

SAFETY DATA SHEET



Revision: 1st March 2023 Version: 5.3

ACCORDING TO EC-REGULATIONS 1907/2006 (REACH), 1272/2008 (CLP) & 2020/878

MTBE V4033

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

1.1 Product identifier

Product Name	MTBE
Product Description	V4033-MTBE-MTBE
Trade Name	MTBE
Product code	V4033, MTBE
Chemical Name	Methyl Tertiary Butyl Ether
CAS No.	1634-04-4
EC No.	216-653-1
REACH Registration No.	01-2119452786-27-xxxx

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

Identified Use(s)

No.	Exposure Scenario	Page:
1	Distribution of substance: MTBE (Industrial)	11
2	Formulation of preparations (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
1201 Geneva
Switzerland
+31 10 498 7200
+31 10 452 9545
xreach@vitol.com

Telephone

Fax

E-Mail (competent person)

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

Product Name

According to Regulation (EC) No. 1272/2008 (CLP)
V4033-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.

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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	01-2119452786-27-xxxx	≥ 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%	Flam. Liq. 2; H225 Acute Tox. 3; H301 Acute Tox. 3; H311 Acute Tox. 3; H331 STOT SE 1; H370

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.

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- 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
Unsuitable extinguishing media
- 5.2 Special hazards arising from the substance or mixture**
- 5.3 Advice for fire-fighters**
- Extinguish with sand or dry chemical. Foam, Carbon dioxide, Water fog or dry powder
Do not use water jet. Direct water jet may spread the fire.
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.
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**
- 6.2 Environmental precautions**
- 6.3 Methods and material for containment and cleaning up**
- 6.4 Reference to other sections**
- 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.
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.
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.
See Section: 8,13

SECTION 7: HANDLING AND STORAGE

- 7.1 Precautions for safe handling**
- Maintenance**
- 7.2 Conditions for safe storage, including any incompatibilities**
- 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.
Observe precautions pertaining to confined space entry. Isolate, vent, drain, wash and purge systems or equipment before maintenance or repair.
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

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Storage temperature
Storage measures
Incompatible materials

product residue. Containers must not be punctured or destroyed by burning, even when empty.
Stable at ambient temperatures.
Keep only in original container. Suitable materials: Carbon steel
Materials to avoid: Most plastics, Viton, Flourel
Keep away from oxidising agents.
See Section: 1.2 and/or Exposure Scenario.

7.3 Specific end use(s)

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/m ³)	STEL (ppm)	STEL (mg/m ³)	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 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/m ³)	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 release) 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). Gloves should be changed regularly to avoid permeation problems. Breakthrough time of the glove material: refer to the information provided by the gloves' producer. Protective index 6, corresponding > 480 minutes of permeation time.

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Recommended: Nitrile rubber (Minimum thickness 0.4mm)

Body protection: Wear anti-static clothing and shoes.
small scale: Wear suitable coveralls to prevent exposure to the skin.
large scale: Chemical protection suit

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

Physical state	Liquid
Colour	Colourless
Odour	Characteristic terpene-like
Melting point/freezing point	- 108.6 °C
Boiling point or initial boiling point and boiling range	55.3 °C
Flammability	Not applicable - Liquid
Lower and upper explosion limit	Flammable Limits (Upper) (%v/v): 8.4 Flammable Limits (Lower) (%v/v): 1.6
Flash point	- 28 °C
Auto-ignition temperature	460 °C
Decomposition temperature	Not established. No data available
pH	Not established. No data available
Kinematic viscosity	0.464 mm ² /s (static) at 20 °C
Solubility	Water 41850 mg/l @ 20 °C Partially soluble.
Partition coefficient: n-octanol/water (log value)	1.06 log P
Vapour pressure	33000 Pa @ 25°C
Density and/or relative density	0.74 g/cm ³ @ 20 °C
Relative vapour density	Not established. No data available
Particle characteristics	Not established. No data available

9.2 Other information

None known.

SECTION 10: STABILITY AND REACTIVITY

10.1 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 products	Carbon monoxide, Carbon dioxide

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on hazard classes as defined in

Regulation (EC) No 1272/2008

Acute toxicity - Ingestion

Based upon the available data, the classification criteria are not met.
Not classified. LD50 > 2000 mg/kg bw/day (rat) OECD 401

Acute toxicity - Inhalation

Based upon the available data, the classification criteria are not met.
Not classified. LC50 85 mg/l @ 4 hour(s) (rat) OECD 403

Acute toxicity - Skin contact

Based upon the available data, the classification criteria are not met.

