.07mg/kg bw/day
Consumers long term exposition		
	DNEL general population (long term, oral - systemic)	DNEL = 0.07mg/kg bw/day
PNEC		
Aquatic		
Fresh water	PNEC aquatic (freshwater)	PNEC=2.08mg/l
Marine water	PNEC aquatic (marine water)	PNEC=0.208mg/l
Intermittant release	PNEC aquatic (intermittent release)	PNEC=1 mg/l
STP	PNEC stp	PNEC=10mg/l
Sedimentary		
Fresh water sediment	PNEC sediment	PNEC= 16mg/kg sediment dw
Marine water sediment	PNEC marine-sediment	PNEC= 1.6mg/kg sediment dw
Terrestrial		
Soil	PNEC soil	PNEC =1.9 mg/kg soil dw
Secondary Poisoning		
Food chain	PNEC oral	PNEC = 6mg/kg food

8.2 Exposure controls

8.2.1 Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice.
Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

8.2.2 Individual protection measures, such as personal protective

a) Eye/face protection

Wear chemical splash goggles and a full face shield.

b) Skin protection

Wear chemical protective gloves, egg. Polyvinyl alcohol, Teflon, Viton®/butyl rubber or 4H and Silver Shield brand
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as: frequency and duration of contact, chemical resistance of glove material, glove thickness and dexterity
Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).
When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
Contaminated gloves should be replaced.
Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.
Eye wash station and safety-shower are necessary.
Wear suitable protective clothing. If clothing is contaminated, remove and thoroughly wash affected area(s). Launder contaminated clothing before reuse. Do not smoke, eat or drink in general vicinity of product.

c) Respiratory protection

If significant mists, vapors, or aerosols are generated, or where concentrations exceed the limits given in this section, a NIOSH/MSHA approved respirator is recommended. An organic vapor cartridge with dust/mist pre-filter or supplied air may be used. In the event of emergency or planned entry into unknown concentrations, a positive pressure, full face, self-contained breathing apparatus should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance, and inspection.

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

Physical state	Clear liquid
Colour	Clear, colourless.
Odour	Ether like
Melting point/freezing point	< -20°C
Boiling point or initial boiling point and boiling range	78°C at 1013 hPa
Flammability	Highly flammable
Lower and upper explosion limit	1.5%-8.9% (Vol%)
Flashpoint	-10°C at 1013 hPa
Auto-ignition temperature	260°C at 1013 hPa
Decomposition Temperature (°C)	Not available
pH value	Not applicable

Kinematic viscosity	0.576 mm^2/s (20°C)
Solubility	Water: easily soluble (140g/L), acetone
Partition coefficient n-octanol/water (log value)	1.1
Vapour pressure (at 25°C) (kPa)	14
Density and/or relative density	0.855
Relative vapour density	2.97
Particle characteristics	Not applicable

9.2 Other information

9.2.1 Information with regard to physical hazard classes

Flammable liquid

9.2.2 Other safety characteristics

Not available

SECTION 10: Stability and Reactivity

10.1 Reactivity

The substance is stable under normal storage and handling conditions.

10.2 Chemical stability

The product is stable if stored and handled as prescribed/indicated.

10.3 Possibility of hazardous reactions

No dangerous reaction known under conditions of standard use.
Hazardous reactions or instability may occur under certain conditions of storage or use.
Conditions may include the following: extended storage.
Reactions may include the following: formation of explosive peroxides

10.4 Conditions to avoid

Incompatible materials. Avoid all sources of ignition: heat, sparks, open flame.

10.5 Incompatible materials

Oxidizing materials, acids and alkalis.

10.6 Hazardous decomposition products

Carbon dioxide, carbon monoxide. May form explosive peroxides.

SECTION 11: Toxicological information

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008

a)	**Acute toxicity**	
	LD_{50} (oral, rat) (mg/kg)	> 300 mg/kg bw
	LD_{50} (dermal, rabbit) (mg/kg)	> 2000 mg/kg bw
	LC_{50} (inhalation, rat, 4 hours) (mg/l)	22mg/l air
b)	**Skin corrosion/Irritation**	Causes skin irritation
c)	**Serious eye damage/irritation**	Causes serious eye damage
d)	**Respiratory or skin Sensitization**	No adverse effect observed (negative)

e)	**Carcinogenicity**	No data available.
f)	**Mutagenicity**	No adverse effect observed (negative)
g)	**Reproductive toxicity**	Not classified as toxic for reproduction
h)	**STOT- single exposure**	Not classified
i)	**STOT- repeated exposure**	Not classified
j	**Aspiration hazard**	Not classified

11.2 Information on other hazards

11.2.1 Endocrine disrupting properties

No endocrine disrupting properties identified.

11.2.2 Other information

Not applicable.

SECTION 12: Ecological information

12.1 Toxicity

Aquatic compartment and sediment	
LC50 (96h, Fish)	>100mg/l
EC50 (48h, Daphnia Magna)	>139mg/l
EC50 (72h, Algae/aquatic plants)	>104mg/l
Chronic (long term toxicity)	
NOEC (Fish)	100mg/l
NOEC (Daphnia)	139mg/l
NOEC (Algae/aquatic plants)	104 mg/l

12.2 Persistence and degradability:

Not readily biodegradable. Under the test conditions no biodegradation observed.

12.3 Bioaccumulative potential:

Low potential for bioaccumulation

12.4 Mobility in soil

Low potential for adsorption.

12.5 Results of PBT or vPvB assessment

The substance is not considered a PBT/vPvB

12.6 Endocrine disrupting properties

Adverse environmental effects of endocrine disruptors are not relevant (see subsection 2.3)

12.7 Other adverse effects

No known significant effects or critical hazards.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Dispose of in accordance with all applicable local and national regulations. Use recovery/recycling where feasible, otherwise incineration is the recommended method of disposal. Empty containers may contain hazardous residues. Do not cut, puncture or weld on or near to the container. Labels should not be removed from containers until they have been cleaned. Contaminated containers must not be treated as household waste. Containers should be cleaned by appropriate methods and then re-used or disposed of by landfill or incineration as appropriate. Do not incinerate closed containers.

