SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifier

Product Name	2-ethoxy-2-methylpropane / ETHYL TERT-BUTYL ETHER
Product Description	V4020a-ETBE-2-ethoxy-2-methylpropane / ETHYL TERT-BUTYL ETHER
Trade Name	ETBE
Product code	ETBE
CAS No.	637-92-3
EC No.	211-309-7
REACH Registration No.	-

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

Identified Use(s)

No.	Exposure Scenario	Page:
1	Transport and Distibution	**10**
2	Formulation	**13**
3	Use as a fuel (industrial)	**16**
4	Use as fuel (professional)	**19**
5	Use as a fuel (consumer)	**22**

Uses Advised Against: Anything other than the above.

1.3 Details of the supplier of the safety data sheet

Company Identification:

Vitol SA
Place des Bergues 3
P.O. Box 2056
1211 Geneva 1
Switzerland

Telephone	+31 10 498 7200
Fax	+31 10 452 9545
E-Mail (competent person)	xreach@vitol.com

1.4 Emergency telephone number

Emergency Phone No.	+44 (0) 1235 239 670, 24/7
Languages spoken	All official European languages.

SECTION 2: HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

2.1.1 Regulation (EC) No. 1272/2008 (CLP)

Flam. Liq. 2; H225
STOT SE 3; H366 (Central nervous system, Inhalation)

2.1.2 Directive 67/548/EEC & Directive 1999/45/EC

F; R11: Highly flammable.
R67: Vapours may cause drowsiness and dizziness.

2.2 Label elements

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

Product Name: V4020a-ETBE-2-ethoxy-2-methylpropane / ETHYL TERT-BUTYL ETHER

Hazard Pictogram(s)

Signal Word(s): Danger

Hazard Statement(s): H225: Highly flammable liquid and vapour.

		H336: May cause drowsiness or dizziness. Central nervous system, Inhalation.
	Precautionary Statement(s)	P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. P243: Take precautionary measures against static discharge. P261: Avoid breathing vapours. P271: Use only outdoors or in a well-ventilated area. P304 + P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing. P403+P233: Store in a well-ventilated place. Keep container tightly closed.
2.3	**Other hazards**	May form explosive mixture with air. The vapour is heavier than air; beware of pits and confined spaces. Releases flammable vapors below normal ambient temperatures.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

SUBSTANCE	CAS No.	EC No.	REACH Registration No.	%W/W
Tert-Butyl Methyl Ether	1634-04-4	216-653-1	-	100

SECTION 4: FIRST AID MEASURES

4.1 Description of first aid measures

Self-protection of the first aider	If it is suspected that fumes are still present, the responder should wear an appropriate mask or self-contained breathing apparatus.
Inhalation	IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical advice/attention if you feel unwell.
Skin Contact	IF ON SKIN (or hair): Remove contaminated clothing immediately and wash affected skin with plenty of water or soap and water. If irritation (redness, rash, blistering) develops, get medical attention.
Eye Contact	IF IN EYES: Flush eyes with water for at least 15 minutes while holding eyelids open. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, get medical advice/attention.
Ingestion	IF SWALLOWED: Do not induce vomiting because of risk of aspiration into the lungs. If vomiting occurs spontaneously, keep head below hips to prevent aspiration into the lungs. Get medical attention immediately.

4.2 Most important symptoms and effects, both acute and delayed

Inhalation: Irritation of the respiratory tract. Coughing, Wheezing. The effect of inhalation may be delayed.
Skin Contact: Causes skin irritation.
Ingestion: Ingestion may cause irritation of the gastrointestinal tract.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to a physician:

IF SWALLOWED: Do NOT induce vomiting, if vomiting does occur, have victim lean forward to reduce risk of aspiration.
In case of ingestion the stomach should be emptied by gastric lavage under qualified medical supervision. At high doses, effects on the CNS are possible.

SECTION 5: FIREFIGHTING MEASURES

5.1	**Extinguishing media**	
	Suitable Extinguishing media	Extinguish with sand or dry chemical. Foam, Carbon dioxide, Water fog or dry powder
	Unsuitable extinguishing media	Do not use water jet. Direct water jet may spread the fire.
5.2	**Special hazards arising from the substance or mixture**	Releases flammable vapors below normal ambient temperatures..Prevent liquid entering sewers, basements and any watercourses. Vapours are heavier than air and may travel considerable distances to a source of ignition and flashback.
5.3	**Advice for fire-fighters**	Fight fire with normal precautions from a reasonable distance. Fire fighters should wear complete protective clothing including self-contained breathing apparatus. Keep containers cool by spraying with water if exposed to fire. Avoid release to the environment. Dike fire control water for later disposal.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1	**Personal precautions, protective equipment and emergency procedures**	Caution - spillages may be slippery. Eliminate sources of ignition. No open flames, no sparks and no smoking. Stop leak if safe to do so. Ensure suitable personal protection during removal of spillages. Avoid all contact. Keep upwind. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.
6.2	**Environmental precautions**	Avoid release to the environment. Do not allow to enter drains, sewers or watercourses. Spillages or uncontrolled discharges into watercourses must be alerted to the Environment Agency or other appropriate regulatory body.
6.3	**Methods and material for containment and cleaning up**	Highly flammable. Adsorb spillages onto sand, earth or any suitable adsorbent material. Use non-sparking equipment when picking up flammable spill. Ensure that the equipment is adequately grounded. Sweep up and shovel into waste drums or plastic bags. Transfer to a lidded container for disposal or recovery.
6.4	**Reference to other sections**	See Section: 8,13

