

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

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| Product Name: cis-2-butene (MSDS No. P-4577-E) | Trade Names: cis-2-Butene |
| Chemical Name: cis-2-Butene | Synonyms: Beta butene, beta butylene, dimethylethene, dimethylethylene, pseudo-butylene, Z-2-butene, Z-2-butylene |
| Chemical Family: Alkene | Product Grades: 2.0 grade |
| Telephone: Emergencies: 1-800-645-4633* CHEMTREC: 1-800-424-9300* Routine: 1-800-PRAXAIR | Company Name: Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113 |

* Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

2. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Flammable liquid and gas under pressure.

Can form explosive mixtures with air.

May cause frostbite.

May cause dizziness and drowsiness.

Self-contained breathing apparatus may be required by rescue workers.

Under ambient conditions, this is a colorless gas with a slightly aromatic odor.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Asphyxiant. May be mildly irritating to the mucous membranes. High concentrations may cause drowsiness. Very high concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, vomiting, and unconsciousness. Lack of oxygen can kill.

Skin Contact. No harm expected from gas. Liquid may cause frostbite.

Swallowing. An unlikely route of exposure. This product is a gas at normal temperature and pressure, but frostbite of the lips and mouth may result from contact with the liquid.

Eye Contact. No harm expected from gas; liquid may cause frostbite.

Effects of Repeated (Chronic) Overexposure. Repeated or prolonged exposure may cause dermatitis.

Other Effects of Overexposure. This product is an asphyxiant. Lack of oxygen can kill.

Medical Conditions Aggravated by Overexposure. The defatting properties of cis-2-butene may aggravate an existing dermatitis.

CARCINOGENICITY: cis-2-Butene is not listed by the NTP, OSHA, or the IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None expected. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

| COMPONENT | CAS NUMBER | CONCENTRATION |
|--------------|------------|---------------|
| cis-2-Butene | 590-18-1 | >99%* |

* The symbol > means "greater than."

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: For exposure to liquid, immediately warm frostbite area with warm water, not to exceed 105°F (41°C). In case of massive exposure, remove clothing while showering with warm water. Call a physician.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: For contact with the liquid, immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are thoroughly flushed. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *This product may be a cardiac sensitizer; avoid use of epinephrine.*

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Forms explosive mixtures with air and oxidizing agents.

SUITABLE EXTINGUISHING MEDIA: CO₂, dry chemical, water spray, or fog.

PRODUCTS OF COMBUSTION: CO, CO₂

PROTECTION OF FIREFIGHTERS: DANGER! Flammable liquid and gas under pressure. Evacuate all personnel from danger area. Immediately spray cylinders with water from maximum distance until cool, taking care not to extinguish flames. Remove sources of ignition if without risk. Remove all cylinders from fire area if without risk; continue cooling water spray while moving cylinders. Do not extinguish any flames emitted from cylinders; stop flow of gas if without risk, or allow flames to burn out. Self-contained breathing apparatus may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Heat of fire can build pressure in cylinder and cause it to rupture. No part of a cylinder should be subjected to a temperature higher than

125°F (52°C). cis-2-Butene cylinders are equipped with a pressure-relief device. (Exceptions may exist where authorized by DOT.) If venting or leaking cis-2-butene catches fire, do not extinguish flames. Flammable gas may spread from leak, creating an explosive re-ignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! Flammable liquid and gas under pressure.

Personal Precautions. Forms explosive mixtures with air. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if without risk. Reduce vapors with fog or fine water spray. Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area. Flammable vapors may spread from spill. Before entering area, especially confined areas, check atmosphere with an appropriate device.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: Store and use with adequate ventilation. Do not get liquid in eyes, on skin, or on clothing. Protect cylinders from direct sunlight. Isolate from cylinders of oxygen and chlorine. Keep away from heat, sparks, and open flame. Use only spark-proof tools and explosion-proof equipment. cis-2-Butene is heavier than air. It tends to accumulate near the floor of an enclosed space, displacing air and pushing it upward. This creates an oxygen-deficient atmosphere near the floor. Ventilate space before entry. Verify sufficient oxygen concentration.

Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open valve. If valve is hard to open, discontinue use and contact your supplier.