SECTION 14: Transport information

33
2536

14.1	**UN Number or ID number**	
	ADR, IDMG, IATA	UN2536
14.2	**UN proper shipping name**	METHYLTETRAHYDROFURAN
14.3	**Transport hazard class(es**	3
14.4	**Packing group**	II
14.5	**Environmental hazards**	
	Marine pollutant	No
	Emergency Schedules IMDG	
	- **Fire schedule**	Echo (F – E)
	- **Spillage schedule**	Delta (S – D)
	Hazard for tank vessels (ADN)	3
14.6	**Specials precautions for user**	
	Classification code (ADR/RID)	F1
	Label (ADR/RID/ADN/IMDG/IATA)	3
	Tunnel restriction code (ADR/RID)	(D/E)
	Hazard Identification No. (ADR/RID)	33
	Limited quantity (ADR/RID/ADN/IMDG/IATA)	1L
	Excepted quantity (ADR/RID/ADN/IMDG/IATA).	E2
	ICAO (air transport)	
	- Packing instructions passenger aircraft	LQ: Y341 - 1L 353 – 5L
	- Packing instructions cargo aircraft	364 - 60L
14.7	**Maritime transport in bulk according to IMO instruments**	
	IMO hazard class	Class 3 Flammable liquids

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
Regulation (EC) 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals and amendments.

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 has been carried out for the substance.

SECTION 16: Other information

16.1 Changes to the previous version:

New version
►Indicates changes in content from previously issued version.
Date of revision: 27-09-2022
Version: 001
Date of previous version: not applicable

16.2 Abbreviations and acronyms

GHS / CLP	Globally Harmonised System / Classification, Labelling and Packaging
IC50	Inhibitory Concentration, 50 percent
LC50	Lethal Concentration, 50 percent
LD50	Lethal Dose, 50 percent
ND	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

Not applicable.

Extended safety data sheet

9 EXPOSURE ASSESSMENT

9.0 General information

9.0.1 Overview of exposure scenarios

In all cases, the exposure scenarios are based on information in the public domain or provided by the registrant.

Table 9.0.1 gives the overview of uses and exposure scenarios. Tonnages, as reported in Table 9.0.1, for the exposure scenarios assessed are generic tonnages for EU consumption within the present tonnage band.

The generic tonnages are increased tonnage values, which have been used as a worst case, as they are higher than actual use volumes, based on available data.

2-Methyltetrahydrofuran

Table 9.0.1 Overview of uses broken down by life cycle stages and the exposure scenarios (ES)

ES Number	CSR section	Exposure scenario name	Related subsequent service life	Main user groups (SU3/21/22)	Sectors of end-use (SU)	Chemical Product Category (PC)	Process category (PROC)	Article category (AC)	Environmental Release Category (ERC)	Tonnage (t/a)
ES1	9.1	Use as solvent in chemical synthesis	No	SU 3	SU 8 SU 9		PROC1 PROC2 PROC3 PROC4 PROC8a PROC8b PROC9	n/a	ERC 4 ERC6a ERC6b	994
ES1a	9.1	Solvent recovery	No	SU 3	SU 8 SU 9	n/a	PROC1 PROC2 PROC3 PROC4 PROC8a PROC8b	n/a	ERC 4 ERC6a ERC6b	994
ES2	9.2	Use as laboratory reagent	No	SU 3	SU24	PC21	PROC15			5

9.0.2 Scope and type of exposure assessment

9.0.2.1 Environment

Table 9.0.2 Scope and type of exposure assessment based on hazard assessment

Protection target	Type of assessment	Explanation / Justification
Water: Fresh Water (Pelagic)	**Quantitative**	Quantitative exposure assessment (EUSES 2.1.2) and risk characterisation
Water: Fresh Water (Sediment)	**Quantitative**	Quantitative exposure assessment (EUSES 2.1.2) and risk characterisation
Water: Marine Water (Pelagic)	**Quantitative**	Quantitative exposure assessment (EUSES 2.1.2) and risk characterisation
Water: Marine Water (Sediment)	**Quantitative**	Quantitative exposure assessment (EUSES 2.1.2) and risk characterisation
Water: Fresh Water Food Chain (Predators)	**Not conducted**	The low log Kow of the substance indicates that bioaccumulation is not an environmental concern for the substance (see Sections 4.4 and 1.3)
Water: Marine Water Food Chain (Predators)	**Not conducted**	The low log Kow of the substance indicates that bioaccumulation is not an environmental concern for the substance (see Sections 4.4 and 1.3)
Water: Marine Water Food Chain (Top Predators)	**Not conducted**	The low log Kow of the substance indicates that bioaccumulation is not an environmental concern for the substance (see Sections 4.4 and 1.3)
Water: Sewage Treatment Plant (Effluent)	**Quantitative**	Quantitative exposure assessment (EUSES 2.1.2) and risk characterisation
Air	**Quantitative exposure assessment**	Quantitative exposure assessment (EUSES 2.1.2)
Soil: Agricultural Soil	**Quantitative**	Quantitative exposure assessment (EUSES 2.1.2) and risk characterisation
Soil: Terrestrial Food Chain (Predators)	**Not conducted**	The low log Kow of the substance indicates that bioaccumulation is not an environmental concern for the substance (see Sections 4.4 and 1.3)

9.0.2.2 Worker

Table 9.0.3 Scope and type of exposure assessment based on hazard assessment

Route of exposure and type of effects	Type of assessment	Explanation / Justification
Inhalation: Acute, Local	**Not conducted**	No hazard identified. See section 5.11.
Inhalation: Acute, Systemic	**Qualitative**	Long term systemic DNELs are considered sufficient to protect against short term exposures. See section 10.
Inhalation: Long term, Local	**Not conducted**	No hazard identified. See section 5.11.
Inhalation: Long term, Systemic	**Quantitative**	Quantitative exposure assessment and risk characterisation. See DNEL in section 5.11.
Dermal: Acute, Local	**Qualitative**	Operational measures to protect against irritation effects are considered sufficient to protect against acute effects. See section 10
Dermal: Acute, Systemic	**Qualitative**	Long term systemic DNELs are considered sufficient to protect against short term exposures. See section 10.
Dermal: Long term, Local	**Qualitative**	High volatility of the substance will protect against dermal exposures. See section 10
Dermal: Long term, Systemic	**Quantitative**	Quantitative exposure assessment and risk characterisation. See DNEL in section 5.11.

