

## Material Safety Data Sheet

Material Name: **Mixed C4 Product**

MSDS ID: NOVA-0014

### Section 1 - Product and Company Identification

**Synonyms:** Crude C<sub>4</sub>'s; Dilute Butadiene; Corunna Mixed C<sub>4</sub>'s (inhibited)**Chemical Name:** Hydrocarbons, C4 ethylene-manuf.-by-product**Chemical Family:** Hydrocarbons, alkadiene**Material Use:** Raw material used in industrial applications for chemical and elastomers manufacturing**Chemical Formula:** mixture; (C<sub>4</sub>H<sub>6</sub>), for main component**NOVA Chemicals**P.O. Box 2518, Station M  
Calgary, Alberta, Canada T2P 5C6**Product Information:** 1-412-490-4063**MSDS Information Email:**[msdsemail@novachem.com](mailto:msdsemail@novachem.com)**EMERGENCY Telephone Numbers:****North America (Canada and US):**

1-800-561-6682, 1-403-314-8767 (NOVA Chemicals) (24 hours)

1-800-424-9300 (CHEMTREC-USA) (24 hours)

1-613-996-6666 (Canutec-Canada) (24 hours)

**Mexico and South America:** +44 208 762 8322 (NCEC) (24 hours)**General Comments**

This product has been assigned a CAS# of 68476-52-8.

### Section 2 - Hazards Identification

**HMIS Ratings: Health: 2 Fire: 4 Physical Hazard: 2 Personal Protection:** chemical goggles, gloves, respirator, apron*Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe \* = Chronic hazard***NFPA Ratings: Health: 2 Fire: 4 Reactivity: 2***Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe***Emergency Overview**

**DANGER! EXTREMELY FLAMMABLE LIQUEFIED GAS.** This product is a colorless liquefied gas with a faint aromatic odor. The Mixed C4 Product is highly volatile, when released it will disperse as a highly flammable vapor cloud. Consider need for immediate emergency isolation and evacuation. Vapors are heavier than air and may travel along ground to some distant source and flash back. **DO NOT ATTEMPT TO EXTINGUISH A GAS FIRE UNLESS LEAK SOURCE CAN BE ISOLATED AND SHUT OFF.** Contact with liquefied gas may cause frostbite. May form explosive peroxides on exposure to air. Excessive inhalation of this material causes headache, dizziness, nausea and loss of coordination and in extreme conditions coma and possibly death. Contains a component that may cause cancer.

**Potential Health Effects: Eye**

Contact of the eye with the liquefied gas may cause severe injury or frostbite. Gas may be mildly irritating.

**Potential Health Effects: Skin**

Contact of the skin with the liquefied gas may result in frostbite and blistering. Gas may be mildly irritating. Product does not penetrate through the skin.

**Potential Health Effects: Ingestion**

Ingestion of this product is extremely unlikely. However, contact of the mouth or throat with the liquefied gas may result in serious injury or frostbite.

**Potential Health Effects: Inhalation**

This product is a mildly narcotic asphyxiant gas that can cause unconsciousness/death if OXYGEN levels are sufficiently reduced. Excessive inhalation of this material irritates the respiratory tract causing coughing and wheezing, and causes headache, dizziness, nausea and loss of coordination, and in extreme conditions coma and possibly death. High concentrations may trigger heartbeat irregularities, and possible cardiac sensitization. Repeated exposures may cause injury to lungs, liver and kidneys, including possible cancer.

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## Section 3 - Composition/Information on Ingredients

| CAS #      | Component   | Percent by Wt. |
|------------|---|----------------|
| 68476-52-8 | Hydrocarbons, C4 ethylene-manuf.-by-product                                       | 100            |
|            | The above listed CAS number and product is comprised of the following components: |                |
| 106-99-0   | 1,3-Butadiene   | 34-46          |
| 115-11-7   | 2-Methyl propene (Isobutylene)  | 17-26          |
| 106-98-9   | 1-Butene  | 14-21          |
| 106-97-8   | Butane  | 2-5            |
| 106-97-8   | Butane  | 5-10           |
| 106-97-8   | Butane  | 10-20          |
| 624-64-6   | Trans-2-butene  | 3-7            |
| 590-18-1   | Cis-2-butene  | 2-5            |
| 590-18-1   | Cis-2-butene  | 5-6            |
| 75-28-5    | Isobutane   | 0.5-1.5        |
| 75-28-5    | Isobutane   | 1.5-5          |
| 594-11-6   | Methylcyclopropane  | < 0.1-1        |
| 594-11-6   | Methylcyclopropane  | 1-3            |
| 463-82-1   | Neopentane  | 0.05-1         |
| 463-82-1   | Neopentane  | 1-2            |
| 590-19-2   | 1,2-Butadiene   | 0.1-0.5        |

### Additional Information

The actual components and weight % concentrations vary based on operating conditions.