SECTION 7: HANDLING AND STORAGE

7.1	**Precautions for safe handling**	Keep away from sources of ignition - No smoking. Use only outdoors or in a well-ventilated area. Prevent vapour build up by providing adequate ventilation during and after use. Light hydrocarbon vapours can build up in the headspace of containers. These can cause flammability / explosion hazards. Take precautionary measures against static discharge. Use only non-sparking tools. Ground/bond container and receiving equipment. The vapour is heavier than air; beware of pits and confined spaces. Avoid all contact. Do not breathe gas. Do not ingest. Use personal protective equipment as required. See Section: 8. Keep good industrial hygiene. Wash hands thoroughly after handling. Contaminated clothing should be thoroughly cleaned.
	Maintenance	Observe precautions pertaining to confined space entry. Isolate, vent, drain, wash and purge systems or equipment before maintenance or repair.
7.2	**Conditions for safe storage, including any incompatibilities**	Light hydrocarbon vapours can build up in the headspace of containers. These can cause flammability / explosion hazards. Bund storage facilities to prevent soil and water pollution in the event of spillage. Keep only in original container. Keep containers properly sealed when not in use. Protect from sunlight. Containers of this material may be hazardous when empty since they retain product residue. Containers must not be punctured or destroyed by burning, even when empty.
	Storage temperature	Stable at ambient temperatures.
	Storage measures	Keep only in original container. Suitable materials: Carbon steel, Mild steel
	Incompatible materials	Keep away from oxidising agents.
7.3	**Specific end use(s)**	See Section: 1.2 and/or Exposure Scenario.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 **Control parameters**

8.1.1 Occupational Exposure Limits None assigned.

8.1.2 Biological limit value Not established.

8.1.3 PNECs and DNELs

DNEL MTBE	Oral (mg/kg bw/day)	Inhalation (mg/m³)	Dermal (mg/kg bw/day)
Industry - Long Term - Systemic effects	-	352	6767
Industry - Short term - Systemic effects	-	2800	-
Industry - Short term - Local effects	-	105	-
Consumer - Long Term - Systemic effects	6	105	4060
Consumer - Long Term - Systemic effects	-	1680	-
Consumer - Long Term - Local effects	-	63	-

PNEC	MTBE
Aquatic Compartment	PNEC aqua (freshwater) 0.51 mg/L PNEC aqua (marine water) 0.017 mg/L PNEC aqua (intermittent releases) 11 mg/L PNEC STP 12.5 mg/L PNEC sediment (freshwater) 2.86 mg/kg sediment dw PNEC sediment (marine water) 0.078 mg/kg sediment dw
Terrestrial Compartment	PNEC soil 0.274 mg/kg soil dw

8.2 Exposure controls

8.2.1 Appropriate engineering controls Ensure adequate ventilation. Guarantee that the eye flushing systems and safety showers are located close to the working place.

8.2.2 Individual protection measures, such as personal protective equipment (PPE) Fuels are typically used, transferred and transported in closed systems. If exposure is likely (i.e. during sampling) the following advice may be appropriate. Good hygiene practices and housekeeping measures

Eye/ face protection

Wear eye protection with side protection (EN166).

Skin protection

Hand protection: Wear impervious gloves (EN374). Gloves should be changed regularly to avoid permeation problems. Breakthrough time of the glove material: refer to the information provided by the gloves' producer.

Body protection: Fire retardant clothing is appropriate for routine occupational use.

Respiratory protection

In case of insufficient ventilation, wear suitable respiratory equipment.

High concentrations/Aerosol or mist formation: Wear suitable respiratory protection (conforming to EN140 with Type A filter or better) and gloves (type EN374) if regular skin contact likely.

Thermal hazards Not applicable.

8.2.3 Environmental Exposure Controls Avoid release to the environment.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	Liquid. Colourless to yellowish liquid.
Odour	Not defined.
Odour threshold	Not established.

pH	Not established.
Melting point/freezing point	- 94 °C
Initial boiling point and boiling range	73 °C
Flash point	- 19 °C
Evaporation rate	Not established.
Flammability (solid, gas)	Not applicable - Liquid
Upper/lower flammability or explosive limits	Flammable Limits (Upper) (%v/v): 7.7 Flammable Limits (Lower) (%v/v): 1.23
Vapour pressure	12.8 @ 20 °C
Vapour density	Not established.
Relative density	0.75 g/cm³ @ 20 °C
Solubility(ies)	Water: 2.37 g/ 100 g @ 20 °C
Partition coefficient: n-octanol/water	1.28 log P
Auto-ignition temperature	375 °C
Decomposition Temperature	Not established.
Viscosity	0.53 mm²/s @ 40 °C
Explosive properties	Not explosive.(Vapour may create explosive atmosphere.)
Oxidising properties	Not oxidising.

9.2 Other information None known.

SECTION 10: STABILITY AND REACTIVITY

10.1	**Stability and reactivity**	Stable under normal conditions. Reacts with - Strong oxidising agents
10.2	**Chemical stability**	Stable under normal conditions.
10.3	**Possibility of hazardous reactions**	None known.
10.4	**Conditions to avoid**	Contact with strong acids can decompose this material and generate extremely flammable isobutylene.
10.5	**Incompatible materials**	Acids. Keep away from oxidising agents.
10.6	**Hazardous decomposition product(s)**	Carbon monoxide, Carbon dioxide

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

Ingestion	Not classified. LD50 > 2000 mg/kg bw/day (rat) OECD 401
Inhalation	Not classified. Estimated LD50 Vapour > 20 mg/l
Skin Contact	Not classified. LD50 > 2000 mg/kg bw/day @ 24 hour(s) (rabbit) OECD 402
Skin corrosion/irritation	Not classified. OECD 404 (rabbit) Mean erythema score :0.67 Mean edema score : 0.11
Serious eye damage/irritation	Based upon the available data, the classification criteria are not met.
Respiratory or skin sensitization	Based upon the available data, the classification criteria are not met.
Germ cell mutagenicity	Based upon the available data, the classification criteria are not met.
Carcinogenicity	Based upon the available data, the classification criteria are not met.
Reproductive toxicity	Based upon the available data, the classification criteria are not met.
STOT - single exposure	STOT SE 3; May cause drowsiness and dizziness. (Central nervous system, Inhalation)
STOT - repeated exposure	Based upon the available data, the classification criteria are not met.
Aspiration hazard	Based upon the available data, the classification criteria are not met.

