

MATERIAL SAFETY DATA SHEET**1,4-DIOXANE**

PRODUCT CODE NUMBER(S): 4300-1, 4301-2

PRODUCT IDENTIFICATION**Chemical Name and Synonyms:** 1,4-Dioxane, Diethylene oxide; Dioxyethylene ether; 1,4-Diethylene dioxide**Chemical Family:** Saturated cyclic aliphatic ether**Chemical Formula:** $\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2$ **Product Use:** Laboratory reagent**Manufacturer's Name and Address:**

Caledon Laboratories Ltd.

40 Armstrong Avenue

Georgetown, Ontario L7G 4R9

Telephone No: (905) 877-0101**Fax No:** (905) 877-6666**Emergency Telephone No:** CANUTEC (613) 996-6666**HAZARDOUS INGREDIENTS OF MATERIALS**

Ingredients	%	TLV Units	CAS No.
1,4-Dioxane	>99	20 ppm (incl. skin exp.)	123-91-1

PHYSICAL DATA**Physical State:** Liquid**Odour and Appearance:** Clear, colourless with ether-like odour.**Odour Threshold (ppm):** 0.8 ppm (detection); 1.8 to 5.7 ppm (recognition). Poor warning properties, threshold values vary widely, and odour fatigue may set in, and diminish sensation.**Vapour Pressure (mm Hg):** 30 mm Hg at 20°C**Vapour Density (Air = 1):** 3.03**Evaporation Rate (bu ac=1):** 2.17**Boiling Point (°C):** 101.3°C**Freezing Point (°C):** 11.8°C**pH:** Neutral**Specific Gravity:** 1.034 at 20°C**Coefficient of Water/Oil distribution:** $\text{LogP}(\text{oct})=-0.27$ **SHIPPING DESCRIPTION****UN:** 1165**T.D.G. Class:** 3**Pkg. Group:** II**REACTIVITY DATA****Chemical Stability:** Stable when dry; hygroscopic (absorbs moisture from air). Forms peroxides in air, especially in the presence of moisture. Explosive peroxides may form in containers exposed to air and light after opening.**Incompatibility with other substances:** Increased risk of fire and explosion with oxidizing agents, halogens, reducing agents, moisture, heat. Forms explosive mixtures with sulphur trioxide, triethynylaluminum, and catalytic hydrogen and hot Raney nickel. Silver and bariumtetrafluorobromates will ignite in contact with dioxane. Not corrosive to most common metals, carbon steel, stainless steel, iron, aluminum, copper, nickel, etc. Can attack many plastics, polyesters, PVC, elastomers.**Reactivity:** Avoid exposure to moisture, air, light, static discharge, open flames, and all ignition sources. Avoid inhibitor depletion. May form explosive peroxides. Distillation, evaporation, or exposure to light and air accelerates peroxide formation.**Hazardous Decomposition Products:** CO_x **FIRE AND EXPLOSION DATA****Flammability:** Flammable liquid and vapour. Releases vapours that form explosive mixtures with air at or above 12°C. Vapour is heavier than air and may travel considerable distance to source of ignition and flash back. Can accumulate in confined spaces, resulting in a toxicity and flammability hazard. Closed containers may rupture violently in heat of fire.**Extinguishing Media:** Alcohol-resistant foam, polymer foam, carbon dioxide, or dry chemical. Water is ineffective for fighting fire, but as spray or fog can be used to cool containers, disperse vapours, dilute chemical to non-flammable point, or flush spills away from ignition sources. Fight fire from upwind, from a safe distance. Firefighters must wear NIOSH/MSHA approved full face-piece, positive-pressure self-contained breathing apparatus and encapsulating chemical splash suit. Containers may explode in heat of fire; withdraw immediately in case of rising sound from vent or discoloration of tank.**Flash Point (Method Used):** 12°C (CC)**Autoignition Temperature:** 180°C**Upper Flammable Limit (% by volume):** 22**Lower Flammable Limit (% by volume):** 2**Hazardous Combustion Products:** CO, CO₂**Sensitivity to Impact:** When pure, not sensitive. When contaminated with high concentrations of peroxides, may explode on impact.**Sensitivity to Static discharge:** Liquid may accumulate static charge by flow or agitation. Vapour may be readily ignited by static discharge of sufficient energy.**TOXICOLOGICAL PROPERTIES AND HEALTH DATA****Toxicological Data:****LD₅₀:** (oral, rat) 4,200 mg/kg; (dermal, rabbit) 7,600 µL/kg**LC₅₀:** (rat) 46 gm/m³/2h; (mouse) 37 gm/m³/2h**Effects of Acute Exposure to Product:****Inhaled:** Irritating; toxic. 160 ppm for 10 min caused slight irritation; 550 ppm/1 min caused more severe irritation. Brief exposures to concentrations of 1,600 ppm cause tearing, burning of nose and throat. Repeated exposures (hours to days) to 500 ppm can cause severe injury or death. Initial symptoms are coughing, headache, nausea, vomiting, drowsiness, loss of balance. Kidney failure, coma and death followed. Severe damage to lungs, brain, liver and kidneys was noted at autopsy.**In contact with skin:** Mildly irritating. Can be absorbed through skin, but not expected to be toxic by absorption. However, chemical rapidly evaporates from skin, and could cause inhalation exposure.**In contact with eyes:** Liquid causes moderate to severe irritation, based on animal information; Vapour causes irritation, tearing; 50-300 ppm caused irritation in volunteers; no irreversible damage has been reported.**Ingested:** Low oral toxicity in animal testing. No human information. May cause nausea, vomiting and diarrhea. May result

CODE: 4300-1, 4301-2

in kidney and liver damage. May be readily aspirated during ingestion or vomiting, and aspiration causes chemical pneumonitis or pulmonary edema, which can be fatal.