This product is considered to be hazardous under 29 CFR 1910.1200 (Hazard Communication).

This material is a controlled product under Canadian WHMIS regulations

This material is regulated as a hazardous material / dangerous goods for transportation.

See Section 8 for applicable exposure limits. See Section 11 for applicable toxicity data.

## Section 4 - First Aid Measures

### First Aid: Eyes

Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.

### First Aid: Skin

Remove contaminated clothing and shoes. Wash immediately with soap and water. Seek medical attention if symptoms develop or persist. Thaw frostbite slowly with lukewarm water. DO NOT RUB affected area. Do not pull off adherent clothing or objects. Seek medical attention at once.

### First Aid: Inhalation

Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, is unconscious or if any other symptoms persist. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary risk to the rescuer. Avoid mouth-to-mouth contact by using a mouth shield or guard to perform artificial respiration.

### First Aid: Ingestion

DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention. Examine the lips and mouth to ascertain whether the tissues are damaged. If the individual is conscious, thaw frostbite in mouth slowly with lukewarm water, ensuring that the individual does not gag or choke. If the individual is not breathing, qualified personnel should perform mouth-to-mouth resuscitation. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary risk to the rescuer. Avoid mouth-to-mouth contact by using a mouth shield or guard to perform artificial respiration.

### First Aid: Notes to Physician

For more detailed medical emergency support information call 1-800-561-6682 or 1-403-314-8767 (24 hours, NOVA Chemicals Emergency Response). Treat unconsciousness, frostbite, nausea, hypotension, seizures and cardiac arrhythmia in the conventional manner. Sympathomimetics or catecholamines should be avoided or used with caution (lowest effective dose) because of possible cardiac sensitization. Administer oxygen by mask if there is respiratory distress. Treatment for overexposure should be directed at controlling the symptoms and clinical

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condition of the patient. After adequate first aid, no further treatment is necessary, unless symptoms reappear.

## Section 5 - Fire Fighting Measures

See Section 9: Physical Properties for flammability limits, flash point and auto-ignition information.

### General Fire Hazards

Fire and container explosion hazards are extremely high when this product is exposed to heat or flame. Use massive quantities of water to cool fire-exposed containers. Immediately withdraw in case of fire and container venting or heat discoloration of a container. Vapors are heavier than air and may travel along the ground to some distant source of ignition and flash back. Consider immediate emergency isolation and evacuation. **DO NOT ATTEMPT TO EXTINGUISH A GAS FIRE UNLESS LEAK SOURCE CAN BE ISOLATED AND SHUT OFF.** Be aware of possibility of re-ignition. If a pipeline, storage vessel, rail car or tank truck is possibly ruptured or involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

### Explosion Hazards

Product may polymerize explosively when heated or involved in a fire. Keep containers away from source of heat or fire. Vapors may form an explosive mixture with air. Highly explosive in the presence of sparks, fire, heat and oxidizing agents.

### Hazardous Combustion Products

Upon combustion, this product emits carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

### Extinguishing Media

Dry chemical, foam, carbon dioxide, and water fog. Use massive quantities of water to cool fire-exposed containers and to protect personnel. **DO NOT ATTEMPT TO EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK SOURCE CAN BE ISOLATED AND SHUT OFF.** Monitor water run-off for flammability, and prevent from entering drains, ditches and sewers, or other confined or underground spaces.

### Fire Fighting Equipment/Instructions

Reference 2008 Emergency Response Guidebook, Guide # 116P for additional details and instructions. Position upwind. Keep unnecessary personnel away. Move containers from fire area if you can do so without risk. Fight fire from maximum distance or use unmanned holders or monitor nozzles. Immediately withdraw in case of fire and container venting or heat discoloration of a container. Fire fighters should wear full-face, self-contained breathing apparatus and thermal protective clothing. Avoid inhaling any smoke and combustion materials. Remove and clean or destroy any contaminated clothing. Cool containers with flooding quantities of water until well after the fire is out. Control runoff waters to prevent entry into sewers, drains, ditches, underground or confined spaces and waterways.

## Section 6 - Accidental Release Measures

### Evacuation Procedures

Isolate area. Keep unnecessary personnel away. Alert stand-by emergency and fire-fighting personnel. Monitor surrounding area for buildup of flammable concentrations in air.

### Small Spills

Isolate spill or leak area for 50-100 meters (164-328 feet). Eliminate all potential ignition sources. Stop leak remotely or when safe to do so. Ground all approved equipment used in area. Keep area isolated until any detectable flammable gas has been dispersed.

