

SAFETY DATA SHEET

In accordance with Occupational Safety and Health Act's Standard of Classification and Labelling of Chemical Substances and MSDS

Butadiene

Version 5.7

Revision Date 2024.06.06

MSDS number 9130
Print Date 2024.06.13

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Butadiene
Product code : X2137, I1520
CAS-No. : 106-99-0
Other means of identification : 1,3-butadiene, Vinyl ethylene

Recommended use of the chemical and restrictions on use

Recommended use : Base chemical., Raw material for use in the chemical industry.

Restrictions on use : This product must not be used in applications other than the above without first seeking the advice of the supplier.

Manufacturer or supplier's details

Supplier : SHELL EASTERN CHEMICALS (S)
A REGISTERED BUSINESS OF SHELL EASTERN
TRADING (PTE) LTD (UEN:198902087C)
9 North Buona Vista Drive , #07-01
The Metropolis Tower 1
Singapore 138588
Singapore
Telephone : +65 6384 8269
Telefax : +65 6384 8454
Contact for Safety Data Sheet : sccmsds@shell.com
Emergency telephone number : + (65) 6542 9595 (Alert-SGS)

2. HAZARDS IDENTIFICATION

GHS Classification

Flammable gases : Category 1A
Gases under pressure : Liquefied gas
Germ cell mutagenicity (Inhalation) : Category 1B
Carcinogenicity (Inhalation) : Category 1A

GHS label elements

Hazard pictograms :



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Signal word

: Danger

Hazard statements

: PHYSICAL HAZARDS:
H220 Extremely flammable gas.
H280 Contains gas under pressure; may explode if heated.
HEALTH HAZARDS:
H340 May cause genetic defects if inhaled.
H350 May cause cancer.
ENVIRONMENTAL HAZARDS:
Not classified as an environmental hazard under GHS criteria.

Precautionary statements

:
Prevention:
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P243 Take precautionary measures against static discharge.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:
P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 Eliminate all ignition sources if safe to do so.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.

Storage:
P410 + P403 Protect from sunlight. Store in a well-ventilated place.
P405 Store locked up.

Disposal:
P501 Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations.

Other hazards which do not result in classification

Vapours are heavier than air. Vapours may travel across the ground and reach remote ignition sources causing a flashback fire danger. May form flammable/explosive vapour-air mixture. This material is a static accumulator. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur. Highly reactive. May form explosive peroxides. Slightly irritating to respiratory system. Slightly irritating to the eye. Vapours may cause drowsiness and dizziness. Rapid release of gases which are liquids under pressure may cause frost burns of exposed tissues (skin, eye) due to evaporative cooling. Possibility of organ or organ system damage from prolonged exposure; see Section 11 for details. Target organ(s): Ovary

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NFPA Rating (Health, Fire, Reactivity)	: 2, 4, 2	

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Substance

Components

Chemical name	Common Name	CAS-No.	Concentration (% w/w)
1,3-butadiene	buta-1,3-diene	106-99-0	>= 99.5

Stabilised with tertiary butyl catechol.

4. FIRST-AID MEASURES

General advice	: Not expected to be a health hazard when used under normal conditions.
In case of eye contact	: Slowly warm the exposed area by rinsing with warm water. Transport to the nearest medical facility for additional treatment.
In case of skin contact	: Slowly warm the exposed area by rinsing with warm water. Transport to the nearest medical facility for additional treatment.
If inhaled	: Call emergency number for your location / facility. Remove to fresh air. Do not attempt to rescue the victim unless proper respiratory protection is worn. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting, or unresponsive, give 100% oxygen with rescue breathing or Cardio-Pulmonary Resuscitation as required and transport to the nearest medical facility.
If swallowed	: In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.
Most important symptoms and effects, both acute and delayed	: Respiratory irritation signs and symptoms may include a temporary burning sensation of the nose and throat, coughing, and/or difficulty breathing. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death.

