

Diethyl Pyrocarbonate

sc-202574

Material Safety Data Sheet



The Power to Question

Hazard Alert Code
Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

Diethyl Pyrocarbonate

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Company: Santa Cruz Biotechnology, Inc.

Address:

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PRODUCT USE

Esterifying agent. Preservative in wines, soft drinks and fruit juices. RNAase inhibitor; reagent for selective modification of histidine. Modification of nucleotides, preferential carbethoxylation of purine N-7. Reagent for alpha-ethoxycarbonylation of ketones. Reagent

SYNONYMS

C6-H10-O5, O(CO2C2H5)2, "dicarbonic acid diethyl ester", "diethyl dicarbonate", "diethyl ester of pyrocarbonic acid", "diethyl oxyformate", "diethyl pyrocarbonic acid", DKD, "ethyl pyrocarbonate", "oxydiformic acid diethyl ester", Piref, "pyrocarbonic acid, diethyl ester", "ethoxyformic anhydride", DEPC, preservative

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Harmful if swallowed.

Limited evidence of a carcinogenic effect.

HARMFUL - May cause lung damage if swallowed.

Irritating to eyes, respiratory system and skin.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.

■ Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733).

■ The main effects of simple esters are irritation, stupor and insensibility. Headache, drowsiness, dizziness, coma and behavioral changes may occur. Respiratory symptoms may include irritation, shortness of breath, rapid breathing, throat inflammation, bronchitis, lung inflammation and pulmonary edema, sometimes delayed. Nausea, vomiting, diarrhea and cramps

are observed. Liver and kidney damage may result from massive exposures.

EYE

- This material can cause eye irritation and damage in some persons.

SKIN

- This material can cause inflammation of the skin on contact in some persons.
- The material may accentuate any pre-existing dermatitis condition.
- Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

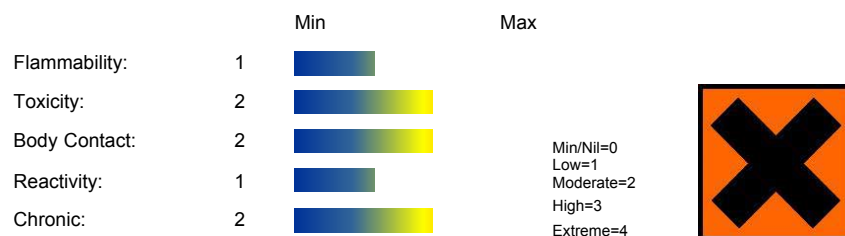
- The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.
- Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.
- Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual.
- The main effects of simple esters are irritation, stupor and insensibility. Headache, drowsiness, dizziness, coma and behavioral changes may occur. Respiratory symptoms may include irritation, shortness of breath, rapid breathing, throat inflammation, bronchitis, lung inflammation and pulmonary edema, sometimes delayed. Nausea, vomiting, diarrhea and cramps are observed. Liver and kidney damage may result from massive exposures.

CHRONIC HEALTH EFFECTS

- Limited evidence of a carcinogenic effect.
- Diethyl dicarbonate slowly decomposes in aqueous solutions and in combination with amino acids and proteins found in beverages (for which it is a preservative) may form toxic and potentially carcinogenic urethane. A replacement for the substance has been sought.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS



NAME	CAS RN	%
diethyl pyrocarbonate	1609-47-8	> 96
Slowly decomposes in water to form		
ethanol	64-17-5	
carbon dioxide	124-38-9	

Section 4 - FIRST AID MEASURES

SWALLOWED

-
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Seek medical advice.
- Avoid giving milk or oils.
- Avoid giving alcohol.
- If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

EYE

- If this product comes in contact with the eyes:
 - Wash out immediately with fresh running water.
 - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
 - If pain persists or recurs seek medical attention.
 - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin contact occurs:
 - Immediately remove all contaminated clothing, including footwear
 - Flush skin and hair with running water (and soap if available).
 - Seek medical attention in event of irritation.

INHALED

-
- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor, without delay.