### Large Spills

Consider initial downwind evacuation for at least 800 meters (1/2 mile). Eliminate all potential ignition sources. Stop leak remotely or when safe to do so. Alert stand-by emergency and fire fighting personnel. Monitor surrounding area for build-up of flammable concentrations in air. Ground all approved equipment used in area. Evacuate personnel to upwind of the spill area, and position at a safe distance. Consider use of water spray to reduce vapors or divert vapor cloud drift. Prevent flammable vapors or liquids from entering drains, ditches and sewers, or other confined or underground structures. Accumulations of gas may persist in low areas. Keep area isolated until any detectable flammable gas has been dispersed. Contain spilled liquid with DRY earth, sand, or other non-combustible material and clean up with non-sparking tools. Soil remediation may be required.

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## Special Procedures

Contact local police/emergency services and appropriate emergency telephone numbers provided in Section 1. Ensure that statutory and regulatory reporting requirements in the applicable jurisdiction are met. Wear appropriate protective equipment and clothing during cleanup. Individuals without appropriate protective equipment should be excluded from area of spill until cleanup has been completed.

*See Section 8 for recommended Personal Protective Equipment and Section 13 for waste disposal considerations.*

## Section 7 - Handling and Storage

### Handling Procedures

Keep locked up or secured. Handle in fully enclosed, grounded, properly designed and approved liquefied pressurized gas systems. Procedures and design should exclude oxygen from the handling and processing systems. Use with adequate ventilation. Avoid inhalation and skin and eye contact. Keep away from uncontrolled heat, ignition sources and incompatible materials. Ground all material handling and transfer equipment to dissipate build-up of static electricity. Wear suitable protective equipment including thermally protective gloves. No smoking or open flames permitted in storage, use or handling areas. Take special precautions when breaking into lines. Equipment and piping may require treatment (decontamination) prior to exposure to air for maintenance or disposal / salvage. Equipment preparation may include nitrogen purge, acid wash (to remove iron oxides), sodium nitrate pacification, and final oxygen removal using diethylhydroxylamine (DEHA) or other suitable materials.

### Storage Procedures

Storage area should be clearly identified, well illuminated, clear of obstruction and accessible only to trained and authorized personnel. Store in grounded, properly designed and approved pressure containers and away from incompatible materials. Store and use away from heat, sparks, open flame, or any other ignition source. Store according to applicable codes or regulations for liquefied pressurized, flammable gases as applicable to cylinders, vessels, piping, buildings, rooms, cabinets, allowable quantities and minimum storage distances. Have appropriate extinguishing capability in storage area (e.g. sprinkler system, portable fire extinguishers) and flammable gas detectors. Storage pressure vessels should be designed with remote impounding or diking as required by local regulations and company standards. Keep cylinders secure while in storage or in transportation. For road, rail and marine shipments, ensure product is transported with the addition of a suitable inhibitor / stabilizer, such as t-butyl catechol (TBC) or equivalent. Consider addition of TBC or equivalent to storage system if it cannot be maintained entirely free of oxygen.

*See Section 8 for recommended Personal Protective Equipment and see Section 10 for information on incompatibilities.*

## Section 8 - Exposure Controls / Personal Protection

### Exposure Guidelines

#### A: General Product Information

Refer to published exposure limits - use effective control measures and PPE to maintain worker exposure to concentrations that are below these limits. Ensure that eyewash stations and safety showers are in close proximity to work locations.

#### B: Component Exposure Limits

ACGIH, OSHA, NIOSH, EPA, Alberta, and Ontario exposure limit lists have been checked for major components listed with CAS registry numbers. Other exposure limits may apply, check with authorities.

\*NOTE: The Vacated OSHA Permissible Exposure Limits (PELs) are those provided in the 1989 update to OSHA's Air Contaminants Standard 29 CFR 1910.1000. These limits were vacated by the U.S. Court of Appeals, Eleventh Circuit but may be enforceable in some states.

#### 1,3-Butadiene (106-99-0)

|                  |  |
|------------------|--|
| ACGIH:           | 2 ppm TWA; 4.4 mg/m <sup>3</sup> TWA                                       |
| OSHA (Vacated)*: | 0.5 ppm Action Level; 1 ppm TWA; 5 ppm STEL (15 min. See 29 CFR 1910.1051) |
| OSHA Final:      | 0.5 ppm Action Level; 1 ppm TWA; 5 ppm STEL (15 min. See 29 CFR 1910.1051) |
|                  | 1 ppm TWA; 5 ppm STEL (see 29 CFR 1910.1051)                               |
| NIOSH:           | 2000 ppm IDLH (10% LEL)  |
| Alberta:         | 2 ppm TWA; 4.4 mg/m <sup>3</sup> TWA                                       |
| Ontario:         | 2 ppm TWAEV  |

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**Isobutylene (115-11-7)**

ACGIH: 250 ppm TWA

**1-Butene (106-98-9)**

ACGIH: 250 ppm TWA (listed under Butenes)

**Butane (106-97-8)**

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases alkane C1-C4)