9.0.3 Regional environmental exposure from the releases of all exposure scenarios covered

9.0.3.1 Total releases

Total regional releases based on the exposure scenarios (ES) described in Sections 9.1 - 9.3 are as follows:
Water: 18 tonnes/year
Air: 50 tonnes/year
Soil: 0 tonnes/year

9.0.3.2 Regional exposure: environment

Table 9.0.4 Summary of predicted regional exposure concentrations (Regional PECs)

Protection target	Regional PEC	Units
Fresh Water	1.1E-04	mg/l
Marine Water	9.8E-06	mg/l
Air	1.9E-06	mg/m3
Agricultural soil	7.0E-06	mg/kgwwt
Fresh Water (sediment)	1.8E-04	mg/kgwwt
Marine Water (sediment)	1.5E-05	mg/kgwwt

9.0.3.3 Regional exposure: man via the environment

The regional total estimated daily intake for humans is as follows:

Table 9.0.5 Summary of estimated daily human doses through intake and concentrations in food from regional exposure

Type of food	Estimated daily dose from regional exposure (mg/kg/day)	Concentration in food from regional exposure
Drinking water	3.2E-06	1.1E-04 mg/l
Fish	3.2E-07	2.0E-04 mg/kg
Leaf crops	2.1E-08	1.2E-06 mg/kg
Root crops	5.2E-08	9.5E-06 mg/kg
Meat	2.2E-11	5.2E-09 mg/kg
Milk	4.2E-10	5.2E-08 mg/kg

9.1 Use as a solvent for chemical synthesis (ES1 & ES1a)

9.1.1 Exposure Scenario 1 & 1a

The Pennakem technical bulletin (Penn A Kem 2011) discusses several applications of tetrahydro-2-methylfuran as a solvent in chemical synthesis. The reactions presented range from low temperature lithiation to elevated temperature reactions including use of reflux condenser. The document also strongly recommends phase separation to be undertaken at temperatures above 60ºC to minimize the loss of tetrahydro-2-methylfuran to the water phase.
The Pennakem technical bulletin (Penn A Kem 2011) also discusses in detail the method for recovering dry tetrahydro-2-methylfuran for reuse. It states that with this process essentially all of the tetrahydro-2-methylfuran can be recovered as dry tetrahydro-2-methylfuran. Tetrahydro-2-methylfuran may also be used as an extraction solvent. At manufacturing scale, this application would be covered by the same Exposure Scenario

. Use of tetrahydro-2-methylfuran as a solvent in chemical synthesis	
Market sector:	
Sector of use:	
Industrial uses: Uses of substances as such or in preparations at industrial sites	SU3
Manufacture of bulk, large scale chemicals (including petroleum products)	SU8
Manufacture of fine chemicals	SU9
Environment:	
Industrial use of processing aids in processes and products, not becoming part of articles	ERC4
Industrial use resulting in manufacture of another substance (use of intermediates)	ERC6a
Industrial use of reactive processing aids	ERC6b
Worker	
Use in closed process, no likelihood of exposure	PROC1
Use in closed, continuous process with occasional controlled exposure	PROC2
Use in closed batch process (synthesis or formulation)	PROC3
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC4
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC8a
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC8b
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC9
Operational conditions and risk management measures	
Control of environmental exposure: Use of tetrahydro-2-methylfuran as a solvent in chemical synthesis	
Manufacture of substances	
Product characteristics	
Physical Form	Liquid
Substance in preparation	Substance as such
Amounts used	
Daily use at a site	5 t
Operational conditions and risk management measures	
Control of environmental exposure: Use of tetrahydro-2-methylfuran as a solvent in chemical synthesis	
Annual use at a site	500 t (140 t imported substance: 500 t in total over use of manufactured

		solvent plus three cycles of use of recovered solvent)			
Percentage of EU tonnage used at regional scale		40%			
Percentage of regional tonnage used at local scale		40%			
Frequency and duration of use					
Emission days		100 (generic assumption)			
Duration of exposure per day		8 hr			
Frequency of exposure		Daily			
Environment factors not influenced by risk management					
Receiving surface water flow rate		18 000 m3/d			
Basis for the above: Default assumption.					
Other given operational conditions affecting environmental exposure					
Technical conditions and measures at process level (source) to prevent release					
High-efficiency solvent recovery system					
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil					
Incineration of wastes Welded piping is preferred to screwed fittings. Pump and valve packing must be tight and of a non-soluble type. (Pennakem technical bulletin)					
Organisational measures to prevent/limit release from site					
Safety and environmental audits					
Conditions and measures related to municipal sewage treatment plant					
Onsite/Municipal STP		Yes			
Discharge rate of STP		10 000 m3/d - Discharged to fresh or marine water			
Basis for the above: ESD model for a large industrial location					
Application of the STP sludge on agricultural soil		Yes			
Basis for the above: Default assumption.					
Conditions and measures related to external treatment of waste for disposal					
None					
Conditions and measures related to external recovery of waste					
None					
Additional good practice advice beyond the REACH CSA					
None					
Operational conditions and risk management measures					
Control of workers exposure: Use as a solvent for chemical synthesis.					
		Inhal*		**Derm***	
		Loc	Sys	Loc	Sys
Product characteristics					
Physical form	Liquid				
Substance in preparation	No		X		X
Amounts used					
Frequency and duration of use/exposure					
Duration of activity	PROCs 1,2 and 3 > 4hours (ECTOC Default) PROCs 4 and 8b for 1-4 hours PROCs 8a and 9 for 15-60 minutes		X		X
Human factors not influenced by risk management					
Surface of skin potentially exposed: palm of one hand (240 cm2) (PROC1, PROC3) Surface of skin potentially exposed: palm of two hands (480 cm2) (PROC2, PROC4, PROC9) Surface of skin potentially exposed: palm of two hands (960 cm2) (PROC8a, PROC8b)					