11.2 Other information None.

SECTION 12: ECOLOGICAL INFORMATION

12.1	**Toxicity**	Not classified. NOEC 64 mg/l freshwater (Zebra fish) OECD 212
12.2	**Persistence and degradibility**	Readily biodegradable (according to OECD criteria).
12.3	**Bioaccumulative potential**	The substance has low potential for bioaccumulation.
12.4	**Mobility in soil**	The product is predicted to have moderate mobility in soil. (Slightly soluble in: Water)
12.5	**Results of PBT and vPvB assessment**	Not classified as PBT or vPvB.
12.6	**Other adverse effects**	None known.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Dispose of this material and its container as hazardous waste (2008/98/EEC). Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point. Disposal should be in accordance with local, state or national legislation. Containers of this material may be hazardous when empty since they retain product residue. Containers must not be punctured or destroyed by burning, even when empty. Allocation of a waste code number, according to the European Waste Catalogue, should be carried out in agreement with the regional waste disposal company. Waste code: 16 05 06, 16 05 08*

SECTION 14: TRANSPORT INFORMATION

		ADR/RID	IMDG/ADN
14.1	**UN number**	UN 1179	UN 1179
14.2	**Proper Shipping Name**	ETHYL BUTYL ETHER	ETHYL BUTYL ETHER
14.3	**Transport hazard class(es)**	3	3
14.4	**Packing group**	II	II
14.5	**Environmental hazards**	Not classified as a Marine Pollutant.	
14.6	**Special precautions for user**	See Section: 2	
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code**	This product is being carried under the scope of MARPOL Annex 1. Special Precautions: Refer to Chapter 7 'Handling and Storage' for special precautions which a user needs to be aware of, or needs to comply with, in connection with transport.	
14.8	**Additional Information**	HIN: 30 Tunnel Code: 3 (D/E) Limited Quantity: 5L	EmS: F-E, S-E Limited Quantity: 5L

SECTION 15: REGULATORY INFORMATION

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

15.1.1 EU regulations

Seveso: Upper Tier: 25000 tonnes; Lower Tier: 2500 tonnes

15.1.2 National regulations: None

15.2 Chemical Safety Assessment: This safety data sheet contains more than one ES in an integrated form. Contents of the exposure scenarios have been included into sections 1.2, 8, 9, 12, 15 and 16 of this safety data sheet.

SECTION 16: OTHER INFORMATION

The following sections contain revisions or new statements:

Header and Section 1.3

References:

Existing ECHA registration(s) for ETBE (CAS No. 637-92-3) and Chemical Safety Report.

This Safety Data Sheet was prepared in accordance with EC Regulation (EC) 1907/2006 (REACH), 1272/2008 (CLP) & 453/2010.

LEGEND

LTEL	Long Term Exposure Limit

STEL	Short Term Exposure Limit
DNEL	Derived No Effect Level
PNEC	Predicted No Effect Concentration
PBT	PBT: Persistent, Bioaccumulative and Toxic
vPvB	very Persistent and very Bioaccumulative
OECD	Organisation for Economic Cooperation and Development

Training advice: Consideration should be given to the work procedures involved and the potential extent of exposure as they may determine whether a higher level of protection is required.

Disclaimers

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2-ethoxy-2-methylpropane

CAS No. 637-92-3
EINECS No. 211-309-7

Summary of Parameters

Physical parameters			
Vapour pressure (hPa)			170 (Liquid with high volatility.)
Partition Coefficient (log K_{OW})			1.48
Aqueous solubility (mg/l)			16,400
Molecular weight			102.18
Biodegradability			Inherently biodegradable, not fulfilling criteria
Human Health (DNEL)			
Workers	Short term	Inhalation (mg/m³)	2800 (= 667 ppm)
		Dermal (mg/kg bw/day)	no toxic effect
	Long Term	Inhalation (mg/m³)	352 (Systemic effects) 105 (Local effects)
		Dermal (mg/kg bw/day)	6767
Consumer		Inhalation (mg/m³)	1680 (Acute) 105 (long-term, Systemic effects) 63 (long-term,Local effects)
		Dermal (mg/kg bw/day)	4060
		Oral (mg/kg bw/day)	12.5
Environmental Parameters (PNECs)			
Sewage Treatment Plant (STP) (mg/l)			12.5
freshwater (mg/l)			0.51
marine water(mg/l)			0.017
freshwater sediment (mg/kg wet weight)			28.5
marine sediment (mg/kg wet weight)			1.45
soil (mg/kg wet weight)			2.41

Contents

Contributing Scenarios

PROC Codes
PROC1 Use in closed process, no likelihood of exposure
PROC2 Use in closed, continuous process with occasional controlled exposure
(Storage) Bulk storage with samples collected at dedicated sample points
PROC3 Use in closed batch process (synthesis or formulation)
(Sampling) with sample collection
(elevated) Process performed at > 20 °C above ambient temperature.
PROC4 Use in batch and other process (synthesis) where opportunity for exposure arises
PROC5 Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
(maintenance) clean down and maintenance of equipment including cleaning fuel storage tanks
(Manual) Manual transfer/pouring from containers
PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
(bulk closed) Bulk open loading (e.g. road/rail car bottom loading)
(bulk open) Bulk open loading (e.g. road/rail car top loading)
(Drum) drum or batch transfers using dedicated drum handling equipment
(bulk) Bulk transfer in a closed system
(refueling) pumped transfer to vehicles, light aircraft or marine
PROC9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC15 Use as laboratory reagent
PROC16 Using material as fuel sources, limited exposure to unburned product to be expected