OSHA (Vacated)\*: 800 ppm TWA; 1900 mg/m3 TWA

NIOSH: 800 ppm TWA; 1900 mg/m3 TWA

Alberta: 1000 ppm TWA

Ontario: 800 ppm TWAEV; 1900 mg/m3 TWAEV

**Trans-2-Butene (624-64-6)**

ACGIH: 250 ppm TWA (listed under Butenes)

**Cis-2-Butene (590-18-1)**

ACGIH: 250 ppm TWA (listed under Butenes)

**Isobutane (75-28-5)**

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases alkane C1-C4)

NIOSH: 800 ppm TWA; 1900 mg/m3 TWA

**Neopentane (463-82-1)**

ACGIH: 600 ppm TWA (listed under Pentane, all isomers)

Alberta: 600 ppm TWA; 1770 mg/m3 TWA

## ENGINEERING CONTROLS

Engineering methods to reduce hazardous exposure are preferred controls. Methods include mechanical ventilation (dilution and local exhaust) process or personal enclosure, remote and automated operation, control of process conditions, leak detection and repair systems, and other process modifications. Ensure all exhaust ventilation systems are discharged to outdoors, away from air intakes and ignition sources. Supply sufficient replacement air to make up for air removed by exhaust systems. Administrative (procedure) controls and use of personal protective equipment may also be required.

## PERSONAL PROTECTIVE EQUIPMENT

### Personal Protective Equipment: Eyes/Face

Use chemical goggles. Use of a full-face shield is recommended if contact with liquefied gas is possible.

### Personal Protective Equipment: Skin/Hands/Feet

Use impervious gloves designed to prevent freezing of body tissues if contact with liquefied gas is possible. Wear chemical-resistant safety footwear with good traction to prevent slipping. Work clothing that sufficiently prevents skin contact and prevents freezing of body tissues if contact with liquefied gas is possible should be worn, such as coveralls and/or long sleeves and pants. Fire resistant (i.e., Nomex) or natural fiber clothing (i.e., cotton or wool) is recommended. Synthetic clothing can generate static electricity and is not recommended where a flammable vapor release may occur. Static Dissipative (SD) rated footwear is recommended.

### Personal Protective Equipment: Respiratory

If engineering controls and ventilation is not sufficient to prevent build up of aerosols or vapors, appropriate NIOSH/ MSHA approved air-purifying respirators or self-contained breathing apparatus (SCBA) appropriate for exposure potential should be used. Air supplied breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.

### Personal Protective Equipment: General

Personal protective equipment (PPE) should not be considered a long-term solution to exposure control. Employer programs to properly select, fit, maintain, and train employees to use equipment must accompany PPE. Consult a competent industrial hygiene resource, the PPE manufacturer's recommendation, and/or applicable regulations to determine hazard potential and ensure adequate protection.

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## Section 9 - Physical & Chemical Properties

|  |   |                                     |   |
|--|---|-------------------------------------|---|
| <b>Physical State and Appearance:</b>        | Gas at room temperature and pressure. Stored and transported as a pressurized liquid. | <b>Color:</b>                       | Clear to translucent  |
| <b>Odor:</b>                                 | Aromatic (faint)  | <b>Odor Threshold:</b>              | Detectable at 0.45 ppm / 1.0 mg/m <sup>3</sup> (1,3-butadiene)                          |
| <b>pH:</b>                                   | Not applicable. Gas   | <b>Vapor Pressure:</b>              | 2 atm at 15.3°C (59.5 °F) (1,3-butadiene)   |
| <b>Vapor Density @ 0°C (Air=1):</b>          | 1.9 (1,3-butadiene)   | <b>Boiling Point:</b>               | Range: -12°C to 4°C (-10.4°F to 39.2°F)   |
| <b>Melting Point:</b>                        | -108.9°C (-164°F) at 101.3 kPa (1,3-butadiene)  | <b>Solubility (H<sub>2</sub>O):</b> | Largely insoluble in hot, cold water; reported 735 ppm at 22°C (71.6°F) (1,3-butadiene) |
| <b>Evaporation Rate (n-Butyl Acetate=1):</b> | Not applicable, gas at ambient temperatures and pressures.                            | <b>Dispersion Properties:</b>       | Is not dispersed in cold water, hot water   |
| <b>Specific Gravity (Water=1):</b>           | Range: 0.61 to 0.62 at 15°C (calculated)  | <b>Percent Volatile:</b>            | 100%  |
| <b>Water/Oil Dist. Coeff.:</b>               | Range:<br>Log Pow = 1.99 - 2.89   | <b>Auto Ignition:</b>               | Range: 422°C to 429°C (791.6°F to 804.2°F) (1,3-butadiene)                              |
| <b>Flash Point:</b>                          | -77°C (-106.6°F) (1,3-butadiene)  | <b>Flash Point Method:</b>          | Closed Cup  |
| <b>Upper Flammable Limit (UFL):</b>          | 11.5% (1,3-butadiene)   | <b>Lower Flammable Limit (LFL):</b> | 2% (1,3-butadiene)  |
| <b>Flammability Classification:</b>          | Extremely Flammable   |                                     |   |

## Section 10 - Stability & Reactivity Information

### Chemical Stability

This product is **unstable**. In the presence of air, explosive peroxides and/or pyrophoric polymers may be produced. Procedures and design should exclude oxygen from the handling and processing systems, including removing oxygen before introducing the product. May form acetylides with copper, silver, mercury or alloys that are explosive and very hazardous when dry.