Body weight: 70 kg					
Other given operational conditions affecting workers exposure					
Place of use	Indoors		X		X
Technical conditions and measures at process level (source) to prevent release					
Provision of mechanical exhaust ventilation to remove flammable vapours Provision of adequate drainage and collection facilities to isolate any spilled liquids Provision of classified electrical equipment (see national legal requirements) Purging and inerting of equipment and containers with dry nitrogen Control of static electricity Control of cutting, welding and other "hot work" Control of smoking and other potential ignition sources MeTHF should be used only in suitable equipment and with provision for adequate ventilation. It can be stored and handled in ordinary steel tanks and piping. Welded piping is preferred to screwed fittings. Pump and valve packing must be tight and of a non-soluble type. (Pennakem technical bulletin)					
Technical conditions and measures to control dispersion from source towards the worker					
Local Exhaust Ventilation	PROC1 N/A PROC2,3,4,8a,8b and 9 Yes		X		X
General Ventilation / Natural Ventilation		Enhanced general ventilation (70% efficiency)			
Organisational measures to prevent /limit releases, dispersion and exposure					
Procedural and control technologies: Process safety assessment. Confined Space Entry Permits and general Permit to Work (PTW) govern all cleaning and maintenance activities. Flushing, purging and venting of vessel lines are implemented before cleaning or maintenance. Plant integrity checks. Operator monitoring. Safety and environmental audits.		X	X	X	X
Training. Monitoring/reporting and auditing systems: Specific activity training (e.g. procedure for glove removal and disposal, use of RPE) is required for personnel handling the substance. Regular training of workers with respect to substance hazards and safe handling; fully trained chemical operators, EMAS/ISO14001, integrated safety management systems etc.					
Conditions and measures related to personal protection, hygiene and health evaluation					
Gloves (Polyvinyl alcohol, Teflon, or 4H and Silver Shield brand)1	Gloves are recommended			X	X
Use of gloves (Polyvinyl alcohol, Teflon, or 4H and Silver Shield brand) is required when there is any potential dermal exposure, to mitigate the risks due to the irritant properties of tetrahydro-2-methylfuran. Breakthrough times for Silver Shield gloves are > 12 hours. Specific activity training (e.g. procedure for glove removal and disposal) is required for personnel handling the substance or chlorosilanes, which are used as starting materials in the manufacturing process. Therefore as a worst-case, a 95% reduction factor could be applied, based on ECETOC TR-107 report (2012). However, in practice the irritant effects of tetrahydro-2-methylfuran would be immediately apparent following skin contact, and steps to remove contamination would be taken, so prolonged or repeated exposure to the substance will not occur. Chemical goggles and face shield should be worn when handling MeTHF.(Pennakem technical bulletin)					
Eye protection	Yes (goggles)				
Respiratory protection	Yes 95% efficiency (Full face, EN 136 type mask with vapour filter)	X	X		
Additional good practice advice beyond the REACH CSA					

*) The route of exposure (Inhalation, Dermal) and type of effect (Local, Systemic and Acute or Long term) for which the determinant has been used for exposure estimation are reported.

9.1.2 Exposure estimation for use as a solvent for chemical synthesis

9.1.2.1 Exposure estimation for the environment

9.1.2.1.1 Environmental releases

The ERC 4 default release level to air is 100%; for ERC 6a, it is 5%; and ERC 6b, 0.1%.
The ERC 4 default release level to waste water is 100%; for ERC 6a, it is 2%; and ERC 6b, 5%. Given what is known about the possibility to recover the solvent, significant levels of release are highly unlikely. The default release rates associated with intermediates from the synthetic process (ERC 6a) are considered to be a realistic maximum to cover incidental losses.

Release to air: 5% (ERC 6a default)

Release to waste water: 2% (ERC 6a default)

The used solvent is assumed to be recovered on-site for reuse at the same location. It is assumed that this step is well controlled and therefore comparable with normal processes of post-synthesis purification; therefore no additional releases need to be assumed. This recycling means the annual
tonnage covered in the exposure assessment appears to exceed the EU tonnage for registration. Three cycles of recovery are assumed in the exposure assessment.

Waste

It is assumed that after a number of re-uses the solvent will be sent for chemical disposal by incineration, specialist chemical disposal as hazardous waste, or in the most conservative interpretation, by landfill.

Releases from incineration or landfilling of waste containing the substance from use as solvent are quantified based on default value from the ECHA guidance on exposure scenario building and environmental release estimation for the waste life stage (Chapter R.18) (ECHA, 2010b). This is assumed to take place on a single site, over 330 days (default).

Fraction of amount used ending up as waste: 80% (worst case at end of life assuming none consumed in use; 7% lost to waste in each cycle of use)

Amount of substance ending up in waste in local area: 400 t/y

Daily amount of waste containing the substance treated: 400 t/y / 330 days = 1200 kg/d

Release rate to air for landfill: 0

Daily release to air from landfill: 0 kg/d

Release rate to water for landfill: 0.032

Daily release to water from landfill: 1200 kg/d x 0.032 = 38 kg/d

Release rate to air for incineration: 0.0001

Daily release to air from incineration: 1200 kg/d x 0.0001 = 0.12 kg/d

Release rate to water for incineration: 0.0001

Daily release to water from incineration: 1200 kg/d x 0.0001 = 0.12 kg/d

If the waste is treated by specialist hazardous waste handling companies the waste release to the environment would be negligible.

It is considered unlikely that landfill waste water will be treated at the same waste water treatment plant as waste water from the local industrial site. Therefore it is assumed that landfill water is treated separately for the purposes of this scenario.