Exposure Scenario 1 – Transport and distribution

1.0 Contributing Scenarios	
Sector of uses SU	3
Process category [PROC]	1, 2, 2 (Storage), 3, 3 (Sampling), 4, 8a (maintenance), 8b (bulk closed), 8b (bulk open), 8b (Drum), 9, 15
Chemical product category [PC]	not applicable
Article Categories [AC]	not applicable
Environmental release categories [ERC]	1, 2
Specific Environmental Release Categories SPERC	ESVOC3 SpERC

2.0 Operational conditions and risk management measures		
2.1 Control of worker exposure		
Product characteristics		
Physical form of product	Liquid with low volatility.	
Concentration of substance in product	Covers concentrations up to 100%	
Human factors not influenced by risk management		
Potential exposure area	Not defined	
Frequency and duration of use		
Exposure duration per day	PROC3 (Sampling)	Covers exposure up to 15 minutes
	PROC2 (Storage), PROC8b (bulk closed),	Covers exposure up to 1 hour
	8b (bulk open), 8a (maintenance)	Covers exposure up to 4 hours
	All other PROC's	Covers exposure up to 8 hours
Other operational conditions affecting worker exposure		
Area of use	PROC2, PROC8b (bulk closed),	Outdoor
	All other PROC's	Indoor
Characteristics of the surroundings	Not defined	
General measures applicable to all activities Assumes use at not more than 20°C above ambient temperature, unless stated differently. Assumes a good basic standard of occupational hygiene is implemented.		
Organisational measures		
PROC8a (maintenance)	Drain or remove substance from equipment prior to break-in or maintenance. (Inhalation Efficiency of at least 90%)	
PROC15	Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Efficiency of at least 70%	
Technical conditions of use		
PROC3, PROC4	Sampling via closed loop systems	
PROC8b (bulk open)	Ensure material transfers are under containment or extract ventilation. Efficiency of at least 30%	
PROC8a (bulk open), PROC9	Ensure material transfers are under containment or extract ventilation. Efficiency of at least 90%	
Risk management measures related to human health		
Respiratory protection	PROC2, PROC 2 (Storage), PROC3 (Sampling), PROC8b (bulk closed), PROC8b (bulk open), PROC8a (maintenance)	If exposure duration cannot be achieved, wear a respirator conforming to EN140 with Type A filter or better.
Hand and/or Skin protection	No special measures are required.	
Eye Protection	No special measures are required.	
Other operational conditions affecting worker exposure		
None.		

2.2 Control of environmental exposure

Amounts used	
Fraction of EU tonnage used in region:	1.0
Regional use tonnage (tons/year):	9.01E+05
Fraction of Regional tonnage used locally: tons/year	0.02 (distribution) 1 (Storage)
Annual site tonnage (tons/year):	18,020 (distribution) 901,000 (Storage)
Maximum daily site tonnage (kg/day)	51,486 (distribution) 2,468,493 (Storage)
Environment factors not influenced by risk management	
Flow rate of receiving surface water (m^3/d):	20,000
Local freshwater dilution factor:	10
Local marine water dilution factor:	100
Operational conditions	
Emission days (days/year):	350 (Continuous release.)
Release fraction to air from process (initial release prior to RMM):	1.0E-04
Release fraction to wastewater from process (initial release prior to RMM):	1.0E-05
Release fraction to soil from process (initial release prior to RMM):	1.0E-05
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Treat air emission to provide a typical removal efficiency of (%):	0
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of (%):	97 (Transport) 99 (Storage)
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of (%):	60 (Transport) 80 (Storage)
Treat soil emission to provide a typical removal efficiency of (%):	0
Note: Common practices vary across sites thus conservative process release estimates used. No wastewater treatment required.	
Organisational measures to prevent/limit release from site	
Prevent discharge of undissolved substance to or recover from onsite wastewater.	
Conditions and measures related to municipal sewage treatment plant	
Size of municipal sewage system/treatment plant (m^3/d)	2,000
Degradation effectiveness (%)	92.3
Conditions and measures related to external treatment of waste for disposal	
External treatment and disposal of waste should comply with applicable local and/or national regulations.	
Substance release quantities after risk management measures	
Release to waste water from process (mg/l)	Not defined
Maximum allowable site tonnage (MSafe) (kg/d):	Not defined

3. Exposure estimation and reference to its source

3.1 Human exposure prediction

Exposure assessment (method/calculation model)	ECETOC TRA

	Inhalation		Dermal		General Comment Regarding All Proc's
Process category [PROC]	**inhalation exposure (mg/m^3)**	**Risk characterisation ratio (RCR)**	**dermal exposure(mg/kg bw/day)**	**Risk characterisation ratio (RCR)**	**Risk characterisation ratio (RCR)**
PROC1	0.04	0.00	0.34	0.00	0.00
PROC2	89	0.84	1.37	0.00	0.84
PROC2 (Storage)	42.4	0.40	1.37	0.00	0.40
PROC3	42	0.40	0.34	0.00	0.40
PROC3 (Sampling)	42.4	0.40	0.34	0.00	0.40
PROC4	42	0.40	6.86	0.00	0.40
PROC8a (maintenance)	63.6	0.60	13.7	0.00	0.60
PROC8b (bulk closed)	89	0.84	6.86	0.00	0.84
PROC8b (bulk open)	63.6	0.60	6.86	0.00	0.60
PROC8b (Drum)	85	0.80	6.86	0.00	0.80
PROC15	64	0.60	0.34	0.00	0.34