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	Rapid release of gases which are liquids under pressure may cause frost burns of exposed tissues (skin, eye) due to evaporative cooling.	
	No specific hazards under normal use conditions. Ingestion may result in nausea, vomiting and/or diarrhoea.	
Protection of first-aiders	: When administering first aid, ensure that you are wearing the appropriate personal protective equipment according to the incident, injury and surroundings.	
Notes to physician	: IMMEDIATE TREATMENT IS EXTREMELY IMPORTANT! Artificial respiration and/or oxygen may be necessary. Call a doctor or poison control center for guidance. Treat symptomatically. Potential for cardiac sensitisation, particularly in abuse situations. Hypoxia or negative inotropes may enhance these effects. Consider: oxygen therapy.	

5. FIRE-FIGHTING MEASURES

Suitable and unsuitable extinguishing media

Suitable extinguishing media : Shut off supply. If not possible and no risk to surroundings, let the fire burn itself out.

Unsuitable extinguishing media : Data not available

Specific hazards during firefighting : Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapor Explosion (BLEVE).
The vapour is heavier than air, spreads along the ground and distant ignition is possible.
Contents are under pressure and can explode when exposed to heat or flames.
As the vapours become lighter than air, the vapours may reach ignition sources at ground or elevated locations.

Specific extinguishing methods : Standard procedure for chemical fires.
Clear fire area of all non-emergency personnel.
Keep adjacent containers cool by spraying with water.

Special protective equipment for firefighters : Wear full protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and : Avoid contact with spilled or released material. Immediately remove all contaminated clothing. For guidance on selection

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emergency procedures

of personal protective equipment see Section 8 of this Safety Data Sheet. For guidance on disposal of spilled material see Section 13 of this Safety Data Sheet.
Be ready for fire or possible exposure.
Stay upwind and keep out of low areas.

- : Avoid contact with skin, eyes and clothing.
Isolate hazard area and deny entry to unnecessary or unprotected personnel.
Do not breathe fumes, vapour.
Do not operate electrical equipment.

Environmental precautions

- : Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area and evacuate all personnel. Attempt to disperse the gas or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Monitor area with combustible gas meter.

Methods and materials for containment and cleaning up

- : Allow to evaporate.
Attempt to disperse the vapour or to direct its flow to a safe location, for example by using fog sprays.

Observe all relevant local and international regulations.

Additional advice

- : For guidance on selection of personal protective equipment see Section 8 of this Safety Data Sheet.
Risk of explosion. Inform the emergency services if liquid enters surface water drains.
For guidance on disposal of spilled material see Section 13 of this Safety Data Sheet.
Vapour may form an explosive mixture with air.

Local authorities should be advised if significant spillages cannot be contained.

7. HANDLING AND STORAGE

General Precautions

- : Avoid breathing of or direct contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Section 8 of this Safety Data Sheet.
Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
Ensure that all local regulations regarding handling and storage facilities are followed.

Advice on safe handling

- : Extinguish any naked flames. Do not smoke. Remove ignition

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sources. Avoid sparks.
The vapour is heavier than air. Beware of accumulation in pits and confined spaces.
Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols.
Bulk storage tanks should be diked (bunded).
Properly dispose of any contaminated rags or cleaning materials in order to prevent fires.
Even with proper grounding and bonding, this material can still accumulate an electrostatic charge.
If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.
Be aware of handling operations that may give rise to additional hazards that result from the accumulation of static charges.
These include but are not limited to pumping (especially turbulent flow), mixing, filtering, splash filling, cleaning and filling of tanks and containers, sampling, switch loading, gauging, vacuum truck operations, and mechanical movements.
These activities may lead to static discharge e.g. spark formation.
Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (≤ 1 m/s until fill pipe submerged to twice its diameter, then ≤ 7 m/s). Avoid splash filling.
Do NOT use compressed air for filling, discharging, or handling operations.
Avoid breathing dust/fume/gas/mist/vapors.
Avoid contact with eyes, skin, and clothing (except for protective clothing) at all times.

Keep away from heat/sparks/open flames/hot surfaces.
Use only non-sparking tools.
Use only outdoors or in a well-ventilated area.
Store in a well-ventilated place and keep it at a low temperature (provided that the storage container is at a temperature not exceeding ignition point (or flash point)).
Store in a well-ventilated place keeping container tightly closed.
Avoid direct sunlight and store in a well-ventilated place.

Avoidance of contact : Strong oxidising agents.
If copper, copper alloys, monel, silver, mercury or magnesium is used during construction or maintenance, the formation of explosive acetylides can occur as a result of contact with butadiene. If Teflon® or Delrin® is used, polymer formation may result.

