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

1.1 Product identifier

Product Name	MTBE
Product Description	V4033a-MTBE-MTBE
Trade Name	MTBE
Product code	V4033a, MTBE
Chemical Name	Methyl Tertiary Butyl Ether
CAS No.	1634-04-4
EC No.	216-653-1
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	Distribution of MTBE (Industrial)	**11**
2	Formulation of MTBE	**15**

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
Skin Irrit. 2; H315

2.2 Label elements

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

Product Name: V4033a-MTBE-MTBE

Hazard Pictogram(s)

Signal Word(s): Danger

Hazard Statement(s):

H225: Highly flammable liquid and vapour.
H315: Causes skin irritation.

Precautionary Statement(s):

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P240: Ground/bond container and receiving equipment.
P243: Take precautionary measures against static discharge.

P280: Wear protective gloves/protective clothing/eye protection/face protection.
P302+P350: IF ON SKIN: Gently wash with plenty of soap and water.
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	-	≥ 99.9 - ≤ 100

Hazard impurities

SUBSTANCE	CAS No.	EC No.	%W/W	Hazard classification
Methanol	67-56-1	200-659-6	> 0.0 - < 0.1%	Flammable Liquid, Category 2; H225: Highly flammable liquid and vapour. Acute toxicity, Category 3; H301: Toxic if swallowed. Acute toxicity, Category 3; H311: Toxic in contact with skin. Acute toxicity, Category 3; H331: Toxic if inhaled. Specific target organ toxicity — single exposure, Category 1; H370: Causes damage to organs.

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. Repeated exposure may cause skin dryness or cracking.
Ingestion: Aspiration into the lungs may cause chemical pneumonitis, which can be fatal. Ingestion may cause irritation of the gastrointestinal tract. Headache, Dizziness, Nausea, Fatigue, Weakness.

4.3 Indication of any immediate medical attention and special treatment needed

IF SWALLOWED: Do NOT induce vomiting, if vomiting does occur, have victim lean forward to reduce risk of aspiration.

Notes to a physician:	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**	Extremely 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
	Incompatible materials	Materials to avoid: Most plastics, Viton, Flourel 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

SUBSTANCE	CAS No.	LTEL (8 hr TWA ppm)	LTEL (8 hr TWA mg/m³)	STEL (ppm)	STEL (mg/m³)	Note
Methyl tert-butyl ether	1634-04-4	25	92	75	275	WEL
Methanol	67-56-1	200	266	250	333	WEL, Sk

Source: WEL: Workplace Exposure Limit (UK HSE EH40). Note: Sk; Can be absorbed through the skin. The assigned substances are those for which there are concerns that dermal absorption will lead to systemic toxicity.

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	-	178.5	5100
Industry - Short term - Local effects	-	357	-
Consumer - Long Term - Systemic effects	7.1	53.6	3570
Consumer - Long Term - Local effects	-	214	-

PNEC	MTBE
Aquatic Compartment	PNEC aqua (freshwater) 5.1 mg/L PNEC aqua (marine water) 0.26 mg/L PNEC aqua (intermittent releases) 47.2 mg/L PNEC STP 71 mg/L PNEC sediment (freshwater) 23 mg/kg sediment dw PNEC sediment (marine water) 1.17 mg/kg sediment dw
Terrestrial Compartment	PNEC soil 1.56 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). Recommended: Nitrile rubber. 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
Odour	Characteristic terpene-like
Odour threshold	Not established.
pH	Not established.
Melting point/freezing point	- 108.6 °C
Initial boiling point and boiling range	55.3 °C
Flash point	- 28 °C
Evaporation rate	Not established.
Flammability (solid, gas)	Not applicable - Liquid
Upper/lower flammability or explosive limits	Flammable Limits (Upper) (%v/v): 8.4 Flammable Limits (Lower) (%v/v): 1.6
Vapour pressure	33000 Pa @ 25°C
Vapour density	Not established.
Relative density	0.74 g/cm³ @ 20 °C
Solubility(ies)	Water 41850 mg/l @ 20 °C Partially soluble.
Partition coefficient: n-octanol/water	1.06 log P
Auto-ignition temperature	460 °C
Decomposition Temperature	Not established.
Viscosity	0.464 mm²/s (static) at 20 °C 0.409 mm²/s (static) at 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	Based upon the available data, the classification criteria are not met.
Ingestion	Not classified. LD50 > 2000 mg/kg bw/day (rat) OECD 401 BM 1996a
Inhalation	Not classified. LC50 85 mg/l @ 4 hour(s) (rat) OECD 403 Industrial Bio-test Laboratories, Inc. (1969a)
Skin Contact	Not classified. LD50 > 2000 mg/kg bw/day (rabbit) OECD 402 RBM (1996c)
Skin corrosion/irritation	Skin Irrit. 2: OECD 404 (rabbit) Hüls, 1985a Mean erythema score :4 Mean edema score : 4
Serious eye damage/irritation	Based upon the available data, the classification criteria are not met. Hüls,1985b Mean conjuctivae score: 1.3 Mean chemosis score: 0.4 Mean cornea score: 0 Mean iris score: 0
Respiratory or skin sensitization	Based upon the available data, the classification criteria are not met.
Skin sensitization	Negative OECD 406 1% MTBE/ Water solution Inveresk Research International, 1979b
Respiratory sensitization	No data.
Germ cell mutagenicity	Based upon the available data, the classification criteria are not met.
In Vivo	Negative UDS test Bushy Run Research Center, 1994
In Vitro	10,000 µg/ml No effects are observed at this level OECD 476 Life Science