Table 9.1.1 Summary of the local releases to the environment

Compartment	**Release factor estimation method**	**Explanation / Justification**
Water	ERC 6a default R18 default	Local release rate: (kg/day): 100 kg/d Local release rate (waste: landfill): (kg/day): 38 kg/d Local release rate (waste: incineration): (kg/day): 0.12 kg/d Local release rate (waste: specialist treatment): negligible
Air	ERC 6a default R18 default	Local release rate (kg/day): 250 kg/d Local release rate (waste: landfill): (kg/day): 0 kg/d Local release rate (waste: incineration): (kg/day): 0.12 kg/d Local release rate (waste: specialist treatment): negligible
Soil	Other method	n/a

Summed releases from all life cycle stages: see section 9.0.3.

9.1.2.2 Environmental exposure

Table 9.1.2. Summary of exposure concentrations

Protection target	**Local PEC**	**Unit**	**Explanation / Justification**
Air	0.019	mg/m3	Annual average local PEC in air (total)
Fresh Water	0.32	mg/l	Local PEC in surface water during emission episode (dissolved)
Fresh Water (sediment)	0.52	mg/kgwwt	Local PEC in fresh-water sediment during emission episode
Marine Water	0.13	mg/l	Local PEC in seawater during emission episode (dissolved)
Marine Water (sediment)	0.21	mg/kgwwt	Local PEC in marine sediment during emission episode
Agricultural soil	0.35	mg/kgwwt	Local PEC in agric. soil (total) averaged over 30 days
Sewage Treatment Plant	9.2	mg/l	PEC for micro-organisms in the STP, if waste water from landfill is treated at separate STP

Fresh Water Food Chain (predators)	0.075	mg/kgwwt	Concentration in fish for secondary poisoning (freshwater)
Marine Water Food Chain (predators)	0.03	mg/kgwwt	Concentration in fish for secondary poisoning (marine)
Marine Water Food Chain (top predators)	0.006	mg/kgwwt	Concentration in fish-eating marine top-predators
Terrestrial Food Chain (predators)	0.17	mg/kg	Concentration in earthworms from

For regional PECs see section 9.0.3.2.

9.1.2.2.1 Indirect exposure of humans via the environment

The assessment of indirect exposure of humans via the environment is not considered relevant as the tonnage of the substance is less than 1000 tonnes/year and it is not classified as toxic, carcinogen, mutagen or toxic to reproduction. This is in line with ECHA's Guidance on Information Requirements and Chemical Safety Assessment Chapter R.16: Environmental Exposure (ECHA, 2010). The indirect exposure of humans is however assessed and reported in Table 9.1.3 for completeness only.

Table 9.1.3. Summary of estimated daily human doses through intake and concentrations in food from local exposure

Type of food	**Estimated daily dose from local exposure (mg/kg/day)**	**Concentration in food from local exposure**
Drinking water	7.4E-03	2.6E-01 mg/l
Fish	1.8E-04	1.1E-01 mg/kg
Leaf crops	2.1E-04	1.2E-02 mg/kg
Root crops	1.5E-03	2.8E-01 mg/kg
Meat	5.9E-08	1.4E-05 mg/kg
Milk	1.1E-06	1.4E-04 mg/kg

Dose from regional exposure: see section 9.0.3.3

9.1.2.3 Exposure estimation for workers

Exposure to workers has been assessed using the Tier 1 ECETOC TRA model (2012). According to the model, the substance is considered to be a 'high' fugacity liquid, based on a measured vapour pressure of 14 000 Pa at 25°C. Exposure to workers is not expected at higher temperatures since the control measures in place would be sufficient to prevent any contact occurring. Site-specific information concerning exposure duration, operational conditions and risk management measures has been taken into account, as described in Section 9.1.1
Predicted inhalation exposures are summarised in Table 9.1.4
Predicted dermal exposures are summarised in Table 9.1.5
No measured exposure data are available for tetrahydro-2-methylfuran.

Table 9.1.4 Inhalation exposure estimates

Life cycle stage	PROC	Location and ventilation	LEV efficiency (%)	Duration	Respiratory protection	Substance in preparation	Inhalation exposure (mg/m3)
Use as solvent in chemical synthesis	PROC 1	Indoors with good general ventilation	0	>4 hours (default)	0.95	No	1.3E-03
Use as solvent in chemical synthesis	PROC 2	Indoors with LEV and enhanced general ventilation	90	>4 hours (default)	0.95	No	1.3E-01
Use as solvent in chemical synthesis	PROC 3	Indoors with LEV and enhanced general ventilation	90	>4 hours (default)	0.95	No	1.6E-01
Use as solvent in chemical synthesis	PROC 4	Indoors with LEV and enhanced general ventilation	90	1 - 4 hours	0.95	No	1.1E-01
Use as solvent in chemical synthesis	PROC 8a	Indoors with LEV and enhanced general ventilation	90	15 mins to 1 hour	0.95	No	1.3E-01
Use as solvent in chemical synthesis	PROC 8b	Indoors with LEV and enhanced general ventilation	95	1 - 4 hours	0.95	No	8.1E-02
Use as solvent in chemical synthesis	PROC 9	Indoors with LEV and enhanced general ventilation	90	15 mins to 1 hour	0.95	No	2.2E-01

Table 9.1.5 Dermal exposure estimates

Life cycle stage	**PROC**	**Location and ventilation**	**Gloves used**	**Efficiency, %**	**Substance in preparation**	**Consider LEV for dermal exposures?**	**Dermal exposed area(cm2)**	**Dermal exposure estimates (mg/kg/d)**
Use as solvent in chemical synthesis	PROC 1	Indoors with good general ventilation	Yes	95	No	N/A	240	1.7E-03
Use as solvent in chemical synthesis	PROC 2	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	480	6.9E-03
Use as solvent in chemical synthesis	PROC 3	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	240	3.4E-03
Use as solvent in chemical synthesis	PROC 4	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	480	2.1E-02
Use as solvent in chemical synthesis	PROC 8a	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	960	1.4E-02
Use as solvent in chemical synthesis	PROC 8b	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	960	2.1E-02
Use as solvent in chemical synthesis	PROC 9	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	480	2.1E-02