### Chemical Stability: Conditions to Avoid

Keep away from heat, sparks, or open flame.

### Incompatibility

Reactive with oxidizing agents, organic materials, certain plastics and rubber, acids. The product may undergo dangerous decomposition, condensation or polymerization; it may become self-reactive under conditions of shock or increase in temperature or pressure. Many materials become brittle after contact with liquefied gases, and may fail without warning. Carefully select and test equipment, gaskets, and hoses periodically to ensure integrity and compatibility. Copper-containing alloys are to be avoided.

### Possibility of Hazardous Reactions or Hazardous Polymerization

Risk of hazardous polymerization increases with the concentration of butadienes. Storage and processing requires review of risks and the need for suitable inhibitors such as t-butyl catechol (TBC) or equivalent.

### Corrosivity

Not considered to be corrosive.

### Hazardous Decomposition

Upon decomposition, this product emits carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

### Special Remarks

Vapors may form an explosive mixture with air. May react vigorously with oxidizing agents. Liquefied gas may explode on contact with hot water (45°C to 75°C) (113°F to 167°F).

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## Section 11 - Toxicological Information

### A: Acute Toxicity - General Product Information

This product has been evaluated and tested under the EPA's High Production Volume (HPV) Chemical Challenge Program in the Crude Butadiene C4 (Olefins) Category. This product is not considered acutely toxic. At very high exposures, it produces an anesthetic effect. Excessive exposures may cause headache, dizziness, nausea, loss of coordination, and in extreme conditions coma and possibly death. High concentrations may trigger heartbeat irregularities. Excessive amounts in the air in an enclosed space will decrease the amount of oxygen and may cause suffocation. The liquefied form will cause freezing burns (frostbite) to the eyes and skin. A stream containing >10% butadiene has given positive results in a mouse micronucleus test.

The following additional information has been found for its components:

1,3-butadiene - May cause irritation of the eyes. Contact can irritate the skin and may cause frostbite. Inhalation irritates the respiratory tract causing coughing and wheezing. Inhalation may cause drowsiness, lightheadedness, unconsciousness, and at very high exposures death.

n-butane, 1-Butene, 2-Butene - Inhalation may cause central nervous system depression, causing headache, dizziness, nausea, loss of coordination, and in extreme conditions coma and possibly death. Very high levels of vapors in an enclosed space will decrease the amount of available oxygen and may cause suffocation.

### B: Acute Toxicity - LD50/LC50

#### **C4 Crude Butadiene (68955-28-2)**

Inhalation LC50 Rat: 5300 mg/m<sup>3</sup>/4H (HPV Summary with 45% 1,3-butadiene)

#### **1,3-Butadiene (106-99-0)**

Inhalation LC50 Rat: 285,000 mg/m<sup>3</sup>/4H; Inhalation LC50 Mouse: 270,000 mg/m<sup>3</sup>/2H; Oral LD50 Rat: 5480 mg/kg (HPV summary)

#### **2-Methyl propene (Isobutylene) (115-11-7)**

Inhalation LC50 Rat: 620 mg/L/4H

#### **Butane (106-97-8)**

Inhalation LC50 Rat: 658 mg/L/4H

#### **Isobutane (75-28-5)**

Inhalation LC50 Rat: 658 mg/L/4H

### C: Chronic Toxicity - General Product Information

This product has been evaluated and tested under the EPA's High Production Volume (HPV) Chemical Challenge Program in the Crude Butadiene C4 (Olefins) Category. A species difference in repeated dose toxicity of crude butadiene C4 was apparent between rats and mice. In rats, minimal toxicity effects were reported with no observable adverse effect levels (NOAEL) at the highest concentration tested (17,679 mg/m<sup>3</sup> / 800 ppm for 90 day exposure and 25,100 mg/m<sup>3</sup> / 11,365 ppm for 9 day exposure). In mice, mortality was observed on exposure of 2,761 mg/m<sup>3</sup> for 90 days, using 99.2% 1,3-butadiene. Test data indicate crude butadiene C4 streams can affect genetic material in mice (positive mouse micronucleus test). Neither reproductive toxicity nor developmental toxicity (birth defects) was observed in rats exposed to crude butadiene C4 streams.