		Research (1989b)
	Carcinogenicity	Based upon the available data, the classification criteria are not met.
	Ingestion	NOAEL: 330 mg/kg bw/day) (chronic; rat) Dodd DE, Layko DK, Bermudez E (2010)
	Inhalation	NOAEC: 1465 mg/m³ (chronic; rat) Non-classified Human Carcinogen Cruzan et al (2007)
	Skin Contact	No data.
	Reproductive toxicity	Based upon the available data, the classification criteria are not met.
	Toxicity for reproduction	NOAEC 400 ppm Bevan et al., 1997a
	Developmental Toxicity	NOAEC 8,000 ppm Bevan et al., 1997b =
		Developmental toxicity evaluation of methyl tertiary-butyl ether (MTBE) by inhalation in mice and rabbits. Journal of Applied Toxicology, 17, S21-9. Bevan C, Tyl RW, Neeper-Bradley TL, Fisher LC, Panson RD, Douglas JF & Andrews LS
	STOT - single exposure	Based upon the available data, the classification criteria are not met. No effects in humans. Prah DJ, Goldstein GM, Devlin R, Otto D, Ashley D, House D, Cohen (1994)
	STOT - repeated exposure	Based upon the available data, the classification criteria are not met.
	Ingestion	Liver / Kidneys NOAEL: 209 mg/kg bw/day (subchronic; rat) CIIT, 2007
	Inhalation	Liver / Kidneys NOAEC: 2856 mg/m³ (subchronic; rat) Bushy Run Research Center, 1989a
	Skin Contact	No data.
	Aspiration hazard	Based upon the available data, the classification criteria are not met. Not classified. LD50 > 2000 mg/kg bw/day (rat) OECD 401 BM 1996a
11.2	**Other information**	None.

SECTION 12: ECOLOGICAL INFORMATION

12.1	**Toxicity**	Not classified as a Marine Pollutant.
	Aquatic Compartment Acute	LC50 for freshwater fish: 672 mg/L Geiger DL, Call DJ & Brooke LT (1988) LC50 for marine water fish: 574 mg/L Ben Kinney MT, Barbieri JF, Gross JS & Naro PA (1994)
	Aquatic Compartment Chronic	31-d NOEC freshwater fish: 299 mg/l ENSR (1999b)
12.2	**Persistence and degradibility**	Not readily biodegradable.
	Water	Not readily biodegradable. 28d: 69% (Unamed publication 2006)
	Soil	Not readily biodegradable. 151d 69% (Unamed publication 2006)
12.3	**Bioaccumulative potential**	The substance has low potential for bioaccumulation. Bioconcentration factor (BCF) : 1.5 Fujiwara et al., 1984
12.4	**Mobility in soil**	Fugacity: Water 6.04% European Commission (2002)
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

SECTION 14: TRANSPORT INFORMATION

		ADR/RID	IMDG/ADN
14.1	**UN number**	UN 2398	UN 2398
14.2	**Proper Shipping Name**	METHYL tert-BUTYL ETHER	METHYL tert-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**	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.
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code**	Product Name: Methyl tert-butyl ether Pollution Category: Z Ship type: 3
14.8	**Additional Information**	HIN: 33 EmS: F-E, S-D Tunnel Code: 3 (D/E) Limited Quantity: 1L Limited Quantity: 1L