NOTES TO PHYSICIAN

■ Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically. Mechanical means should be used if it is considered necessary to evacuate the stomach contents; these include gastric lavage after endotracheal intubation. If spontaneous vomiting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours.

Treat symptomatically.

for simple esters:

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary edema.
- Monitor and treat, where necessary, for shock.
- DO NOT use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.
- Give activated charcoal.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary edema.
- Hypotension with signs of hypovolemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

EMERGENCY DEPARTMENT

- Laboratory analysis of complete blood count, serum electrolytes, BUN, creatinine, glucose, urinalysis, baseline for serum aminotransferases (ALT and AST), calcium, phosphorus and magnesium, may assist in establishing a treatment regime. Other useful analyses include anion and osmolar gaps, arterial blood gases (ABGs), chest radiographs and electrocardiograph.
- Positive end-expiratory pressure (PEEP)-assisted ventilation may be required for acute parenchymal injury or adult respiratory distress syndrome.
- Consult a toxicologist as necessary.

BRONSTEIN, A.C. and CURRANCE, P.L. EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Not available
Upper Explosive Limit (%):	Not available
Specific Gravity (water=1):	1.12
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA

-
- Alcohol stable foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.
- Water spray or fog - Large fires only.

FIRE FIGHTING

-
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Use water delivered as a fine spray to control fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- Do not approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

-
- Combustible.
- Slight fire hazard when exposed to heat or flame.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO).
- May emit acrid smoke.
- Mists containing combustible materials may be explosive.

Combustion products include: carbon dioxide (CO₂), other pyrolysis products typical of burning organic material.

May emit poisonous fumes.

May emit corrosive fumes.

FIRE INCOMPATIBILITY

- Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

PERSONAL PROTECTION

Glasses:

Chemical goggles.

Gloves:
Respirator:
Type A Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Slippery when spilt.
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable labeled container for waste disposal.

MAJOR SPILLS

■ Chemical Class: ester and ethers

For release onto land: recommended sorbents listed in order of priority.

SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
LAND SPILL - SMALL				
cross-linked polymer - particulate	1	shovel	shovel	R, W, SS
cross-linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
sorbent clay - particulate	2	shovel	shovel	R, I, P
wood fiber - particulate	3	shovel	shovel	R, W, P, DGC
wood fiber - pillow	3	throw	pitchfork	R, P, DGC, RT
treated wood fiber - pillow	3	throw	pitchfork	DGC, RT
LAND SPILL - MEDIUM				
cross-linked polymer - particulate	1	blower	skiploader	R, W, SS
cross-linked polymer - pillow	2	throw	skiploader	R, DGC, RT
sorbent clay - particulate	3	blower	skiploader	R, I, P
polypropylene - particulate	3	blower	skiploader	W, SS, DGC
expanded mineral - particulate	4	blower	skiploader	R, I, W, P, DGC
wood fiber - particulate	4	blower	skiploader	R, W, P, DGC

Legend

DGC: Not effective where ground cover is dense

R; Not reusable

I: Not incinerable

P: Effectiveness reduced when rainy

RT: Not effective where terrain is rugged

SS: Not for use within environmentally sensitive sites

W: Effectiveness reduced when windy

Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;

R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988.

Slippery when spilt.

Moderate hazard.

- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- No smoking, naked lights or ignition sources. Increase ventilation.
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGl) (in ppm)

AEGl 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGl 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGl 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

-
- DO NOT allow clothing wet with material to stay in contact with skin
- Avoid all personal contact, including inhalation.

- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- Avoid smoking, naked lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

RECOMMENDED STORAGE METHODS

- Metal can or drum
- Packing as recommended by manufacturer.
- Check all containers are clearly labeled and free from leaks.