3.2 Environmental exposure prediction	
Exposure assessment (method/calculation model)	EUSES v2.1

Transport

environmental exposure	STP	freshwater	marine water	soil	freshwater sediment	marine sediment
RCR	8.32E-04	2.88E-04	9.47E-03	2.83E-04	6.28E-05	1.34E-04
PEC	0.01	1.47E-03	1.61E-04	6.82E-04	1.79E-03	1.95E-04

Storage

environmental exposure	STP	freshwater	marine water	soil	freshwater sediment	marine sediment
RCR	8.48E-04	2.94E-03	n.a.	9.54E-03	2.94E-03	n.a.
PEC	0.011	1.50E-03	n.a.	0.023	1.82E-03	n.a.

Human exposure prediction

Route of Exposure	Exposure (µg kg^{-1} day^{-1})	RCR
Transport		
Oral	7.86E-03	6.29E-06
Inhalation	2.03E-04	1.13E-05
Storage		
Oral	8.08E-04	6.46E-05
Inhalation	7.84E-04	4.35E-05

4. Evaluation guidance to downstream user		
For scaling see	Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not support the need for a DNEL to be established for other health effects. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).	
Exposure assessment instrument/tool/method	Workers	ECETOC TRA v2.0 Worker
	environmental exposure	EUSES v2.1

Exposure Scenario 2 – Formulation

1.0 Contributing Scenarios	
Sector of uses SU	3,
Process category [PROC]	1, 2, 2 (Storage), 3, 3 (Sampling), 3 (elevated), 8a (maintenance), 8a (manual), 8b (bulk closed), 8b (Drum), 9, 15
Chemical product category [PC]	not applicable
Article Categories [AC]	not applicable
Environmental release categories [ERC]	2
Specific Environmental Release Categories SPERC	ESVOC3 SpERC

2.0 Operational conditions and risk management measures		
2.1 Control of worker exposure		
Product characteristics		
Physical form of product	Liquid with high volatility.	
Concentration of substance in product	Covers concentrations up to 100%	
Human factors not influenced by risk management		
Potential exposure area	Not defined	
Frequency and duration of use		
Exposure duration per day	PROC2 (Storage), PROC8a (maintenance)	Covers exposure up to 1 hour
	PROC2, PROC5, PROC8a (manual)	Covers exposure up to 4 hours
	All other PROC's	Covers exposure up to 8 hours
Other operational conditions affecting worker exposure		
Area of use	PROC2	Outdoor
	All other PROC's	Indoor
Characteristics of the surroundings	Not defined	
General measures applicable to all activities Assumes use at not more than 20°C above ambient temperature, unless stated differently. Assumes a good basic standard of occupational hygiene is implemented.		
Organisational measures		
PROC8a (maintenance)	Drain or remove substance from equipment prior to break-in or maintenance. Inhalation Efficiency of at least 90%	
PROC15	Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Efficiency of at lest 70%	
Technical conditions of use		
PROC3, PROC3 (Sampling), PROC3 (elevated), PROC4, PROC5, PROC9	Provide extract ventilation to points where emissions occur. Efficiency of at lest 90%	
PROC8b (bulk), PROC8b (Drum)	Provide extract ventilation to points where emissions occur. Efficiency of at lest 97%	
PROC8a (manual)	Provide extract ventilation to points where emissions occur. Efficiency of at lest 90%	
Risk management measures related to human health		
Respiratory protection	PROC2, PROC2 (Storage), PROC5, PROC8a (manual), PROC8a (maintenance)	If exposure duration cannot be achieved, wear a respirator conforming to EN140 with Type A filter or better.
Hand and/or Skin protection	No special measures are required.	
Eye Protection	No special measures are required.	
Other operational conditions affecting worker exposure		
None.		
2.2 Control of environmental exposure		
Amounts used		
Fraction of EU tonnage used in region:		
Regional use tonnage (tons/year):	901,000	
Fraction of Regional tonnage used locally: tons/year	0.05	

Annual site tonnage (tons/year):	45,050
Maximum daily site tonnage (kg/day)	150,167
Environment factors not influenced by risk management	
Flow rate of receiving surface water (m³/d):	20,000
Local freshwater dilution factor:	10
Local marine water dilution factor:	100
Operational conditions	
Emission days (days/year):	300 (Continuous release.)
Release fraction to air from process (initial release prior to RMM):	1.0E-03
Release fraction to wastewater from process (initial release prior to RMM):	3.0E-04
Release fraction to soil from process (initial release prior to RMM):	1.0E-04
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Treat air emission to provide a typical removal efficiency of (%):	0
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of (%):	99
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of (%):	80
Treat soil emission to provide a typical removal efficiency of (%):	0
Note: Common practices vary across sites thus conservative process release estimates used. No wastewater treatment required.	
Organisational measures to prevent/limit release from site	
Prevent discharge of undissolved substance to or recover from onsite wastewater.	
Conditions and measures related to municipal sewage treatment plant	
Not applicable	
Conditions and measures related to external treatment of waste for disposal	
Not applicable	
Substance release quantities after risk management measures	
Release to waste water from process (mg/l)	Not defined
Maximum allowable site tonnage (MSafe) (kg/d):	Not defined