SECTION 15: REGULATORY INFORMATION

15.1	**Safety, health and environmental regulations/legislation specific for the substance or mixture**	
15.1.1	**EU regulations**	
	CoRAP Substance Evaluation	Tert-Butyl Methyl Ether: Yes - Substance evaluated in 2014; evaluating Member State has proposed to ask the registrants to provide further information Methanol: Yes - Substance evaluated in 2012; evaluating Member State has proposed to ask the registrants to provide further information.
	Seveso	Tert-Butyl Methyl Ether: Upper Tier: 50000 tonnes, Lower Tier: 5000 tonnes Methanol: Upper Tier: 5000 tonnes, Lower Tier: 5000
15.1.2	**National regulations**	Not applicable.
15.2	**Chemical Safety Assessment**	A REACH chemical safety assessment has been carried out. 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

Page Header	Updated version and date
Section 14	Updated 14.6 and 14.7

References:
Existing ECHA registration(s) for MTBE (CAS No. 1634-04-4) and Chemical Safety Report. EH40 – UK Occupational Exposure Limits. Existing ECHA registration(s) for Methanol (CAS No. 67-56-1).

This Safety Data Sheet was prepared in accordance with EC Regulation (EC) 1907/2006 (REACH), 1272/2008 (CLP) & 2015/830.

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.

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Annex to the extended Safety Data Sheet (eSDS)
Page: 9

Tert-Butyl Methyl Ether

CAS No. 1634-04-4
EC No. 216-653-0

Summary of Parameters

Physical parameters			
Vapour pressure (hPa)			33
Partition Coefficient (log K_{OW})			1.06
Aqueous solubility (mg/l)			41850
Molecular weight			88.15
Biodegradability			Not readily biodegradable.
Human Health (DNEL)			
Workers	Short term	Inhalation (mg/m³)	357 (100 ppm)
		Dermal (mg/kg bw/day)	Not defined
	Long Term	Inhalation (mg/m³)	178.5 (50 ppm)
		Dermal (mg/kg bw/day)	5100
Consumer		Inhalation (mg m^{-3})	53.6
		Dermal (mg kg^{-1} bw day^{-1})	3570
		Oral (mg kg^{-1} bw day^{-1})	7.1
Environmental Parameters (PNECs)			
STP (mg/l)			71
freshwater (mg/l)			5.1
marine water (mg/l)			0.26
freshwater sediment (mg/kg dry weight)			23
marine sediment (mg/kg dry weight)			1.17
Soil (mg/kg dry weight)			1.56

Contents

Contributing Scenarios

Contributing Scenarios
PROC1 Use in closed process, no likelihood of exposure
PROC2 Use in closed, continuous process with occasional controlled exposure
(Storage) Use in closed, continuous process with occasional controlled exposure, bulk Storage
PROC3 Use in closed batch process (synthesis or formulation)
(Sampling) Use in closed batch process (synthesis or formulation). Sample collection at ventilation at ventilated sample points.
(elevated) Use in closed batch process (synthesis or formulation). Batch process at elevated temperature with sampling.
PROC5 Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC8a (maintenance) Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. Clean down and maintenance of vessels and containers.
(bulk) Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. Bulk open loading and unloading.
(Drum/batch transfers) Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. Drum/batch transfers
PROC8b (bulk) Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities. Bulk transfers (closed systems).
(Drum/batch transfers) Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.
PROC15 Use as laboratory reagent

Exposure Scenario 1 – Industrial distribution of MTBE and gasoline containing MTBE

1.0 Contributing Scenarios	
Sector of uses SU	SU3 Industrial uses: Uses of substances as such or in preparations at industrial sites
Process category [PROC]	1 2 2 (Storage) 3 3 (Sampling) 4 8a (maintenance) 8a (bulk) 8b (bulk) 9 15
Chemical product category [PC]	not applicable
Article Categories [AC]	not applicable
Environmental release categories [ERC]	ERC1 Manufacture of substances ERC2 Formulation of preparations
Specific Environmental Release Categories SPERC	ESVOC 3