STORAGE REQUIREMENTS

- Store in original containers.
- Keep containers securely sealed.
- No smoking, naked lights or ignition sources.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X: Must not be stored together

O: May be stored together with specific preventions

+: May be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC	Notes
Canada - Alberta Occupational Exposure Limits	ethanol (Ethanol (Ethyl alcohol))	1000	1880						
Canada - British Columbia Occupational Exposure Limits	ethanol (Ethanol Revised 2009)			1000					
Canada - Ontario Occupational Exposure Limits	ethanol (Ethanol)	1,000	1,900						
US ACGIH Threshold Limit Values (TLV)	ethanol (Ethanol)			1000					TLV Basis: upper respiratory tract irritation
US NIOSH Recommended Exposure Limits (RELs)	ethanol (Ethyl alcohol)	1000	1900						
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	ethanol (Ethyl alcohol (Ethanol))	1000	1900						
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	ethanol (Ethyl alcohol (Ethanol))	1000	1900						
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	ethanol (Ethyl alcohol (Ethanol))	1000	1900						
US - Minnesota Permissible Exposure Limits (PELs)	ethanol (Ethyl alcohol (Ethanol))	1000	1900						
US - California Permissible Exposure Limits for Chemical	ethanol (Ethyl	1 000	1 900						

Exposure Limits for Chemical Contaminants	alcohol; ethanol)	1,000	1,900		
US - Idaho - Limits for Air Contaminants	ethanol (Ethyl alcohol (ethanol))	1000	1900		
US OSHA Permissible Exposure Levels (PELs) - Table Z1	ethanol (Ethyl alcohol (Ethanol))	1000	1900		
US - Hawaii Air Contaminant Limits	ethanol (Ethyl alcohol (Ethanol))	1,000	1,900		
US - Alaska Limits for Air Contaminants	ethanol (Ethyl alcohol (Ethanol))	1000	1900		
US - Michigan Exposure Limits for Air Contaminants	ethanol (Ethyl alcohol (Ethanol))	1000	1900		
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	ethanol (Ethyl alcohol (Ethanol))	1,000	1,900	1,000	1,900
US - Washington Permissible exposure limits of air contaminants	ethanol (Ethyl alcohol (ethanol))	1,000		1,250	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	ethanol (Ethanol)	1000		1250	
Canada - Prince Edward Island Occupational Exposure Limits	ethanol (Ethanol)			1000	TLV Basis: upper respiratory tract irritation
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	ethanol (Ethyl alcohol (Ethanol))	1000	1900		
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	ethanol (Ethyl alcohol)	1000	1880		
US - Oregon Permissible Exposure Limits (Z1)	ethanol (Ethyl alcohol (ethanol))	1,000	1,900		
Canada - Northwest Territories Occupational Exposure Limits (English)	ethanol (Ethyl alcohol (Ethanol))	1000	1884	1250	2355
Canada - Nova Scotia Occupational Exposure Limits	ethanol (Ethanol)			1000	TLV Basis: upper respiratory tract irritation
Canada - Alberta Occupational Exposure Limits	carbon dioxide (Carbon dioxide)	5000	9000	30,000	54,000
Canada - British Columbia Occupational Exposure Limits	carbon dioxide (Carbon dioxide)	5000		15,000	
Canada - Ontario Occupational Exposure Limits	carbon dioxide (Carbon dioxide)	5,000	9,000	30,000	54,000
US ACGIH Threshold Limit Values (TLV)	carbon dioxide (Carbon dioxide)	5000		30000	TLV Basis: asphyxia; 19.5% minimum oxygen content by volume under normal atmospheric pressure.
US NIOSH Recommended Exposure Limits (RELs)	carbon dioxide (Carbon dioxide)	5000	9000	30,000	54,000
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	carbon dioxide (Carbon dioxide)	10,000	18,000	30,000	54,000
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	carbon dioxide (Carbon	5000	9000		