The following additional information has been found for its components:

1,3-Butadiene - Prolonged and repeated exposure may cause irritation effects and hematological changes. Elevated incidence of lymphomas, leukemias, and other neoplastic diseases of the blood system are found in studies of Butadiene (BD) monomer production workers. The Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC) have classified 1,3-butadiene as a known human carcinogen. There is limited evidence that 1,3-Butadiene is a teratogen in animals and may cause damage to the testes and ovaries.

n-Butane, 1-Butene, 2-Butene - Minimal long-term toxic effects reported in repeat dose toxicity tests in animals. 2-Butene was found to be not mutagenic with or without metabolic activation. No reproductive or developmental toxicity was observed in rats exposed to 2-butene or 1-butene.

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## C: Component Carcinogenicity

ACGIH, EPA, IARC, OSHA, and NTP carcinogen lists have been checked for selected similar materials or those components with CAS registry numbers.

### 1,3-Butadiene (106-99-0)

ACGIH: A2 - Suspected Human Carcinogen

OSHA: 0.5 ppm Action Level; 1 ppm TWA; 5 ppm STEL (15 min. See 29 CFR 1910.1051)

EPA: Classification: 1,3-butadiene is characterized as carcinogenic to humans by inhalation

NTP: Known Human Carcinogen (Select Carcinogen)

IARC: Monograph 97 [2008], Monograph 71 [1999] (Group 1 (carcinogenic to humans))

## Section 12 - Ecological Information

### Ecotoxicity

#### A: General Product Information

This product has been evaluated and tested under the EPA's High Production Volume (HPV) Chemical Challenge Program in the Crude Butadiene C4 (Olefins) Category. Due to its high volatility, exposure to aquatic life is expected to be minimal. Calculated toxicity for components of this mixture indicates moderate toxicity to aquatic organisms, due to disruption of membrane function.

#### B: Component Analysis - Ecotoxicity - Aquatic Toxicity

##### Crude Butadiene C4 Streams:

96 Hr LC50 (fish): 6.28 to 40.98 mg/L; 48 Hr LC50 (invertebrate): 7.15 to 43.88 mg/L; 96 Hr Toxicity (alga): 4.71 to 27.42 mg/L (calculated using ECOSAR model, EPIWIN experimental database)

##### 1,3-Butadiene (106-99-0)

###### Test & Species

|                                | Conditions |
|--------------------------------|------------|
| 24 Hr LC50 Lagodon rhomboides  | 71.5 mg/L  |
| 96 Hr LC50 Lepomis macrochirus | 37.8 mg/L  |
| 96 Hr LC50 Pimephales promelas | 49.8 mg/L  |
| 96 Hr LC50 Oncorhynchus mykiss | 22.4 mg/L  |
| 96 Hr EC50 Daphnia magna       | 24.8 mg/L  |

### Environmental Fate/Mobility

Modeling indicates that the product will distribute 99.97 to 99.99% into air, 0.01 to 0.03% into water, and < 0.01% into soil, sediment, suspended sediment and biota. For butadiene, the log Kow is 1.99, the estimated soil adsorption coefficient is 288 and the log Koc is estimated between 1.86-2.36, indicating some mobility in soil. Components are not expected to hydrolyze in water.

### Persistence/Degradability

Components are not expected to be persistent in the air. Airborne degradation byproducts of butadiene may induce adverse health effects. Product will react with photochemically produced radicals, with an estimated half-life in the order of a few hours for 1,3-butadiene to 48 hours for butane. Biodegradation is likely to occur. Biodegradation is found to rapidly occur for constituent chemicals at variable rates based on environmental conditions and not persist.

### Bioaccumulation/Accumulation

Based on log Kow =1.99 for 1,3-butadiene, this product is not expected to bioconcentrate.

## Section 13 - Disposal Considerations

### U.S./Canadian Waste Number & Descriptions

#### A: General Product Information

This product as sold, is ignitable and, if disposed of, would be considered a hazardous waste according to US and Canadian regulations. The use, mixing or processing of this product may alter this product. Contact federal provincial/state and local authorities in order to generate or ship a waste material associated with this product to ensure materials are handled appropriately and meet all criteria for disposal of hazardous waste. **DO NOT ATTEMPT TO DISPOSE OF BY UNCONTROLLED IGNITION.** Since emptied containers retain product/material residue, follow safe handling/label warnings even after container is emptied.

See Section 7: Handling and Storage and Section 8: Exposure Controls/Personal Protection for additional information that may be applicable for safe handling and the protection of employees.

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Waste generator is advised to carefully consider hazardous properties and control measures needed for other materials that may be found in the waste.