3. Exposure estimation and reference to its source

3.1 Human exposure prediction

Exposure assessment (method/calculation model)	ECETOC TRA

	Inhalation		Dermal		General Comment Regarding All Proc's
Process category [PROC]	**inhalation exposure (mg/m³)**	**Risk characterisation ratio (RCR)**	**dermal exposure(mg/kg bw/day)**	**Risk characterisation ratio (RCR)**	**Risk characterisation ratio (RCR)**
PROC1	0.04	0.00	0.34	0.00	0.00
PROC2	89	0.84	1.37	0.00	0.84
PROC2 (Storage)	42	0.40	1.37	0.00	0.40
PROC3	42	0.40	0.34	0.00	0.40
PROC3 (Sampling)	42	0.40	0.34	0.00	0.40
PROC3 (elevated)	42	0.40	0.34	0.00	0.40
PROC4	42	0.40	6.86	0.00	0.40
PROC5	64	0.60	13.7	0.00	0.60
PROC8a (maintenance)	21	0.20	13.7	0.00	0.20
PROC8a (manual)	64	0.60	13.7	0.00	0.60
PROC8b (bulk closed)	19	0.18	6.86	0.00	0.18
PROC8b (drum)	19	0.20	6.86	0.00	0.20
PROC9	85	0.80	6.86	0.00	0.80
PROC15	64	0.60	0.34	0.00	0.60

3.2 Environmental exposure prediction

Exposure assessment (method/calculation model)	EUSES v2.1

environmental exposure	STP	freshwater	marine water	soil	freshwater sediment	marine sediment
RCR	8.8E-04	2.94E-03	9.65E-03	0.019	6.39E-05	1.37E-04
PEC	0.011	1.50E-03	1.63E-04	0.045	1.82E-03	1.99E-04

Human exposure prediction

Route of Exposure	Exposure (µg kg^{-1} day^{-1})	RCR
Oral	1.92E-04	1.54E-05
Inhalation	4.04E-04	2.24E-06

4. Evaluation guidance to downstream user

For scaling see	Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not support the need for a DNEL to be established for other health effects. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).	
Exposure assessment instrument/tool/method	Workers	ECETOC TRA v2.0 Worker
	environmental exposure	EUSES v2.1

Exposure Scenario 3 – Use as a fuel (industrial)

1.0 Contributing Scenarios	
Sector of uses SU	3
Process category [PROC]	1, 2, 2 (Storage), 3, 8a (maintenance), 8a (manual), 8b (bulk), 8b (Drum), 16
Chemical product category [PC]	not applicable
Article Categories [AC]	not applicable
Environmental release categories [ERC]	8b
Specific Environmental Release Categories SPERC	ESVOC3 SpERC

2.0 Operational conditions and risk management measures		
2.1 Control of worker exposure		
Product characteristics		
Physical form of product	Liquid with high volatility.	
Concentration of substance in product	Covers concentrations up to 15%	
Human factors not influenced by risk management		
Potential exposure area	Not defined	
Frequency and duration of use		
Exposure duration per day	PROC8a (maintenance), PROC8a (bulk)	Covers exposure up to 4 hours
	All other PROC's	Covers exposure up to 8 hours
Other operational conditions affecting worker exposure		
Area of use	PROC2 (Storage)	Outdoor
	All other PROC's	Indoor
Characteristics of the surroundings	Not defined	
General measures applicable to all activities Assumes use at not more than 20°C above ambient temperature, unless stated differently. Assumes a good basic standard of occupational hygiene is implemented.		
Organisational measures		
PROC8a (maintenance)	Drain or remove substance from equipment prior to break-in or maintenance. Inhalation Efficiency of at least 80%	
Technical conditions of use		
PROC8b (bulk)	Mandatory use of Stage 1 Vapour Recovery. Efficiency of at least 80%	
PROC2, PROC3	Provide extract ventilation to points where emissions occur. Efficiency of at least 90%	
PROC8b (drum)	Use drum pumps. Efficiency of at least 80%	
Risk management measures related to human health		
Respiratory protection	PROC8a (bulk), PROC8a (maintenance)	If exposure duration cannot be achieved, wear a respirator conforming to EN140 with Type A filter or better.
Hand and/or Skin protection	No special measures are required.	
Eye Protection	No special measures are required.	
Other operational conditions affecting worker exposure		
None.		
2.2 Control of environmental exposure		
Amounts used		
Fraction of EU tonnage used in region:	1	
Regional use tonnage (tons/year):	901,000	
Fraction of Regional tonnage used locally: tons/year	0.02	
Annual site tonnage (tons/year):	18,020	
Maximum daily site tonnage (kg/day)	51,486	
Environment factors not influenced by risk management		
Flow rate of receiving surface water (m^3/d):	20,000	
Local freshwater dilution factor:	10	
Local marine water dilution factor:	100	
Operational conditions		
Emission days (days/year):	350 (Continuous release.)	
Release fraction to air from process (initial release prior to RMM):	0.25	

Release fraction to wastewater from process (initial release prior to RMM):	1.0E-04
Release fraction to soil from process (initial release prior to RMM):	1.0E-03
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Treat air emission to provide a typical removal efficiency of (%):	0
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of (%):	95
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of (%):	0
Treat soil emission to provide a typical removal efficiency of (%):	0
Note: Common practices vary across sites thus conservative process release estimates used. No wastewater treatment required.	
Organisational measures to prevent/limit release from site	
Prevent discharge of undissolved substance to or recover from onsite wastewater.	
Conditions and measures related to municipal sewage treatment plant	
Not applicable	
Conditions and measures related to external treatment of waste for disposal	
Not applicable	
Substance release quantities after risk management measures	
Release to waste water from process (mg/l)	Not defined
Maximum allowable site tonnage (MSafe) (kg/d):	Not defined