Limits for Air Contaminants	dioxide)				
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	carbon dioxide (Carbon dioxide)	10,000	18,000	30,000	54,000
US - Minnesota Permissible Exposure Limits (PELs)	carbon dioxide (Carbon dioxide)	10,000	18,000	30,000	54,000
US - California Permissible Exposure Limits for Chemical Contaminants	carbon dioxide (Carbon dioxide)	5,000	9,000	30,000	54,000
US - Idaho - Limits for Air Contaminants	carbon dioxide (Carbon dioxide)	5000	9000		
US OSHA Permissible Exposure Levels (PELs) - Table Z1	carbon dioxide (Carbon dioxide)	5000	9000		
US - Hawaii Air Contaminant Limits	carbon dioxide (Carbon dioxide)	5,000	9,000	15,000	27,000
US - Alaska Limits for Air Contaminants	carbon dioxide (Carbon dioxide)	10	18	30	54
US - Michigan Exposure Limits for Air Contaminants	carbon dioxide (Carbon dioxide)	10000	18000	30000	54000
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	carbon dioxide (Carbon dioxide)	5,000	9,000	15,000	27,000
US - Washington Permissible exposure limits of air contaminants	carbon dioxide (Carbon dioxide)	5,000		30,000	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	carbon dioxide (Carbon dioxide)	5000		30,000	
Canada - Prince Edward Island Occupational Exposure Limits	carbon dioxide (Carbon dioxide)	5000		30000	TLV Basis: asphyxia; 19.5% minimum oxygen content by volume under normal atmospheric pressure.
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	carbon dioxide (Carbon dioxide)	5000	9000		
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	carbon dioxide (Carbon dioxide)	5000	9000	30000	54000
US - Oregon Permissible Exposure Limits (Z1)	carbon dioxide (Carbon dioxide)	5,000	9,000		
Canada - Northwest Territories Occupational Exposure Limits (English)	carbon dioxide (Carbon dioxide)	5000	9000	15000	27000
Canada - Nova Scotia Occupational Exposure Limits	carbon dioxide (Carbon dioxide)	5000		30000	TLV Basis: asphyxia; 19.5% minimum oxygen content by volume under normal atmospheric pressure.
The following materials had no OELs on our records					
• diethyl pyrocarbonate: CAS:1609-47-8					

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
ethanol		3,300 [LEL]
carbon dioxide		40,000

NOTES

Values marked LEL indicate that the IDLH was based on 10% of the lower explosive limit for safety considerations even though the relevant toxicological data indicated that irreversible health effects or impairment of escape existed only at higher concentrations.

ODOR SAFETY FACTOR (OSF)

OSF=0.068 (CARBON DIOXIDE)

■ Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.

Odor Safety Factor (OSF) is determined to fall into either Class C, D or E.

The Odor Safety Factor (OSF) is defined as:

OSF= Exposure Standard (TWA) ppm/ Odor Threshold Value (OTV) ppm

Classification into classes follows:

Class	OSF	Description
A	550	Over 90% of exposed individuals are aware by smell that the Exposure Standard (TLV-TWA for example) is being reached, even when distracted by working activities
B	26-550	Idem for 50-90% of persons being distracted
C	1-26	Idem for less than 50% of persons being distracted
D	0.18-1	0-50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	Idem for less than 10% of persons aware of being tested

Amoore and Hautala * have determined that it is only at an OSF value of 26 that 50% of distracted persons can detect the substance at the Exposure Standard value. In the case of alerted persons, an OSF of 26 means that 99% of them can detect the odor at the Exposure Standard value. It is ONLY for substances belonging to Class A and B that there is a reasonable chance of being warned in time, that the Exposure Standard is being exceeded. * Journal Applied Toxicology: Vol 3, 1983, p272

NOTE: The use of the OSF may be inappropriate for mixtures where substances mask the odor of others.

MATERIAL DATA

DIETHYL PYROCARBONATE:

ETHANOL:

■ Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.

OSHA (USA) concluded that exposure to sensory irritants can:

- cause inflammation
- cause increased susceptibility to other irritants and infectious agents
- lead to permanent injury or dysfunction
- permit greater absorption of hazardous substances and
- acclimate the worker to the irritant warning properties of these substances thus increasing the risk of overexposure.