## B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

## Section 14 - Transportation Information

### US DOT Information

**Shipping Name:** Butadienes, stabilized

- or - Butadienes and Hydrocarbon mixture, *stabilized containing more than 40% butadienes*

**UN#** 1010 **Hazard Class:** 2.1

**Required Label(s):** FLAMMABLE GAS

**Additional Info.:** The Reportable Quantity for butadiene is 10 lbs. (4.54 kg).

2008 Emergency Response Guidebook, Guide # 116P.

### Canadian TDG Information

**Shipping Name:** Butadienes, stabilized

**UN#** 1010 **Hazard Class:** 2.1

**Required Label(s):** FLAMMABLE GAS

**Additional Info.:** 2008 Emergency Response Guidebook, Guide # 116P.

### International Air Transport Association (IATA) and ICAO Information

**Shipping Name:** Butadienes, stabilized

- or - Butadienes and Hydrocarbon mixture, *stabilized containing more than 40% butadienes*

**UN#** 1010 **Hazard Class:** 2.1

**Required Label(s):** FLAMMABLE GAS

### International Maritime Dangerous Goods (IMDG) Code

**Shipping Name:** Butadienes, stabilized

- or - Butadienes and Hydrocarbon mixture, *stabilized containing more than 40% butadienes*

**UN#** 1010 **Hazard Class:** 2.1

**Required Label(s):** FLAMMABLE GAS

**Additional Info.:** EmS. No.: F-D, S-U

**Marine Pollutant:** No

## Section 15 - Regulatory Information

### A: International Regulations

#### Component Analysis - International Inventory Status

| Component                                    | CAS #      | US - TSCA | CANADA - DSL | EU - EINECS |
|--|------------|-----------|--------------|-------------|
| Hydrocarbons, C4, ethylene-manuf.-by-product | 68476-52-8 | Yes       | Yes          | Yes         |
| 1,3-Butadiene                                | 106-99-0   | Yes       | Yes          | Yes         |
| 2-Methyl propene (Isobutylene)               | 115-11-7   | Yes       | Yes          | Yes         |
| 1-Butene                                     | 106-98-9   | Yes       | Yes          | Yes         |
| Butane                                       | 106-97-8   | Yes       | Yes          | Yes         |
| Trans-2-butene                               | 624-64-6   | Yes       | Yes          | Yes         |
| Cis-2-butene                                 | 590-18-1   | Yes       | Yes          | Yes         |
| Isobutane                                    | 75-28-5    | Yes       | Yes          | Yes         |
| Methylcyclopropane                           | 594-11-6   | Yes       | No - NDSL    | Yes         |
| Neopentane                                   | 463-82-1   | Yes       | Yes          | Yes         |
| 1,2-Butadiene                                | 590-19-2   | Yes       | Yes          | Yes         |
| t-butyl catechol (TBC) as inhibitor          | 27213-78-1 | Yes       | Yes          | Yes         |

### B: USA Federal & State Regulations

Ongoing occupational hygiene, medical surveillance programs, or site emission or spill reporting may be required by Federal or State regulations. Check for applicable regulations.

#### USA OSHA Hazard Communication Class

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication). HCS Classes:

HCS CLASS: Flammable gas.

HCS CLASS: MAY CAUSE CANCER

# Material Safety Data Sheet

Material Name: **Mixed C4 Product**

MSDS ID: NOVA-0014

## USA Right-to-Know - Federal

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

### 1,3-Butadiene (106-99-0)

SARA 313: 0.1 % de minimis concentration

CERCLA: 10 lb final RQ; 4.54 kg final RQ

## USA Right-to-Know - State

The following components appear on one or more of the following state hazardous substances lists. Some components (including those present only in trace quantities, and therefore not listed in this document) may be included on the Right- To- Know lists of other U.S. states. The reader is therefore cautioned to contact his or her NOVA Chemicals' representative or NOVA Chemicals' Product Integrity group for further U.S. State Right- To- Know information.

| Component                      | CAS      | NJ  | PA  |
|--------------------------------|----------|-----|-----|
| 1,3-Butadiene                  | 106-99-0 | Yes | Yes |
| 2-Methyl propene (Isobutylene) | 115-11-7 | Yes | Yes |
| 1-Butene                       | 106-98-9 | No  | Yes |
| Butane                         | 106-97-8 | Yes | Yes |
| Trans-2-Butene                 | 624-64-6 | No  | Yes |
| Cis-2-Butene                   | 590-18-1 | No  | Yes |
| Isobutane                      | 75-28-5  | Yes | Yes |
| Neopentane                     | 463-82-1 | Yes | Yes |

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

WARNING! This product contains a chemical known to the state of California to cause reproductive/developmental effects.

## C: Canadian Regulations - Federal and Provincial

Canadian Environmental Protection Act (CEPA): All components of this product are on the Domestic Substances List (DSL), and are acceptable for use under the provisions of CEPA.

## WHMIS Ingredient Disclosure List (IDL)

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List (IDL):

| Component     | CAS #    | Minimum Concentration |
|---------------|----------|-----------------------|
| 1,3-Butadiene | 106-99-0 | 0.1 %                 |
| Butane        | 106-97-8 | 1 %                   |

## WHMIS Classification

Workplace Hazardous Materials Information System (WHMIS): This product has been classified in accordance with the hazard criteria of the CPR (Canadian Controlled Products Regulations) and the MSDS contains all the information required by the CPR.