Effects of Chronic Exposure to Product:

Chronic inhalation may cause loss of appetite, nausea, vomiting, liver, kidney, central nervous system damage. Results are not conclusive due to small samples, multiple or unknown exposures. A study of 165 employees working with dioxane for 5 years indicated a no-effect level of 32 ppm. May cause skin sensitization, but results are inconclusive.

Carcinogenicity: Carcinogenic to laboratory animals orally, not by inhalation. IARC Group 2B (possibly carcinogenic to humans). ACGIH Group A3, confirmed animal carcinogen.

Teratogenicity: No human information available. Some slight effects in some animal testing.

Reproductive Effects: No human or animal information available

Mutagenicity: Probably not mutagenic. Available information does not support mutagenicity.

Synergistic Products: Increased toxic effects with acetonitrile or tetrachloroethylene, possibly alcohols.

PREVENTIVE MEASURES

Engineering Controls: Local exhaust ventilation required.

Respiratory Protection: At concentrations above the Recommended Exposure Limit (REL), 1ppm/30 min, or at any detectable concentration: positive pressure, full facepiece self-contained breathing apparatus, or positive pressure, full face-piece air-supplied respirator with an auxiliary positive pressure self-contained breathing apparatus.

Eye Protection: Chemical goggles and/or face shield.

Skin Protection: Tychem 10000™, or 4H™ gloves; butyl rubber or Teflon™ are satisfactory for use <8 h. Other impervious protective clothing, apron, sleeves, coveralls, boots, as required to prevent contact.

Other Personal Protective Equipment: Safety shower and eye bath located close to chemical exposure area.

Leak and Spill Procedure: Eliminate all sources of ignition. Evacuate area. Cleanup personnel must be thoroughly trained in the hazards of this chemical and must wear protective equipment and clothing sufficient to prevent inhalation of vapours or mists and contact with skin and eyes. Stop or reduce discharge if safe to do so. Contain spill with inert absorbent (sand, earth). Prevent from entering sewers or waterways. Recover product and collect contaminated soil for disposal. For small spills, contain by applying inert absorbent. Collect waste for disposal. Contaminated absorbent may pose the same hazards as the spilled product. Flush area of spill with running water.

Waste Disposal: Follow all federal, provincial, and local regulations.

Handling Procedures and Equipment: FLAMMABLE, VERY TOXIC, POSSIBLE CARCINOGEN. Personnel working with this chemical must be thoroughly trained regarding its hazards, and its safe use, and must wear appropriate protective equipment and clothing. Ground and bond all equipment to prevent static charge accumulation. Use non-sparking tools. Post "No Smoking" signs. Can form potentially explosive peroxides upon long standing in air. Do not distill if test shows more than 0.05% peroxides present; they may explode upon concentration by distillation. Open containers with caution. Do not open if container is of unknown age, if solid particles have formed, or if the material's characteristics differ from pure substance. Use smallest amount possible for the purpose, in an area with adequate ventilation. Avoid generating vapour or mist. Do not use

pressure to transfer liquid. Keep containers closed when not in use. Avoid all contact with eyes, skin or clothing.

Storage Requirements: Store in suitable, labelled containers, in a cool, dry, well-ventilated area, out of direct sunlight and away from all sources of ignition and incompatible materials. Storage facilities should be made of fire-resistant materials, and have raised sills and a trench which drains to a safe location. Protect from damage. Inspect regularly for signs of leaking, bulging, or damage. Keep storage area clear of combustible materials. Bond and ground metal containers in storage area.

FIRST AID MEASURES**Specific Measures:**

Eyes: Immediately flush eyes with warm, gently running water for at least twenty (20) minutes, holding eyelids open while flushing. Wear protective gloves to avoid contact. Take care not to flush contaminated water into unaffected eye. Get medical attention immediately.

Skin: Immediately remove contaminated clothing (including rings, watches, belts and shoes). Wear protective gloves to avoid contact. Flush exposed area with large amounts of warm running water and non-abrasive soap for at least five to ten (5 to 10) minutes. Get medical attention. Decontaminate clothing before reuse, or discard.

Inhalation: IMMEDIATELY remove casualty from contaminated area to fresh air (caution must be used by rescuers to avoid exposure to contaminating fumes). Remove any sources of ignition. Give oxygen and get medical attention for any breathing difficulty. If breathing has stopped give artificial respiration. If breathing and pulse are absent give CPR. Immediately obtain medical attention. Stay with casualty until medical assistance is reached.

Ingestion: DO NOT INDUCE VOMITING. If the casualty is alert and not convulsing, give 2 to 4 glasses of water to drink to dilute the material. If spontaneous vomiting occurs, have casualty lean forward to avoid breathing in of emesis. Rinse mouth and administer more water. Get medical attention immediately.

REFERENCES USED

CCINFO disc: MSDS's April 2007

Budavari: The Merck Index, 12th ed., 1997

Royal Society of Chemistry, Chemical Safety Data Sheets, Vol. 1, 1992

Sax, Lewis: Hawley's Condensed Chemical Dictionary, 11th ed., 1987

Suppliers' Material Safety Data Sheets

ADDITIONAL INFORMATION

Date Issued: March 1, 1989

Revision: April 2010

MSDS: 4300-1, 4301-2

Proposed WHMIS Designation: B2; D2A; D2B

Prepared by: Caledon Laboratories Ltd. (905) 877-0101 Caledon Laboratories Ltd. believes the information contained herein is reliable and accurate. Caledon makes no warranty with respect thereto and expressly disclaims all liability for reliance thereon. Such information is solely for your consideration, investigation, and verification.