ETHANOL:

■ For ethanol:

Odour Threshold Value: 49-716 ppm (detection), 101 ppm (recognition)

Eye and respiratory tract irritation do not appear to occur at exposure levels of less than 5000 ppm and the TLV-TWA is thought to provide an adequate margin of safety against such effects. Experiments in man show that inhalation of 1000 ppm caused slight symptoms of poisoning and 5000 ppm caused strong stupor and morbid sleepiness. Subjects exposed to 5000 ppm to 10000 ppm experienced smarting of the eyes and nose and coughing. Symptoms disappeared within minutes. Inhalation also causes local irritating effects to the eyes and upper respiratory tract, headaches, sensation of heat intraocular tension, stupor, fatigue and a need to sleep. At 15000 ppm there was continuous lachrymation and coughing.

CARBON DIOXIDE:

■ ES TWA: simple asphyxiant TLV TWA: simple asphyxiant. Simple asphyxiants are gases which, when present in high concentrations, reduce the oxygen content in air below that required to support breathing, consciousness and life; i.e. loss of consciousness, with death by suffocation may rapidly occur in an oxygen deficient atmosphere. CARE: Most simple asphyxiants are odorless and there is no warning on entry into an oxygen deficient atmosphere. If there is any doubt, oxygen content can be checked simply and quickly. It may not be appropriate to only recommend an exposure standard for simple asphyxiants rather it is essential that sufficient oxygen be maintained. Air normally has 21 percent oxygen by volume, with 18 percent regarded as minimum under normal atmospheric pressure to maintain consciousness / life. At pressures significantly higher or lower than normal atmospheric pressure, expert guidance should be sought.

For carbon dioxide:

NOTE: Detector tubes for carbon dioxide, measuring in excess of 0.01 % vol., are commercially available. Long-term measurements (4 hrs) may be conducted to detect concentrations exceeding 250 ppm.

Studies using physically fit males in confined spaces indicate the TLV-TWA and STEL provides a wide margin of safety against asphyxiation and from undue metabolic stress, provided normal amounts of oxygen are present in inhaled air. Lowered oxygen content, increased physical activity and prolonged exposures each impact on systemic and respiratory effects.

Stimulation of the respiratory centre is produced at 50,000 ppm (5%). The gas is weakly narcotic at 30,000 ppm giving rise to reduced acuity of hearing and increasing blood pressure and pulse. Persons exposed a 20,000 ppm for several hours developed headaches and dyspnea on mild exertion. Acidosis and adrenal cortical exhaustion occurred as a result of prolonged continuous exposure at 10,000-20,000 ppm.

Intoxication occurs after a 30 minute exposure at 50,000 ppm whilst exposure at 70,000-100,000 ppm produces unconsciousness within a few minutes.

Odour Safety Factor (OSF)

OSF=0.068 (CARBON DIOXIDE).

PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

■

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses.

HANDS/FEET

- Wear chemical protective gloves, eg. PVC.

Wear safety footwear or safety gumboots, eg. Rubber.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

OTHER

-
- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.
- Eye wash unit.

RESPIRATOR

- Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-face Respirator	Full-Face Respirator
1000	10	A-1	-
1000	50	-	A-1
5000	50	Airline*	-
5000	100	-	A-2
10000	100	-	A-3
	100+		Airline* *

* - Continuous Flow ** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

ENGINEERING CONTROLS

- Local exhaust ventilation usually required. If risk of overexposure exists, wear an approved respirator. Correct fit is essential to obtain adequate protection an approved self contained breathing apparatus (SCBA) may be required in some situations. Provide adequate ventilation in warehouse or closed storage area.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
solvent, vapors, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favorable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

PHYSICAL PROPERTIES

Liquid.