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Skin corrosion/irritation	Not classified. LD50 > 2000 mg/kg bw/day (rabbit) OECD 402 Skin Irrit. 2: OECD 404 (rabbit) Mean erythema score :4 Mean edema score : 4
Serious eye damage/irritation	Based upon the available data, the classification criteria are not met.
Respiratory or skin sensitisation	Based upon the available data, the classification criteria are not met.
Skin sensitization	Negative OECD 406 1% MTBE/ Aqueous solution
Respiratory sensitization	No data
Germ cell mutagenicity	Based upon the available data, the classification criteria are not met.
In Vivo	Negative UDS test
In Vitro	10,000 µg/ml No effects are observed at this level OECD 476
Carcinogenicity	Based upon the available data, the classification criteria are not met.
Ingestion	NOAEL: 330 mg/kg bw/day (Chronic; Rat)
Inhalation	NOAEC: 1465 mg/m ³ (Chronic; Rat) Non-classified Human Carcinogen
Skin Contact	No data.
Reproductive toxicity	Based upon the available data, the classification criteria are not met.
Toxicity for reproduction	NOAEC 400 ppm
Developmental Toxicity	NOAEC 8,000 ppm 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.
STOT - Repeated Exposure	Based upon the available data, the classification criteria are not met.
Ingestion	Liver / Kidneys NOAEL: 209 mg/kg bw/day (Chronic; Rat)
Inhalation	Liver / Kidneys NOAEC: 2856 mg/m ³ (Chronic; Rat)
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
11.2 Information on other hazards	
11.2.1 Endocrine disrupting properties	This substance does not have endocrine disrupting properties with respect to humans.
11.2.2 Other information	None.

SECTION 12: ECOLOGICAL INFORMATION

12.1 Toxicity	Not classified as a Marine Pollutant.
Aquatic Compartment Acute	LC50 Freshwater Fish: 672 mg/L LC50 Marine Fish: 574 mg/L
Aquatic Compartment Chronic	31-d NOEC Freshwater Fish: 299 mg/l
12.2 Persistence and degradability	Not readily biodegradable.
Water	Not readily biodegradable. 28d: 69% (Unnamed publication 2006)
Soil	Not readily biodegradable. 151d 69% (Unnamed publication 2006)
12.3 Bioaccumulative potential	The substance has low potential for bioaccumulation. Bioconcentration factor (BCF) : 1.5
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 Endocrine disrupting properties	This substance does not have endocrine disrupting properties with respect to non-target organisms.
12.7 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,
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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
EU Waste Codes: HP3, HP4

Waste classification according to Directive 2008/98/EC (Waste Framework Directive)

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 Maritime transport in bulk according to IMO instruments	Product Name: Methyl tert-butyl ether Pollution category: Z Ship type: 3	
14.8 Additional Information	HIN: 33 Tunnel Code: 3 (D/E) Limited Quantity: 1L	EmS: F-E, S-D 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: New SDS Regulation 2020/878 format, all sections have been updated to include new information. Please review SDS with care.

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).

EU Classification: This Safety Data Sheet was prepared in accordance with EC Regulation (EC) 1907/2006 (REACH), 1272/2008 (CLP) & 2020/878

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Legend

ADR	ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
ADN	ADN: European Agreement on the International Transport of Dangerous Goods by Inland Waterways
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures
DNEL	Derived no effect level
IATA	IATA: International Air Transport Association
ICAO	ICAO: International Civil Aviation Organization
IMDG	IMDG: International Maritime Dangerous Goods
LTEL	Long term exposure limit
PBT	PBT: Persistent, Bioaccumulative and Toxic
PNEC	Predicted No Effect Concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RID	RID: Regulations concerning the international railway transport of dangerous goods
STEL	Short term exposure limit
vPvB	vPvB: very Persistent and very Bioaccumulative
OECD	Organisation for Economic Cooperation and Development

Hazard classification / Classification code:

Flam. Liq. 2, Flammable liquid, Category 2
Acute Tox. 3, Acute Toxicity, Category 3
Acute Tox. 3, Acute Toxicity, Category 3
Skin Irrit. 2, Skin irritation, Category 2
Acute Tox. 3, Acute Toxicity, Category 3
STOT SE 1, Specific target organ toxicity - Single exposure, Category 1

Hazard Statement(s)

H225: Highly flammable liquid and vapour.
H301: Toxic if swallowed.
H311: Toxic in contact with skin.
H315: Causes skin irritation.
H331: Toxic if inhaled.
H370: Causes damage to organs.

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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Annex to the extended Safety Data Sheet (eSDS)

See below -

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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/m ³)	357 (100 ppm)
		Dermal (mg/kg bw/day)	Not defined
	Long Term	Inhalation (mg/m ³)	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	

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Exposure scenario 2	Formulation of MTBE	15

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 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

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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	

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	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.	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 use, 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 / minimize 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: ≥ 95 Storage: ≥ 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

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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

Process category [PROC]	Inhalation		Dermal		General Comment Regarding All Tables
	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

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3.2 Environmental exposure prediction

Exposure assessment (method/calculation model) EUSES

Storage

environmental exposure	STP	freshwater	marine water	soil	freshwater sediment	marine 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

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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 / minimize 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 systems, 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 process, Sample collection) PROC 4, PROC 5	Provide extract ventilation to points where emissions occur.	
PROC 3 (Open systems, Batch processes at elevated temperatures, 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%	

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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 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

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Exposure assessment (method/calculation model)	ECETOC TRA
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Process category [PROC]	Inhalation		Dermal		General Comment Regarding All Tables
	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
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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