2.0 Operational conditions and risk management measures		
2.1 Control of worker exposure		
Product characteristics		
Physical form of product	Liquid	
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	PROC1, PROC2, PROC4, PROC8a (maintenance), PROC8a (bulk), PROC9, PROC15	Covers daily exposures up to 8 hours (unless stated differently).
	PROC3	Covers exposure up to 4 hours
	PROC2 (Storage), PROC8b (bulk)	Covers exposure up to 1 hour(s)
	PROC3 (Sampling)	< 0.25 hours
Exposure duration per year	300 days per year	
Other operational conditions affecting worker exposure		
Area of use	PROC1, PROC2, PROC2 (Storage), PROC3, PROC3 (Sampling) PROC8a (maintenance), PROC8a (bulk), PROC8b (bulk)	Outdoor
	PROC4, PROC9, PROC15	Indoor
Characteristics of the surroundings	Not defined	
General measures applicable to all activities Provide basic employee training to prevent / minimize exposures. Report any skin problems that may develop.		
Technical conditions of use		
Common practices vary across sites thus conservative process release estimates used.		
Organisational measures		
PROC8a	Drain down and flush system prior to equipment break-in or maintenance. Efficiency of at least 90%	
Risk management measures related to human health		
General measures (skin irritants)	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off any skin contamination immediately. Provide basic employee training to prevent /minimise exposures and to report any skin problems that may develop.	

PROC1. General exposures (closed systems)	No specific measures identified
PROC2 General exposures (closed systems) with sample collection & Storage. General exposures (closed systems) with sample collection.	Ensure operation is undertaken outdoors
PROC3 Process sampling	Ensure operation is undertaken outdoors. Avoid carrying out activities involving exposure for more than 15 minutes, or, Wear a respirator conforming to EN140 with Type A filter or better.
PROC3 General exposures (closed systems). Use in contained batch processes with sample collection	Ensure operation is undertaken outdoors. Avoid carrying out activities involving exposure for more than 4 hours , or, Wear a respirator conforming to EN140 with Type A filter or better.
PROC 4 General exposures (open systems) Batch process with sample collection. Filling / preparation of equipment from drums or containers.	Provide extract ventilation to points where emissions occur. Ensure samples are obtained under containment or extract ventilation.
PROC 8a Bulk open loading and unloading. Non-dedicated facility.	Ensure material transfers are under containment or extract ventilation. or, Wear a respirator conforming to EN140 with Type A filter or better.
PROC8a. Equipment cleaning and maintenance. Non-dedicated facility.	Drain down and flush system prior to equipment break-in or maintenance.
PROC8b. Bulk closed loading and unloading. Dedicated facility	Ensure operation is undertaken outdoors. Avoid carrying out activities involving exposure for more than 1 hour, or, Wear a respirator conforming to EN140 with Type A filter or better.
PROC9. Drum and small package filling. Dedicated facility.	Use drum pumps. Fill containers/cans at dedicated fill points supplied with local extract ventilation.
PROC15. Laboratory activities, Cleaning, Wiping, Rolling, Brushing	Handle in a fume cupboard or under extract ventilation

Other operational conditions affecting worker exposure

Provide basic employee training to prevent/minimise exposures and to report any skin problems that may develop.Assumes a good basic standard of occupational hygiene is implemented. Assumes use at not more than 20°C above ambient temperature, unless stated differently. Outdoor use. Common practices vary across sites thus conservative process release estimates used.