WHMIS CLASS A: Compressed gas

WHMIS CLASS B1: Flammable gas

WHMIS CLASS D2A: Carcinogen (1,3-Butadiene), Mutagen (1,3-Butadiene)

WHMIS D2B: Toxic

WHMIS CLASS F: Dangerously Reactive Material

## Other Regulations

Ongoing occupational hygiene, medical surveillance programs, or site emission or spill reporting may be required by Federal or Provincial regulations. Check for applicable regulations.

## Section 16 - Other Information

### Label Information

DANGER! EXTREMELY FLAMMABLE LIQUEFIED GAS. This product is a colorless liquefied gas with a faint aromatic odor. The Mixed C4 Product is highly volatile, when released it will disperse as a highly flammable vapor cloud. Consider need for immediate emergency isolation and evacuation. Vapors are heavier than air and may travel along ground to some distant source and flash back. DO NOT ATTEMPT TO EXTINGUISH A GAS FIRE UNLESS LEAK SOURCE CAN BE ISOLATED

# Material Safety Data Sheet

Material Name: **Mixed C4 Product**

MSDS ID: NOVA-0014

AND SHUT OFF. Contact with liquefied gas may cause frostbite. May form explosive peroxides on exposure to air. Excessive inhalation of this material causes headache, dizziness, nausea and loss of coordination and in extreme conditions coma and possibly death. Contains a component that may cause cancer.

#### FIRST AID:

SKIN: Remove contaminated clothing and shoes. Wash immediately with soap and water. Seek medical attention if symptoms develop or persist. Thaw frostbite slowly with lukewarm water. DO NOT RUB affected area. Do not pull off adherent clothing or objects. Seek medical attention at once.

EYES: Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.

INHALATION: Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, is unconscious or if any other symptoms persist. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary risk to the rescuer. Avoid mouth-to-mouth contact by using a mouth shield or guard to perform artificial respiration.

INGESTION: DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention. Examine the lips and mouth to ascertain whether the tissues are damaged. If the individual is conscious, thaw frostbite in mouth slowly with lukewarm water, ensuring that the individual does not gag or choke. If the individual is not breathing, qualified personnel should perform mouth-to-mouth resuscitation. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary risk to the rescuer. Avoid mouth-to-mouth contact by using a mouth shield or guard to perform artificial respiration.

IN CASE OF A LARGE SPILL: Consider initial downwind evacuation for at least 800 meters (1/2 mile). Eliminate all potential ignition sources. Stop leak remotely or when safe to do so. Alert stand-by emergency and fire fighting personnel. Monitor surrounding area for build-up of flammable concentrations in air. Ground all approved equipment used in area. Evacuate personnel to upwind of the spill area, and position at a safe distance. Consider use of water spray to reduce vapors or divert vapor cloud drift. Prevent flammable vapors or liquids from entering drains, ditches and sewers, or other confined or underground structures. Accumulations of gas may persist in low areas. Keep area isolated until any detectable flammable gas has been dispersed. Contain spilled liquid with DRY earth, sand, or other non-combustible material and clean up with non-sparking tools. Soil remediation may be required.

#### References

Available on request.

#### Special Considerations

For additional information on properties, health and environmental hazard information, regulatory overview, handling, transport and storage, fire safety and emergency response, please refer to the, "Butadiene Product Stewardship Guidance Manual", published 03/10/2002, by the American Chemistry Council ([www.americanchemistry.com](http://www.americanchemistry.com)).

For additional information on the safe handling of butadiene, please refer to the "Butadiene Popcorn Polymer Resource Book", published by the International Institute of Synthetic Rubber Producers, Inc. (IISRP) ([www.iisrp.com](http://www.iisrp.com)).

For additional information on equipment bonding and grounding, refer to the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents" or National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity".

#### Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; BLEVE = Boiling Liquid Expanding Vapor Explosion; BOD = Biochemical Oxygen Demand; CAS = Chemical Abstracts Service; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CPR = Controlled Products Regulations; DOT = Department of Transportation; DSL = Domestic Substances List; EINECS = European Inventory of Existing Commercial Substances; EPA = Environmental Protection Agency; EU = European Union; FDA = Food and Drug Administration; IARC = International Agency for Research on Cancer; IDL = Ingredient Disclosure List; Kow = Octanol/water partition coefficient; LEL = Lower Explosive Limit; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; RCRA = Resource Conservation and Recovery Act; SARA = Superfund Amendments and Reauthorization Act; TDG = Transportation of Dangerous Goods; TSCA = Toxic Substances Control Act.

MSDS Prepared by: NOVA Chemicals

MSDS Information Phone Number: 1-412-490-4063

# Material Safety Data Sheet

Material Name: **Mixed C4 Product**

MSDS ID: NOVA-0014

## Other Information

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This is the end of MSDS # NOVA-0014.