Product Transfer : Refer to guidance under Handling section.

Safe storage methods (including conditions to be avoided)

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Other data

: Keep away from aerosols, flammables, oxidizing agents, corrosives and from other flammable products which are not harmful or toxic to man or to the environment.
Must be stored in a diked (bunded) well- ventilated area, away from sunlight, ignition sources and other sources of heat.
Must be kept inhibited during storage and shipment as material can polymerise.
Vapours from tanks should not be released to atmosphere.
Breathing losses during storage should be controlled by a suitable vapour treatment system.
Electrostatic charges will be generated during pumping.
Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk.
The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable.
Storage Temperature:
Ambient.
Nitrogen blanket recommended.
The product is normally supplied in a stabilized form. If the permissible storage period and/or storage temperature is noticeably exceeded, the product may polymerise with heat evolution.
Stable under recommended storage conditions.

Packaging material

: Suitable material: For containers, or container linings use mild steel, stainless steel.
Unsuitable material: Copper., Copper alloys., Magnesium., Mercury., Monel., Silver.

Specific use(s)

: Not applicable

Ensure that all local regulations regarding handling and storage facilities are followed.
See additional references that provide safe handling practices for liquids that are determined to be static accumulators:
American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity).
IEC/TS 60079-32-1: Electrostatic hazards, guidance

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
1,3-butadiene	106-99-0	STEL	10 ppm	KR OEL
Further information: Sufficient evidence of carcinogenicity in				

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	humans, Substances which should be regarded as if they induce heritable mutations in the germ cells of humans			
1,3-butadiene		TWA	2 ppm	KR OEL
	Further information: Sufficient evidence of carcinogenicity in humans, Substances which should be regarded as if they induce heritable mutations in the germ cells of humans			
1,3-butadiene		TWA	2 ppm	KR PEL
1,3-butadiene		STEL	10 ppm	KR PEL
1,3-butadiene	106-99-0	TWA	2 ppm	ACGIH
1,3-butadiene		PEL	1 ppm	OSHA CARC
1,3-butadiene		STEL	5 ppm	OSHA CARC
1,3-butadiene		TWA	1 ppm	OSHA Z-1
1,3-butadiene		STEL	5 ppm	OSHA Z-1

Biological occupational exposure limits

No biological limit allocated.

Monitoring Methods

Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.

Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory.

Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available.

National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods
<http://www.cdc.gov/niosh/>

Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods
<http://www.osha.gov/>

Health and Safety Executive (HSE), UK: Methods for the Determination of Hazardous Substances
<http://www.hse.gov.uk/>

Institut für Arbeitsschutz Deutschen Gesetzlichen Unfallversicherung (IFA) , Germany
<http://www.dguv.de/inhalt/index.jsp>

L'Institut National de Recherche et de Sécurité, (INRS), France <http://www.inrs.fr/accueil>

Engineering measures

: Use sealed systems as far as possible.
Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits.
Local exhaust ventilation is recommended.
Firewater monitors and deluge systems are recommended.
Eye washes and showers for emergency use.
The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances.
Appropriate measures include:

General Information:

Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down

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systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when there is potential for inhalation; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance.

Personal protective equipment

Protective measures

Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

Respiratory protection : If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. If air-filtering respirators are suitable for conditions of use:

Select a filter suitable for organic gases and vapours [Type AX boiling point $\leq 65^{\circ}\text{C}$ (149°F)].

Eye protection : Wear goggles for use against liquids and gas, combined with face shield with chin guard.

Hand protection : Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection. When prolonged or frequent repeated contact occurs. Viton. For incidental contact/splash protection - Neoprene rubber. If contact with liquefied product is possible or anticipated, gloves should be thermally insulated to prevent cold burns. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same but recognize that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time maybe acceptable so long as appropriate maintenance and replacement regimes are followed. Glove

Remarks

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thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Glove thickness should be typically greater than 0.35 mm depending on the glove make and model. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.