3. Exposure estimation and reference to its source

3.1 Human exposure prediction

Exposure assessment (method/calculation model)	ECETOC TRA v2.0 Worker

	Inhalation		Dermal		General Comment Regarding All Proc's
Process category [PROC]	**inhalation exposure (mg/m³)**	**Risk characterisation ratio (RCR)**	**dermal exposure(mg/kg bw/day)**	**Risk characterisation ratio (RCR)**	**Risk characterisation ratio (RCR)**
PROC1	0.03	0.00	0.00	0.00	0.00
PROC2	13	0.12	0.82	0.00	0.12
PROC2 (Storage)	21ppm	0.84	0.82	0.00	0.84
PROC3	6ppm	0.24	0.20	0.00	0.24
PROC8a (maintenance)	76	0.72	8.23	0.00	0.72
PROC8b (bulk)	46	0.43	4.12	0.00	0.43
PROC8b (drum)	76	0.72	4.12	0.00	0.72
PROC16	64	0.60	0.20	0.00	0.60

3.2 Environmental exposure prediction

Exposure assessment (method/calculation model)	EUSES v2.1

environmental exposure	STP	freshwater	marine water	soil	freshwater sediment	marine sediment
RCR	8.32E-04	2.88E-04	9.47E-03	2.83E-04	6.28E-05	1.34E-04
PEC	0.01	1.47E-04	1.61E-04	6.82E-04	1.79E-03	1.95E-04

Human exposure prediction

Route of Exposure	Exposure (µg kg^{-1} day^{-1})	RCR
Oral	1.92E-04	1.54E-05
Inhalation	4.04E-04	2.24E-06

4. Evaluation guidance to downstream user

For scaling see	Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

	Available hazard data do not support the need for a DNEL to be established for other health effects. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).	
Exposure assessment instrument/tool/method	Workers	ECETOC TRA v2.0 Worker
	environmental exposure	EUSES v2.1

Exposure Scenario 4 – Use as a fuel (professional)

1.0 Contributing Scenarios	
Sector of uses SU	22
Process category [PROC]	1 (Storage), 2, 3, 8a (maintenance), 8b (bulk), 8b (Drum), 8b (refueling), 9, 16
Chemical product category [PC]	not applicable
Article Categories [AC]	not applicable
Environmental release categories [ERC]	8b, 8e
Specific Environmental Release Categories SPERC	ESVOC3 SpERC

2.0 Operational conditions and risk management measures		
2.1 Control of worker exposure		
Product characteristics		
Physical form of product	Liquid with high volatility.	
Concentration of substance in product	Covers concentrations up to 15%	
Human factors not influenced by risk management		
Potential exposure area	Not defined	
Frequency and duration of use		
Exposure duration per day	PROC8b (refuelling)	Covers exposure up to 1 hours
	PROC2, PROC8a (maintenance), PROC8b (bulk), PROC9	Covers exposure up to 4 hours
	All other scenarios	Covers exposure up to 8 hours
Other operational conditions affecting worker exposure		
Area of use	PROC8b (Drum), PROC16	Outdoor
	All other scenarios	Indoor
Characteristics of the surroundings	Not defined	
General measures applicable to all activities Assumes use at not more than 20°C above ambient temperature, unless stated differently. Assumes a good basic standard of occupational hygiene is implemented.		
Organisational measures		
PROC8a (maintenance)	Drain or remove substance from equipment prior to break-in or maintenance. Inhalation Efficiency of at least 90%	
PROC3, PROC8b (refueling)	Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Efficiency of at least 70%	
PROC16	Use only outdoors or in a well-ventilated area. Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Efficiency of at least 70%	
Technical conditions of use		
PROC8b (bulk), PROC8b (Drum)	Mandatory use of Stage 1 Vapour Recovery. Efficiency of at least 80%	
PROC9	Use drum pumps. Efficiency of at least 80%	
Risk management measures related to human health		
Respiratory protection	PROC2, PROC8a (bulk), PROC8a (maintenance), PROC8b (refueling), PROC9	If exposure duration cannot be achieved, wear a respirator conforming to EN140 with Type A filter or better.
Hand and/or Skin protection	No special measures are required.	
Eye Protection	No special measures are required.	
Other operational conditions affecting worker exposure		
None.		
2.2 Control of environmental exposure		
Amounts used		
Fraction of EU tonnage used in region:	Not defined	
Regional use tonnage (tons/year):	Not defined	
Fraction of Regional tonnage used locally: tons/year	Not defined	
Annual site tonnage (tons/year):	Not applicable - Dispersive use	
Maximum daily site tonnage (kg/day)	4.94	
Environment factors not influenced by risk management		
Flow rate of receiving surface water (m^3/d):	20,000	

Local freshwater dilution factor:	10
Local marine water dilution factor:	100
Operational conditions	
Emission days (days/year):	365 (Dispersive use)
Release fraction to air from process (initial release prior to RMM):	1.0E-04
Release fraction to wastewater from process (initial release prior to RMM):	1.0E-05
Release fraction to soil from process (initial release prior to RMM):	1.0E-05
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Treat air emission to provide a typical removal efficiency of (%):	0
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of (%):	95
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of (%):	0
Treat soil emission to provide a typical removal efficiency of (%):	0
Note: Common practices vary across sites thus conservative process release estimates used. No wastewater treatment required.	
Organisational measures to prevent/limit release from site	
Prevent discharge of undissolved substance to or recover from onsite wastewater.	
Conditions and measures related to municipal sewage treatment plant	
Not applicable	
Conditions and measures related to external treatment of waste for disposal	
Not applicable	
Substance release quantities after risk management measures	
Release to waste water from process (mg/l)	Not defined
Maximum allowable site tonnage (MSafe) (kg/d):	Not defined