PRECAUTIONS TO BE TAKEN IN STORAGE: Separate cis-2-butene cylinders from oxygen, chlorine, and other oxidizers by at least 20 ft (6.1 m), or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53 m) high and have a fire resistance rating of at least ½ hour. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Post "No Smoking or Open Flames" signs in storage and use areas. There must be no sources of ignition. All electrical equipment in storage areas must be explosion-proof. Storage areas must meet national electric codes for Class 1 hazardous areas. Store only where temperature will not exceed 125°F (52°C). Store

full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods. For other precautions in using cis-2-butene, see section 16.

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use, see Praxair publication P-14-153, *Guidelines for Handling Gas Cylinders and Containers*. Obtain from your local supplier.

8. Exposure Controls/Personal Protection

| COMPONENT | OSHA PEL | ACGIH TLV-TWA (2009) |
|--------------|----------|----------------------|
| cis-2-Butene | N.E. | 250 ppm |

N.E. – Not Established

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = Not available.

ENGINEERING CONTROLS:

Local Exhaust. Use an explosion-proof local exhaust system with sufficient flow velocity to maintain an adequate supply of air in the worker's breathing zone.

Mechanical (General). Inadequate. See SPECIAL.

Special. Use only in a closed system.

Other. See SPECIAL.

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Metatarsal shoes and work gloves for cylinder handling; protective clothing where needed. Wear neoprene gloves where contact with product is possible.

Eye/Face Protection. Select in accordance with OSHA 29 CFR 1910.133.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

| | |
|--------------------------------|--|
| APPEARANCE: | Colorless gas |
| ODOR: | Slightly aromatic |
| ODOR THRESHOLD: | Not available. |
| PHYSICAL STATE: | Gas at normal temperature and pressure |
| pH: | Not applicable. |
| MELTING POINT at 1 atm: | -218°F (-138.89°C) |
| BOILING POINT at 1 atm: | 38.7°F (3.72°C) |

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Liquefied petroleum gas

| HAZARD CLASS: | PACKING GROUP/Zone: | IDENTIFICATION NUMBER: | PRODUCT RQ: |
|---------------|---------------------|------------------------|-------------|
| 2.1 | NA | UN1075 | None |

SHIPPING LABEL(s): FLAMMABLE GAS

PLACARD (when required): FLAMMABLE GAS

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

MARINE POLLUTANTS: cis-2-Butene is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: None

EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes

DELAYED: No

PRESSURE: Yes

REACTIVITY: No

FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

cis-2-Butene is not subject to reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

cis-2-Butene is listed as a regulated substance in quantities of 10,000 lb (4536 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: cis-2-Butene is listed on the TSCA inventory.

OSHA OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

cis-2-Butene is not listed in Appendix A as a highly hazardous chemical. However, any process that involves a flammable gas on site in one location in quantities of 10,000 lb (4536 kg) or greater is covered under this regulation unless the gas is used as a fuel.

STATE REGULATIONS:

CALIFORNIA: cis-2-Butene is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: cis-2-Butene is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Flammable liquid and gas under pressure.* Use piping and equipment adequately designed to withstand pressures to be encountered. Use a backflow prevention device in any piping. Use only in a closed system. Prevent reverse flow. Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. All piped cis-2-butene systems and associated equipment must be grounded. Electrical equipment must be non-sparking or explosion-proof. Ground all equipment. Leak check system with soapy water; never use a flame. Never work on a pressurized system. If there is a leak, blow the system down in an environmentally safe manner in compliance with all federal, state, and local laws; then repair the leak. Never place a compressed gas cylinder where it may become part of an electrical circuit.

Mixtures. When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:

| | |
|--------------|--------|
| HEALTH | = 1 |
| FLAMMABILITY | = 4 |
| INSTABILITY | = 0 |
| SPECIAL | = None |

HMIS RATINGS:

| | |
|-----------------|-----|
| HEALTH | = 0 |
| FLAMMABILITY | = 4 |
| PHYSICAL HAZARD | = 1 |

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:**THREADED:** CGA-510**PIN-INDEXED YOKE:** None**ULTRA-HIGH-INTEGRITY CONNECTION:** None

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, <http://www.cganet.com/Publication.asp>.

- P-1 *Safe Handling of Compressed Gases in Containers*
- SB-2 *Oxygen-Deficient Atmospheres*
- V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections*
- *Handbook of Compressed Gases, Fourth Edition*

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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