9.2 Use as Laboratory reagent (ES2)

9.2.1 Exposure scenario 2 Use of tetrahydro-2-methylfuran as a laboratory reagent in an industrial setting					
Market sector:					
Laboratory chemicals		PC21			
Sector of use:					
Industrial uses: Uses of substances as such or in preparations at industrial sites		SU3			
Scientific research and development		SU24			
Environment:					
No relevant descriptor codes are defined (refer to text)					
Worker					
Use as laboratory reagent		PROC15			
Operational conditions and risk management measures					
Control of workers exposure for use as a laboratory reagent					
		Inhal*)		**Derm*)**	
		Loc	**Sys**	**Loc**	**Sys**
Product characteristics					
Physical Form	Liquid				
Substance in preparation	No	X		X	
Amounts used					
Frequency and duration of use/exposure					
Duration of activity	PROC15: > 4hours	X		X	
Human factors not influenced by risk management					
Surface of skin potentially exposed: palm of one hand (240 cm2) (PROC15)				X	
Other given operational conditions affecting workers exposure					
Place of use	Indoor	X			
Technical conditions and measures at process level (source) to prevent release					
Technical conditions and measures to control dispersion from source towards the worker					
Local Exhaust Ventilation	Yes (fume cupboard)	X		X	
General ventilation	Enhanced general ventilation (70% efficiency)				
Organisational measures to prevent /limit releases, dispersion and exposure					
Conditions and measures related to personal protection, hygiene and health evaluation					
Gloves (Polyvinyl alcohol, Teflon, or 4H and Silver Shield brand)2	Gloves are recommended			X	X
Use of gloves (Polyvinyl alcohol, Teflon, or 4H and Silver Shield brand) is required when there is any potential dermal exposure, to mitigate the risks due to the irritant properties of tetrahydro-2-methylfuran. Breakthrough times for Silver Shield gloves are > 12 hours. Basic worker training on chemical hazards and exposure control is required. Therefore as a worst-case, a 90% reduction factor could be applied, based on of ECETOC TR-107 report (2012). However, in practice the irritant effects of tetrahydro-2-methylfuran would be immediately apparent following skin contact, and steps to remove contamination would be taken, so prolonged or repeated exposure to the substance will not occur. Goggles and chemically resistant protective clothing should be worn.					
Respiratory protection	Yes 95% efficiency (Full face, EN 136 type mask with vapour filter)	X			
Additional good practice advice beyond the REACH CSA					

*) The route of exposure (Inhalation, Dermal) and type of effect (Local, Systemic and Acute or Long term) for which the determinant has been used for exposure estimation are reported.

9.2.2 Exposure estimation for use as laboratory reagent

9.2.2.1 Exposure estimation for the environment

Given the very small scale use, it is not appropriate to assess environmental exposure for this scenario. There is no intentional release of tetrahydro-2-methylfuran to waste water and any fugitive releases to air will be of negligible volume.

9.2.2.2 Exposure estimation for workers

Exposure to workers has been assessed using the Tier 1 ECETOC TRA model (2012). According to the model, the substance is considered to be a ‘high’ fugacity liquid, based on a measured vapour pressure of 14 000 Pa at 25°C. Site-specific information concerning exposure duration, operational conditions and risk management measures has been taken into account, as described in Section 9.1.1
Due to the high volatility of tetrahydro-2-methylfuran evaporation from the dermal contact area is extremely rapid and diffusion through the skin would be minimal as a result. Predicted inhalation exposures are summarised in Table 9.2.1

Predicted dermal exposures are summarised in Table 9.2.2

No measured exposure data are available for tetrahydro-2-methylfuran.

Table 9.2.1 Inhalation exposure estimates

Life cycle stage	PROC	Location and ventilation	LEV efficiency (%)	Duration	Respiratory protection	Substance in preparation	Inhalation exposure (mg/m3)
Laboratory Chemical	PROC 15	Indoors with LEV and enhanced general ventilation	90	>4 hours (default)	0.95	No	2.7E-01

Table 9.2.2 Dermal exposure estimates

Life cycle stage	PROC	Location and ventilation	Gloves used	Efficiency, %	Substance in preparation	Consider LEV for dermal exposures?	Dermal exposed area(cm2)	Dermal exposure estimates (mg/kg/d)
Laboratory Chemical	PROC 15	Indoors with LEV and enhanced general ventilation	Yes	90	No	Yes	240	3.4E-03

10 RISK CHARACTERISATION

See section 9.0.2 "Scope and type of exposure assessment" as to whether a risk characterisation is required for the different target groups and exposure pathways.

10.1 Use as a solvent for chemical synthesis (ES1 & 1a)

10.1.1 Human health

10.1.1.1 Workers

10.1.1.1.1 Qualitative risk assessment of physicochemical hazards

Tetrahydro-2-methylfuran is classified as a highly flammable liquid. Suitable precautionary measures to avoid sources of ignition are recommended. These can include, but are not limited to:
- Provision of mechanical exhaust ventilation to remove flammable vapours
- Provision of adequate drainage and collection facilities to isolate any spilled liquids
- Provision of classified electrical equipment (see national legal requirements)
- Purging and inerting of equipment and containers with dry nitrogen
- Control of static electricity
- Control of cutting, welding and other "hot work"
- Control of smoking and other potential ignition sources

When the appropriate measures are applied there is no unacceptable risk to human health from use of tetrahydro-2-methylfuran in this application.

10.1.1.1.2 Qualitative risk characterisation for dermal exposure

Due to the substance having a high vapour pressure of 14 000 Pa at 25°C it is expected to volatilise quickly and will not remain on the skin for a significant period of time, therefore it is considered that diffusion through the skin will be negligible.

The substance is classified as a skin irritant (Category 2). Workers are required to wear suitable protective gloves, safety goggles and impervious overalls when there is potential for dermal contact. Specific worker training in the use and disposal of protective clothing is provided. It is therefore considered that there is no unacceptable risk to humans from dermal exposure to tetrahydro-2-methylfuran.

10.1.1.1.3 Quantitative risk characterisation

Quantitative risk characterisation has been performed for systemic inhalation and dermal effects of tetrahydro-2-methylfuran. No separate risk characterisation is required for acute effects as DNELs for long-term effects are adequate to protect against both short and long-term exposures.