- | | |
|--------------------------|--|
| Skin and body protection | : Wear antistatic and flame-retardant clothing.
Chemical and cryogenic gloves/gauntlets, boots, and apron. |
| Thermal hazards | : When handling cold material that can cause frost burns, wear cryogenic gloves, safety hat and visor, cold resistant overalls (with cuffs over gloves and legs over boots) and heavy duty boots e.g. leather for cold resistance. |
| Hygiene measures | : Wash hands before eating, drinking, smoking and using the toilet.
Launder contaminated clothing before re-use. |

Environmental exposure controls

- | | |
|----------------|--|
| General advice | : Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.
Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.
Information on accidental release measures are to be found in section 6. |
|----------------|--|

9. PHYSICAL AND CHEMICAL PROPERTIES

- | | |
|------------------------------|---|
| Appearance | : Liquid under pressure. |
| Colour | : colourless |
| Odour | : Mild aromatic |
| Odour Threshold | : 1.3 ppm |
| pH | : Data not available |
| Melting point/freezing point | : -108.9 °C / -164.0 °F |
| Boiling point/boiling range | : -4.4 °C / 24.1 °F |
| Flash point | : ca. -79 °C / -110 °F
Method: No information available. |

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Evaporation rate	: Data not available
Flammability (solid, gas)	: Flammable gas.
Upper/Lower explosion limit	
Upper explosion limit	: 16.3 %(V)
Lower explosion limit	: 1.4 %(V)
Vapour pressure	: 120 kPa (0 °C / 32 °F)
	240 kPa (20 °C / 68 °F)
	580 kPa (50 °C / 122 °F)
	1,750 kPa (100 °C / 212 °F)
Solubility(ies)	
Water solubility	: 735 mg/l
Relative vapour density	: 1.92 (21 °C / 70 °F) (Air = 1.0)
Relative density	: no data available
Density	: 622 kg/m ³ (20 °C / 68 °F) Method: ASTM D4052 (as liquid)
Partition coefficient: n-octanol/water	: log Pow: 1.99
Auto-ignition temperature	: 415 °C / 779 °F
Decomposition temperature	: Data not available
Viscosity	
Viscosity, kinematic	: 0.288 mm ² /s (0 °C / 32 °F) Method: ASTM D445
Explosive properties	: no data available
Oxidizing properties	: Data not available
Surface tension	: Data not available
Conductivity	: Low conductivity: < 100 pS/m

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The conductivity of this material makes it a static accumulator., A liquid is typically considered nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10,000 pS/m., Whether a liquid is nonconductive or semi-conductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid

Particle size : Data not available

Molecular weight : 54.1 g/mol

10. STABILITY AND REACTIVITY

Chemical stability and possibility of hazardous reactions:

- : Reacts violently with strong oxidising agents.
- Oxidises on contact with air to form unstable peroxides.,
- Unstable at elevated temperatures.
- Polymerisation may occur at elevated temperatures.

Conditions to avoid : Heat, flames, and sparks.
Exposure to air.

Incompatible materials : Strong oxidising agents.
If copper, copper alloys, monel, silver, mercury or magnesium is used during construction or maintenance, the formation of explosive acetylides can occur as a result of contact with butadiene. If Teflon® or Delrin® is used, polymer formation may result.

11. TOXICOLOGICAL INFORMATION

Basis for assessment : Information given is based on product testing.
Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Information on likely routes of exposure : Inhalation is the primary route of exposure.

Health hazard information

Acute toxicity

Components:

1,3-butadiene:

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Acute oral toxicity	:	Remarks: no data available
Acute inhalation toxicity	:	LC 50 Mouse: > 20,000 mg/l Exposure time: 2 h Test atmosphere: gas Method: Literature data Remarks: Based on available data, the classification criteria are not met. High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.
Acute dermal toxicity	:	Remarks: no data available

Skin corrosion/irritation

Components:

1,3-butadiene:

Remarks: Rapid release of gases which are liquids under pressure may cause frost burns of exposed tissues (skin, eye) due to evaporative cooling.

Serious eye damage/eye irritation

Components:

1,3-butadiene:

Remarks: Rapid release of gases which are liquids under pressure may cause frost burns of exposed tissues (skin, eye) due to evaporative cooling.

Respiratory or skin sensitisation

Components:

1,3-butadiene:

Remarks: no data available

Carcinogenicity

Components:

1,3-butadiene:

Species: Mouse, (male and female)

Application Route: Inhalation

Method: Test(s) equivalent or similar to OECD Test Guideline 453

Remarks: May cause cancer., OSHA has concluded that there is strong evidence that workplace exposure to butadiene poses an increased risk of death from cancers of the lymphohematopoietic (blood-forming) system.