2.2 Control of environmental exposure

Amounts used

Fraction of EU tonnage used in region:	0.57	
Regional use tonnage (tons/year):	6.59E+05	
Fraction of Regional tonnage used locally: tons/year	1	
Annual site tonnage (tons/year):	6.59E+05	
Average daily use (kg/day)	1,805,479	
Environment factors not influenced by risk management		
Flow rate of receiving surface water (m^3/d):	Not defined (default = 18,000)	
Local freshwater dilution factor:	10	
Local marine water dilution factor:	100	
Operational conditions	***Distribution***	***Storage***
Emission days (days/year):	300	300
Release fraction to air from process (initial release prior to RMM):	0.0001	0
Release fraction to wastewater from process (initial release prior to RMM):	0.00001	8.4kg/day
Release fraction to soil from process (initial release prior to RMM):	0.05	0
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 (%):	Distribution: $\geq$ 95 Storage: $\geq$ 99	
Treat soil emission to provide a typical removal efficiency of (%):	not applicable - no direct release to soil	
Common practices vary across sites thus conservative process release estimates used.		
Organisational measures to prevent/limit release from site		
Prevent discharge of undissolved substance to or recover from onsite wastewater. Prevent leakages and spillages to soil.		
Conditions and measures related to municipal sewage treatment plant		
Size of municipal sewage system/treatment plant (m^3/d)	2000	
Degradation effectiveness (%)	Not defined.	
Conditions and measures related to external treatment of waste for disposal		
Not defined		
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
2.2b Control of environmental exposure (Distribution of substance)	
Amounts used	
Fraction of EU tonnage used in region:	0.57
Regional use tonnage (tons/year):	6.59E+05
Fraction of Regional tonnage used locally: tons/year	0.02
Annual site tonnage (tons/year):	13,180
Average daily use (kg/day)	37,657
Environment factors not influenced by risk management	
Flow rate of receiving surface water (m^3/d):	Not defined (default = 18,000)
Local freshwater dilution factor:	10
Local marine water dilution factor:	100
Operational conditions	
Emission days (days/year):	300
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 (%):	Transport: ≥ 95 Storage: ≥ 99
Treat soil emission to provide a typical removal efficiency of (%):	0
Common practices vary across sites thus conservative process release estimates used.	
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)	2000
Degradation effectiveness (%)	Not defined.
Conditions and measures related to external treatment of waste for disposal	
Not defined	
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 Tables
Process category [PROC]	**inhalation exposure 8 hour (ppm)**	**Risk characterisation ratio (RCR)**	**dermal exposure (mg/kg bw/day)**	**Risk characterisation ratio (RCR)**	**Risk characterisation ratio (RCR)**
PROC 1	0.01	<0.01	0.03	<0.001	<0.01
PROC 2	18	0.35	0.27	<0.001	0.35
PROC 3	21	0.42	0.082	<0.001	0.42
PROC 3 (sampling)	3.4	0.07	0.013	<0.001	0.07
PROC 4	10	0.2	0.13	<0.001	0.2
PROC 8a	25	0.5	0.27	<0.001	0.5
PROC 8a (maintenance)	25	0.5	2.7	<0.001	0.5
PROC 8b	21	0.42	0.54	<0.001	0.42
PROC 9	4	0.08	0.13	<0.001	0.08
PROC 15	5	0.1	0.0068	<0.001	0.1

3.2 Environmental exposure prediction

Exposure assessment (method/calculation model)	EUSES

Storage

environmental	STP	freshwater	marine water	soil	freshwater	marine sediment

exposure					sediment	
PEC Environment	0.00978	0.00182	0.000208	0.00902	0.00174	0.000198
RCR	1.38E-04	3.57E-04	8.00E-04	6.54E-03	3.48E-04	7.92E-04

Human exposure prediction

Route of Exposure	Exposure	RCR
Oral	2.7 mg/kg/day	<0.001
Inhalation	25 ppm / 8 hr	0.5

Distribution

environmental exposure	STP	freshwater	marine water	soil	freshwater sediment	marine sediment
PEC Environment	0.00964	0.00181	0.00542	0.00164	0.00173	0.00531
RCR	1.36E-04	3.55E-4	2.08E-02	1.19E-03	3.46E-04	2.12E-02

Human exposure prediction

Route of Exposure	Exposure	RCR
Oral	2.7 mg/kg/day	<0.001
Inhalation	25 ppm / 8 hr	0.5

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
	environmental exposure	EUSES

Exposure Scenario 2 – Formulation of MTBE

1.0 Contributing Scenarios	
Sector of uses SU	SU3 Industrial uses: Uses of substances as such or in preparations at industrial sites
Process category [PROC]	1 2 2 (Storage) 3 3 (elevated) 4 5 8a (manual) 8a (maintenance) 8b (bulk) 8b (Drum/batch transfers) 9 15
Chemical product category [PC]	not applicable
Article Categories [AC]	not applicable
Environmental release categories [ERC]	ERC2 Formulation of preparations
Specific Environmental Release Categories SPERC	not applicable

2.0 Operational conditions and risk management measures		
2.1 Control of worker exposure		
Product characteristics		
Physical form of product	liquid	
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- 4 hours
	All other PROC's	Covers daily exposures up to 8 hours (unless stated differently).
Exposure duration per year	300 days per year	
Other operational conditions affecting worker exposure		
Area of use	Not defined (default = Indoor)	
Characteristics of the surroundings	Not defined	
General measures applicable to all activities Provide basic employee training to prevent/minimise exposures and to report any skin problems that may develop.		
Technical conditions of use		
PROC 1	No specific measures identified.	
PROC2 (closed systems, sample collection)	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Efficiency of at least 30%	
PROC2 (Storage, closed system, sample collection)	Avoid carrying out activities involving exposure for more than 4 hours. Alternatively: Wear a full face respirator conforming to EN140 with Type A filter or better.	
PROC 3 (closed systems, batch processes, sample collection) PROC 4, PROC 5	Provide extract ventilation to points where emissions occur.	
PROC 3 (open systems, batch processes elevated temperature, sample collection)	Provide extract ventilation to points where emissions occur. Formulate in enclosed or ventilated mixing vessels	
PROC3 (Sampling)	Provide extract ventilation to points where emissions occur. Avoid carrying out activities involving exposure for more than 15 minutes. Alternatively: Wear a full face respirator conforming to EN140 with Type A filter or better.	
PROC15	Use fume cupboard. Efficiency of at least 90%	
PROC 8b (Dedicated facility)	Provide extract ventilation to material transfer points and other openings.	
PROC 8b (Drum/batch transfers, Dedicated facility)	Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings. Avoid carrying out activities involving exposure for more than 1 hour. Alternatively: Wear	