Risk characterisation ratios for inhalation are given in Table 10.1.1, dermal in Table 10.1.2 and for combined effects in Table 10.1.3

All RCRs are below 1 for manufacture and on-site uses of tetrahydro-2-methylfuran under the conditions specified in Section 9.1.1 therefore there is no unacceptable risk for humans from exposure to tetrahydro-2-methylfuran

Note regarding results from ECETOC TRA
Exposure concentrations have been calculated using the ECETOC TRA model, with modifications for use of respiratory protection where applicable. It should be noted that some uses not explicitly discussed in this CSR can also be considered to be safe by comparison to the description given. Therefore, if a new scenario covers the same user group, the same or shorter duration, the same or more complete controls, or more effective PPE, for the same PROC, then a use

which might appear to be outside the scope of the CSR would in fact be judged to be safe. This is consistent with REACH guidance to downstream users.

Table 10.1.1 Quantitative risk characterisation for inhalation effects during use as a solvent in chemical synthesis

Life cycle stage	**PROC**	**Location and ventilation**	**LEV efficiency (%)**	**Duration**	**Respiratory protection**	**Substance in preparation**	**Inhalation exposure (mg/m3)**	**Inhalation RCR**
Use as solvent in chemical synthesis	PROC 1	Indoors with LEV and good general ventilation	0	>4 hours (default)	0.95	No	1.3E-03	2.7E-03
Use as solvent in chemical synthesis	PROC 2	Indoors with LEV and enhanced general ventilation	90	>4 hours (default)	0.95	No	1.3E-01	2.9E-01
Use as solvent in chemical synthesis	PROC 3	Indoors with LEV and enhanced general ventilation	90	>4 hours (default)	0.95	No	1.6E-01	3.5E-01
Use as solvent in chemical synthesis	PROC 4	Indoors with LEV and enhanced general ventilation	90	1 - 4 hours	0.95	No	1.1E-01	2.3E-01
Use as solvent in chemical synthesis	PROC 8a	Indoors with LEV and enhanced general ventilation	90	15 mins to 1 hour	0.95	No	1.3E-01	2.9E-01
Use as solvent in chemical synthesis	PROC 8b	Indoors with LEV and enhanced general ventilation	95	1 - 4 hours	0.95	No	8.1E-02	1.8E-01
Use as solvent in chemical synthesis	PROC 9	Indoors with LEV and enhanced general ventilation	90	15 mins to 1 hour	0.95	No	2.2E-01	4.7E-01

Table 10.1.2 Quantitative risk characterisation for dermal effects during use as a solvent in chemical synthesis

Life cycle stage	**PROC**	**Location and ventilation**	**Gloves used**	**Efficiency, %**	**Substance in preparation**	**Consider LEV for dermal exposures?**	**Dermal exposure estimates (mg/kg/d)**	**Dermal RCR**

Use as solvent in chemical synthesis	PROC 1	Indoors with LEV and good general ventilation	Yes	95	No	Yes	1.7E-03	1.3E-02
Use as solvent in chemical synthesis	PROC 2	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	6.9E-03	5.3E-02
Use as solvent in chemical synthesis	PROC 3	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	3.4E-03	2.6E-02
Use as solvent in chemical synthesis	PROC 4	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	2.1E-02	1.6E-01
Use as solvent in chemical synthesis	PROC 8a	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	1.4E-02	1.1E-01
Use as solvent in chemical synthesis	PROC 8b	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	2.1E-02	1.6E-01
Use as solvent in chemical synthesis	PROC 9	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	2.1E-02	1.6E-01

Table 10.1.3 Quantitative risk characterisation for combined effects during use as a solvent in chemical synthesis

Life cycle stage	**PROC**	**Location and ventilation**	**Substance in preparation**	**Inhalation RCR**	**Dermal RCR**	**RCR(Combined)**
Use as solvent in chemical synthesis	PROC 1	Indoors with LEV and good general ventilation	No	2.7E-03	1.3E-02	1.6E-02
Use as solvent in chemical synthesis	PROC 2	Indoors with LEV and enhanced general ventilation	No	2.9E-01	5.3E-02	3.5E-01
Use as solvent in chemical synthesis	PROC 3	Indoors with LEV and enhanced general ventilation	No	3.5E-01	1.6E-02	3.7E-01

Use as solvent in chemical synthesis	PROC 4	Indoors with LEV and enhanced general ventilation	No	2.3E-01	5.3E-02	2.9E-01
Use as solvent in chemical synthesis	PROC 8a	Indoors with LEV and enhanced general ventilation	No	2.9E-01	5.3E-02	3.5E-01
Use as solvent in chemical synthesis	PROC 8b	Indoors with LEV and enhanced general ventilation	No	1.8E-01	5.3E-02	2.3E-01
Use as solvent in chemical synthesis	PROC 9	Indoors with LEV and enhanced general ventilation	No	4.7E-01	5.3E-02	5.2E-01

10.1.1.2 Consumers

This exposure scenario does not address consumers.

10.1.1.3 Indirect exposure of humans via the environment

The indirect exposure concentrations of man via the environment are compared with the oral DNEL of 0.07 mg/kg bw/day to give the risk characterisation ratios reported in Table 10.1.4.

Table 10.1.4 Risk Characterisation for the indirect exposure of humans via the environment

Route	Exposure concentration	DNEL (oral) mg/kg/day	Risk characterisation ratio
Drinking water (mg/kg/day)	7.40E-03	0.07	1.06E-01
Fish (mg/kg/day)	1.80E-04	0.07	2.57E-03
Leaf crops (mg/kg/day)	2.10E-04	0.07	3.00E-03
Root crops (mg/kg/day)	1.50E-03	0.07	2.14E-02
Meat (mg/kg/day)	5.90E-08	0.07	8.43E-07
Milk (mg/kg/day)	1.10E-06	0.07	1.57E-05

10.1.2 Environment

The documented PNECs are considered adequate for the present REACH risk characterisation. They have been calculated using the current ECHA guideline, including the most conservative assessment factors, and are used for the registration under the regulation 1907/2006 dated June 1st 2007 (REACH) only. They should not be used for other regulatory purposes (e.g., OELs) without further consideration and evaluation.