Carcinogenicity - Assessment	:	May cause cancer.
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Material	GHS/CLP Carcinogenicity Classification
1,3-butadiene	Carcinogenicity Category 1A

Material	Other Carcinogenicity Classification
1,3-butadiene	IARC: Group 1: Carcinogenic to humans

Germ cell mutagenicity

Components:

1,3-butadiene:

Genotoxicity in vitro : Method: OECD Test Guideline 471
Remarks: May cause genetic defects.
: Method: OECD Test Guideline 473
: Method: OECD Test Guideline 476
: Test species: mice Method: Test(s) equivalent or similar to
OECD Test Guideline 474
Remarks: May cause genetic defects.
Method: OECD Test Guideline 478

Germ cell mutagenicity-
Assessment : May cause genetic defects.

Reproductive toxicity

Components:

1,3-butadiene:

: Species: Rat
Sex: male and female
Application Route: Inhalation
Method: OECD Test Guideline 421
Remarks: Based on available data, the classification criteria
are not met.

Effects on foetal
development : Species: Rat, female
Application Route: Inhalation
Method: Test(s) equivalent or similar to OECD Test Guideline
414
Remarks: Based on available data, the classification criteria
are not met., Causes foetotoxicity in animals at doses which
are maternally toxic.

Reproductive toxicity -
Assessment : This product does not meet the criteria for classification in
categories 1A/1B.

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STOT - single exposure

Components:

1,3-butadiene:

Remarks: Based on available data, the classification criteria are not met., Inhalation of vapours or mists may cause irritation to the respiratory system.

STOT - repeated exposure

Components:

1,3-butadiene:

Remarks: Based on available data, the classification criteria are not met., Blood-forming organs: repeated exposure affects the bone marrow., Reproductive system: repeated exposure affects the ovaries and testes in mice.

Repeated dose toxicity

Components:

1,3-butadiene:

Rat, male and female:

Application Route: Inhalation

Test atmosphere: Gas

Method: Test(s) equivalent or similar to OECD Test Guideline 453

Target Organs: No specific target organs noted

Aspiration toxicity

Components:

1,3-butadiene:

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

Further information

Components:

1,3-butadiene:

Remarks: Classifications by other authorities under varying regulatory frameworks may exist.

12. ECOLOGICAL INFORMATION

Basis for assessment : Incomplete ecotoxicological data are available for this product. The information given below is based partly on a knowledge of the components and the ecotoxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s). Incomplete ecotoxicological data are available for this product. The information given below is based partly on a knowledge of the components and the ecotoxicology of similar products.

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Ecotoxicity

Components:

1,3-butadiene :

Toxicity to fish (Acute toxicity) : LC50 (Pimephales promelas (fathead minnow)): 45 mg/l
Exposure time: 96 h
Method: Based on quantitative structure-activity relationship (QSAR) modelling
Remarks: Based on available data, the classification criteria are not met.

Toxicity to crustacean (Acute toxicity) : EC50 (Daphnia magna (Water flea)): 33 mg/l
Exposure time: 48 h
Method: Based on quantitative structure-activity relationship (QSAR) modelling
Remarks: Based on available data, the classification criteria are not met.

Toxicity to algae/aquatic plants (Acute toxicity) : EC50 (green algae): 33 mg/l
Exposure time: 72 h
Method: Based on quantitative structure-activity relationship (QSAR) modelling
Remarks: Based on available data, the classification criteria are not met.

Toxicity to microorganisms (Acute toxicity) : Remarks: no data available

Toxicity to fish (Chronic toxicity) : Remarks: no data available

Toxicity to crustacean(Chronic toxicity) : Remarks: no data available

Persistence and degradability

Components:

1,3-butadiene :

Biodegradability : Remarks: Not readily biodegradable.
Oxidises rapidly by photo-chemical reactions in air.

Photodegradation : Remarks: Oxidises rapidly by photo-chemical reactions in air.

Bioaccumulative potential

Product:

Partition coefficient: n-octanol/water : log Pow: 1.99

Components:

1,3-butadiene :

Bioaccumulation : Remarks: Does not bioaccumulate significantly.