	a full face respirator conforming to EN140 with Type A filter or better. Use drum pumps.	
PROC 9	Fill containers/cans at dedicated fill points supplied with local extract ventilation. Use drum pumps.	
PROC 8a	Avoid carrying out activities involving exposure for more than 4 hours. Alternatively: Wear a full face respirator conforming to EN140 with Type A filter or better.Drain down and flush system prior to equipment break-in or maintenance.	
Organisational measures		
PROC8a (maintenance)	Drain down and flush system prior to equipment break-in or maintenance. Efficiency of at least 90%	
Risk management measures related to human health		
Respiratory protection	PROC2 (Storage), PROC8a (maintenance)	If exposure exceeds 4 hours, wear a respirator conforming to EN140 with a type A filter or better. Efficiency of at least 90%
Hand and/or Skin protection	PROC1	No specific measures identified.
	All other PROC's	Wear suitable gloves tested to EN374. Efficiency of at least 80%
Eye Protection	No special measures are required.	
Other operational conditions affecting worker exposure		
Outdoor use. Common practices vary across sites thus conservative process release estimates used.		

2.2 Control of environmental exposure	
Amounts used	
Fraction of EU tonnage used in region:	Fraction of EU production volume: 0.25 Fraction of tonnage for application: 0.985 Fraction of chemical in formulation: 0.15
Regional use tonnage (tons/year):	6.59E+05
Fraction of Regional tonnage used locally: tons/year	0.05
Annual site tonnage (tons/year):	32,950
Average daily use (kg/day)	109,833
Environment factors not influenced by risk management	
Flow rate of receiving surface water (m^3/d):	Not defined (default = 18,000)
Local freshwater dilution factor:	10
Local marine water dilution factor:	100
Operational conditions	
Emission days (days/year):	300
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
Common practices vary across sites thus conservative process release estimates used.Prevent discharge of undissolved substance to or recover from onsite wastewater.	
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
Treat soil emission to provide a typical removal efficiency of (%):	0
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)	2000
Degradation effectiveness (%)	Not defined
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 Tables

Process category [PROC]	inhalation exposure 8 hour (ppm)	Risk characterisation ratio (RCR)	dermal exposure (mg/kg bw/day)	Risk characterisation ratio (RCR)	Risk characterisation ratio (RCR)
PROC1	0.01	<0.01	0.03	<0.001	<0.01
PROC2	18	0.35	0.27	<0.001	0.35
PROC2 (Storage)	15	0.3	0.16	<0.001	0.3
PROC3	5	0.1	0.013	<0.001	0.1
PROC3 (Sampling)	0.5	0.01	0.0013	<0.001	0.01
PROC4	10	0.2	0.13	<0.001	0.2
PROC5	25	0.5	0.27	<0.001	0.5
PROC8a (manual)	5	0.1	0.054	<0.001	0.1
PROC8a (maintenance)	15	0.3	1.6	<0.001	0.3
PROC8b (bulk)	7.5	0.15	0.13	<0.001	0.15
PROC8b (Drum/batch transfers)	0.3	<0.01	0.027	<0.001	<0.01
PROC 9	4	0.08	0.13	<0.001	0.08
PROC15	5	0.1	0.0068	<0.001	0.1

3.2 Environmental exposure prediction

Exposure assessment (method/calculation model)	ECETOC TRA v.2 EUSES 2008

environmental exposure	STP	freshwater	marine water	soil	freshwater sediment	marine sediment
PEC Environment	0.0101	0.00185	0.000211	0.0995	0.00177	0.000201
RCR	1.42E-04	3.63E-04	8.12E-04	7.21E-02	3.54E-04	8.04E-04

Human exposure prediction

Route of Exposure	Exposure (8 hour)	RCR
Dermal	0.27 mg/kg/day	< 0.001
Inhalation	25ppm	0.5

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 v.2
	environmental exposure	EUSES 2008