10.1.2.1.1 Quantitative risk characterisation

The RCRs for the environmental compartments are shown in Table 10.1.5. All the RCRs are <1 and indicate an acceptable risk and no immediate concern for the environment. The conclusion for waste water treatment plant RCR is indicative since the PNEC for micro-organisms is a limit value from a test in which only slight inhibition was seen at the highest test concentration of 1000 mg/l and therefore extremely conservative. The exposure model assumes that landfill waste water will not be treated at the same waste water treatment plant as waste water from the local industrial site.

Table 10.1.5 Risk characterisation for environmental compartments

Protection target	Risk characterisation ratio	Risk characterisation
Fresh Water	0.15	**Conclusion on risk characterisation:** The use as a solvent for chemical synthesis is of no immediate risk to the environment.
Marine Water	0.61	**Conclusion on risk characterisation:** The use as a solvent for chemical synthesis is of no immediate risk to the environment.
Fresh Water (Sediment)	0.15	**Conclusion on risk characterisation:** The use as a solvent for chemical synthesis is of no immediate risk to the environment.

Marine Water (Sediment)	0.61	**Conclusion on risk characterisation:** The use as a solvent for chemical synthesis is of no immediate risk to the environment.
Agricultural Soil	0.21	**Conclusion on risk characterisation:** The use as a solvent for chemical synthesis is of no immediate risk to the environment.
Sewage Treatment Plant	<0.92	**If waste water from landfill is treated at separate STP** **Conclusion on risk characterisation:** The use as a solvent for chemical synthesis is of no immediate risk to the environment.

10.2 Use as laboratory reagent (ES2)

10.2.1 Human health

10.2.1.1 Workers

10.2.1.1.1 Qualitative risk assessment of physico-chemical hazards

Tetrahydro-2-methylfuran is classified as a highly flammable liquid, Suitable precautionary measures to avoid sources of ignition are recommended. These can include, but are not limited to:
- Provision of mechanical exhaust ventilation (fume cupboard) to remove flammable vapours
- Provision of adequate drainage and collection facilities to isolate any spilled liquids
- Provision of classified electrical equipment (see national legal requirements)
- Control of smoking and other potential ignition sources

When the appropriate measures are applied there is no unacceptable risk to human health from use of tetrahydro-2-methylfuran in this application.

10.2.1.1.2 Qualitative risk characterisation of dermal exposure

Due to the substance having a high vapour pressure of 14 000 Pa at 25°C it is expected to volatalise quickly and will not remain on the skin for a significant period of time, therefore it is considered that diffusion through the skin will be negligible.

The substance is classified as a skin irritant (Category 2). Workers are required to wear suitable protective gloves, safety goggles and impervious overalls when there is potential for dermal contact. Specific worker training in the use and disposal of protective clothing is provided. It is therefore considered that there is no unacceptable risk to humans from dermal exposure to tetrahydro-2-methylfuran.

10.2.1.1.3 Quantitative risk characterisation

Quantitative risk characterisation has been performed for local inhalation and dermal effects of tetrahydro-2-methylfuran. No separate risk characterisation is required for acute effects as DNELs for long-term effects are adequate to protect against both short and long-term exposures.

Risk characterisation ratios for inhalation are given in Table 10.2.1, dermal in Table 10.2.2 and for combined effects in Table 10.2.3

The RCR is below 1 for use of tetrahydro-2-methylfuran as a laboratory reagent under the conditions specified in Section 9.2.1. Therefore, there is no unacceptable risk for humans from exposure to tetrahydro-2-methylfuran.

Table 10.2.1 Quantitative risk characterisation for inhalation effects during laboratory reagent use Life cycle stage

	PROC	Location and ventilation	LEV efficiency (%)	Duration	Respiratory protection	Substance in preparation	Inhalation exposure (mg/m3)	Inhalation RCR
Laboratory Chemical	PROC 15	Indoors with LEV and enhanced general ventilation	90	>4 hours (default)	0.95	No	2.7E-01	5.9E-01

Table 10.2.2 Quantitative risk characterisation for dermal effects during laboratory reagent use Life cycle stage

	PROC	Location and ventilation	Gloves used	Efficiency, %	Substance in preparation	Consider LEV for dermal exposures?	Dermal exposure estimates (mg/kg/d)	Dermal RCR
Laboratory Chemical	PROC 15	Indoors with LEV and enhanced general ventilation	Yes	95	No	Yes	1.7E-03	1.3E-02

Table 10.2.3 Quantitative risk characterisation for combined effects during laboratory reagent use Life cycle stage

	PROC	Location and ventilation	Substance in preparation	Inhalation RCR	Dermal RCR	RCR(Combined)
Laboratory Chemical	PROC 15	Indoors with LEV and enhanced general ventilation	No	5.9E-01	1.3E-02	6.0E-01

10.2.1.1.4 Consumers

This exposure scenario does not address consumers.

10.2.2 Environment

Given the very small scale use, it is not appropriate to assess environmental exposure for this scenario. There is no intentional release of tetrahydro-2-methylfuran to waste water and any fugitive releases to air will be of negligible volume. Therefore, no environmental exposure estimation and no quantitative risk characterisation for the environmental compartments were conducted.

10.3 Overall exposure (combined for all relevant emission/release sources)

10.3.1 Human health (combined for all exposure routes)

10.3.1.1 Use as a solvent for chemical synthesis

Simultaneous exposure of workers can occur during the use as solvent in chemical synthesis (PROC's, 1, 2, 3, and 4) and loading or filling operations (PROC's, 8a, 8b, and 9). Therefore, from Table 10.1.3., the highest risk characterisation ratio for potential sources of simultaneous exposure of workers during Use as solvent in chemical synthesis is from PROC 9 (15 mins to 1 hour, Enhanced General Ventilation, With LEV) PROC 3 (1 - 4 hours, Enhanced General Ventilation, With LEV).
Combined risk characterisation ratio = 5.20E-01 + 3.70E-01 = 0.89

10.3.1.2 Use as a laboratory reagent

There are no combined tasks for this exposure scenario.