3. Exposure estimation and reference to its source

3.1 Human exposure prediction

Exposure assessment (method/calculation model)	ECETOC TRA v2.0 Worker

	Inhalation		Dermal		General Comment Regarding All Proc's
Process category [PROC]	**inhalation exposure (mg/m³)**	**Risk characterisation ratio (RCR)**	**dermal exposure(mg/kg bw/day)**	**Risk characterisation ratio (RCR)**	**Risk characterisation ratio (RCR)**
PROC1 (Storage)	0.25	0.00	0.2	0.00	0.00
PROC2	76	0.72	0.20	0.00	0.72
PROC3	76	0.72	8.2	0.00	0.72
PROC8a (maintenance)	76	0.72	8.2	0.00	0.72
PROC8b (bulk)	76	0.72	4.1	0.00	0.72
PROC8b (drum)	89	0.84	2.1	0.00	0.84
PROC8b (refueling)	38	0.36	2.1	0.00	0.36
PROC9	76	0.72	4.1	0.00	0.72
PROC16	89	0.84	0.20	0.00	0.84

3.2 Environmental exposure prediction

Exposure assessment (method/calculation model)	EUSES v2.1

environmental exposure	STP	freshwater	marine water	soil	freshwater sediment	marine sediment
RCR	4.16E-07	8.51E-04	3.35E-03	2.22E-05	4.78E-05	4.78E-05
PEC	5.20E-06	4.34E-04	5.70E-05	5.35E-05	5.27E-04	6.93E-05

Human exposure prediction

Route of Exposure	Exposure (µg kg^{-1} day^{-1})	RCR
Oral	2.98E-05	2.38E-06

	Inhalation	1.41E-04	7.84E-06

4. Evaluation guidance to downstream user		
For scaling see	Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not support the need for a DNEL to be established for other health effects. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).	
Exposure assessment instrument/tool/method	Workers	ECETOC TRA v2.0 Worker
	environmental exposure	EUSES v2.1

Exposure Scenario 5 – Use as a fuel (Consumer)

1.0 Contributing Scenarios	
Sector of uses SU	21
Process category [PROC]	not applicable
Chemical product category [PC]	PC13 (refueling cars)
Article Categories [AC]	not applicable
Environmental release categories [ERC]	8d
Specific Environmental Release Categories SPERC	ESVOC30 SpERC

2.0 Operational conditions and risk management measures	
2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Liquid with high volatility.
Concentration of substance in product	Covers concentrations up to 15%
Human factors not influenced by risk management	
Potential exposure area	Not defined
Operational conditions	
Area of use	Not defined
Characteristics of the surroundings	Not defined
Risk management measures	
Respiratory protection	No specific measures identified.
Hand/Skin protection	No specific measures identified.
Eye Protection	No specific measures identified.
2.2 Control of environmental exposure	
Amounts used	
Fraction of EU tonnage used in region:	Not defined
Regional use tonnage (tons/year):	Not defined
Fraction of Regional tonnage used locally: tons/year	Not defined
Annual site tonnage (tons/year):	Not defined
Maximum daily site tonnage (kg/day):	4.94
Environment factors not influenced by risk management	
Flow rate of receiving surface water (m^3/d):	20,000
Local freshwater dilution factor:	10
Local marine water dilution factor:	100
Operational conditions	
Emission days (days/year):	365 (Dispersive use)
Release fraction to air from process (initial release prior to RMM):	1.0E-02
Release fraction to wastewater from process (initial release prior to RMM):	1.0E-05
Release fraction to soil from process (initial release prior to RMM):	1.0E-05
Organisational measures to prevent/limit release from site	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Treat air emission to provide the required removal efficiency of (%):	0
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of (%):	95
Estimated substance removal from wastewater via on-site sewage treatment (%):	0
Treat soil emission to provide a typical removal efficiency of (%):	0
Note: No specific measures identified.	
Conditions and measures related to municipal sewage treatment plant	
Size of municipal sewage system/treatment plant (m^3/d)	2,000
Degradation effectiveness (%)	95
Conditions and measures related to external treatment of waste for disposal	
Combustion emissions limited by required exhaust emission controls. External treatment and disposal of waste should comply with applicable local and/or national regulations.	
Substance release quantities after risk management measures	
Release to waste water from process (mg/l)	Not defined
Maximum allowable site tonnage (MSafe) (kg/d):	Not defined

3. Exposure estimation and reference to its source

3.1 Human exposure prediction

Exposure assessment (method/calculation model)	ECETOC TRA

Note: Oral exposure is not expected to occur.

	Inhalation		Dermal		Overall
Process category [PROC]	**inhalation exposure (mg/m³)**	**Risk characterisation ratio (RCR)**	**dermal exposure(mg/kg bw/day)**	**Risk characterisation ratio (RCR)**	**inhalation exposure (mg/m³)**
PC13 (refueling cars)	0.026	4.13E-04	0.0011	2.81E-06	4.16E-04

3.2 Environmental exposure prediction

Exposure assessment (method/calculation model)	EUSES v2.1

environmental exposure	**STP**	**freshwater**	**marine water**	**soil**	**freshwater sediment**	**marine sediment**
RCR	4.16E-07	8.51E-04	3.35E-03	2.22E-05	4.78E-05	4.78E-05
PEC	5.2E-06	4.34E-04	5.70E-05	5.35E-05	5.27E-04	6.93E-05

Indirect exposure to humans via the environment:

Exposure route	**Exposure estimation (µg/kg/day)**	**Risk characterisation ratio (RCR)**
Oral	2.98E-05	2.38E-06
Inhalation	1.41E-04	7.84E-06

4. Evaluation guidance to downstream user

For scaling see	Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not support the need for a DNEL to be established for other health effects. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).	
Exposure assessment instrument/tool/method	Workers	Exposure measured (EU RAR of MTBE)
	environmental exposure	EUSES v2.1