Mobility in soil

Components:

1,3-butadiene :

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Mobility	: Remarks: Because of their extreme volatility, air is the only environmental compartment that hydrocarbon gases will be found.	

Other adverse effects

Components:

1,3-butadiene :

Results of PBT and vPvB assessment	: The substance does not fulfill all screening criteria for persistence, bioaccumulation and toxicity and hence is not considered to be PBT or vPvB.
Additional ecological information	: In view of the high rate of loss from solution, the product is unlikely to pose a significant hazard to aquatic life.

13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	: Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Waste product should not be allowed to contaminate soil or water. Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be complied with.
Contaminated packaging	: Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Send to drum recoverer or metal reclaimer.

Disposal considerations

Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

National Regulations

Refer to section 15 for specific national regulation.

International Regulations

ADR

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UN number	: 1010
Proper shipping name	: BUTADIENES, STABILIZED
Class	: 2
Packing group	: Not Assigned
Labels	: 2.1
Hazard Identification Number	: 239
Environmentally hazardous	: no

IATA-DGR

UN/ID No.	: UN 1010
Proper shipping name	: BUTADIENES, STABILIZED
Class	: 2.1
Packing group	: Not Assigned
Labels	: 2.1

IMDG-Code

UN number	: UN 1010
Proper shipping name	: BUTADIENES, STABILIZED
Class	: 2.1
Packing group	: Not Assigned
Labels	: 2.1
Marine pollutant	: no

Maritime transport in bulk according to IMO instruments

Ship type	: 2G/2PG
Product name	: Butadiene (all isomers)

Special precautions for user

Remarks	: Special Precautions: Refer to Section 7, Handling & Storage, for special precautions which a user needs to be aware of or needs to comply with in connection with transport.
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Additional Information	: Transport in bulk according to the IGC code This product may be transported under nitrogen blanketing. Nitrogen is an odourless and invisible gas. Exposure to nitrogen enriched atmospheres displaces available oxygen which may cause asphyxiation or death. Personnel must observe strict safety precautions when involved with a confined space entry.
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15. REGULATORY INFORMATION

National regulatory information

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

INDUSTRY SAFETY & HEALTH ACT:	Hazardous substances prohibited from manufacturing, etc., Not applicable
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	Hazardous substances subject to authorization, Not applicable
	Hazardous substances subject to control, Applicable
	Substances established for exposure limits, Applicable
	Hazardous factor subject to keep below permissible limit, Not applicable
	Hazardous Factors Subject to Working Environment Monitoring, Applicable
	Hazardous Factors Subject to Special Medical Examination, Applicable
CHEMICALS CONTROL ACT:	Toxic chemical substances, Applicable
	Authorization chemical substances, Not applicable
	Restricted chemical substances, Not applicable
	Prohibited chemical substances, Not applicable
	Accident precaution chemical substance, Not applicable
DANGEROUS GOODS SAFE CONTROL ACT:	Category/Classification of dangerous material:., Category 4 Dangerous Goods (Flammable Liquids), Grade 1 petroleum chemicals
WASTES MANAGEMENT ACT:	Designated waste, Applicable

Other requirements in domestic and other countries

The components of this product are reported in the following inventories:

AIIC : Listed
DSL : Listed
IECSC : Listed
ENCS : Listed
KECI : Listed

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NZIoC	: Listed
PICCS	: Listed
TCSI	: Listed
TSCA	: Listed

16. OTHER INFORMATION

Full text of other abbreviations

Carc.	Carcinogenicity
Flam. Gas	Flammable gases
Muta.	Germ cell mutagenicity
Press. Gas	Gases under pressure

Abbreviations and Acronyms

AIIC - Australian Inventory of Industrial Chemicals; ANTT - National Agency for Transport by Land of Brazil; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; Nch - Chilean Norm; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NOM - Official Mexican Norm; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TDG - Transportation of Dangerous Goods; TECI - Thailand Existing Chemicals Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative; WHMIS - Workplace Hazardous Materials Information System

Further information

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Training advice	: Provide adequate information, instruction and training for operators.
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Sources of key data used to compile the Safety Data Sheet	: The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).
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Other information	: A vertical bar () in the left margin indicates an amendment from the previous version.
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The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

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