State	Liquid	Molecular Weight	162.14
Melting Range (°F)	Not available	Viscosity	Not Available
Boiling Range (°F)	199.4 (18 mm Hg)	Solubility in water (g/L)	Reacts
Flash Point (°F)	156.992	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	Not available
Upper Explosive Limit (%)	Not available	Specific Gravity (water=1)	1.12
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	>1
Volatile Component (%vol)	Not available	Evaporation Rate	Not available

APPEARANCE

Colourless liquid with fruity odour; does not mix with water without decomposition.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

-
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY

-
- Esters react with acids to liberate heat along with alcohols and acids.
- Strong oxidizing acids may cause a vigorous reaction with esters that is sufficiently exothermic to ignite the reaction products.
- Heat is also generated by the interaction of esters with caustic solutions.
- Flammable hydrogen is generated by mixing esters with alkali metals and hydrides.
- Esters may be incompatible with aliphatic amines and nitrates.

Avoid storage with reducing agents.

Segregate from alcohol, water.

- Avoid strong acids, bases.
- NOTE: May develop pressure in containers; open carefully. Vent periodically.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

diethyl pyrocarbonate

TOXICITY AND IRRITATION

- unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Oral (rat) LD50: 850 mg/kg	Nil Reported
Intraperitoneal (Rat) LD50: 47 mg/kg	
Oral (Mouse) LD50: 1558 mg/kg	
Oral (Dog) LD50: 500 mg/kg	
Oral (Cat) LD50: 100 mg/kg	
Oral (Rabbit) LD50: 500 mg/kg	

- Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

Intraperitoneal (mouse): 47 mg/kg

CARCINOGEN

Ethanol in alcoholic beverages	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	1
Ethanol	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A3
ETHANOL	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	HAZMAP, NTP-C
ETHYL ALCOHOL IN ALCOHOLIC BEVERAGES	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	IARC

REPROTOXIN

carbon dioxide ILO Chemicals in the electronics industry that have toxic effects on reproduction Reduced fertility or sterility

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

ETHANOL:

DIETHYL PYROCARBONATE:

■ DO NOT discharge into sewer or waterways.

DIETHYL PYROCARBONATE:

ETHANOL:

■ Fish LC50 (96hr.) (mg/l):	13480
■ Algae IC50 (72hr.) (mg/l):	1450
■ log Kow (Sangster 1997):	- 0.3
■ BOD5:	63%
■ ThOD:	2.1
■ Half- life Soil - High (hours):	24
■ Half- life Soil - Low (hours):	2.6
■ Half- life Air - High (hours):	122
■ Half- life Air - Low (hours):	12.2
■ Half- life Surface water - High (hours):	26
■ Half- life Surface water - Low (hours):	6.5
■ Half- life Ground water - High (hours):	52
■ Half- life Ground water - Low (hours):	13
■ Aqueous biodegradation - Aerobic - High (hours):	26
■ Aqueous biodegradation - Aerobic - Low (hours):	6.5
■ Aqueous biodegradation - Anaerobic - High (hours):	104
■ Aqueous biodegradation - Anaerobic - Low (hours):	26
■ Aqueous biodegradation - Removal secondary treatment - High (hours):	67%
■ Photooxidation half- life water - High (hours):	3.20E+05
■ Photooxidation half- life water - Low (hours):	8020
■ Photooxidation half- life air - High (hours):	122
■ Photooxidation half- life air - Low (hours):	12.2

■ When ethanol is released into the soil it readily and quickly biodegrades but may leach into ground water; most is lost by evaporation. When released into water the material readily evaporates and is biodegradable.

Ethanol does not bioaccumulate to an appreciable extent.

The material is readily degraded by reaction with photochemically produced hydroxy radicals; release into air will result in photodegradation and wet deposition.

Environmental Fate:

TERRESTRIAL FATE: An estimated Koc value of 1 indicates that ethanol is expected to have very high mobility in soil. Volatilisation of ethanol from moist soil surfaces is expected to be an important fate process given a Henry's Law constant of 5×10^{-6} atm-m³/mole. The potential for volatilization of ethanol from dry soil surfaces may exist based upon an extrapolated vapor pressure of 59.3 mm Hg. Biodegradation is expected to be an important fate process for ethanol based on half-lives on the order of a few days for ethanol in sandy soil/groundwater microcosms.

AQUATIC FATE: An estimated Koc value of 1 indicates that ethanol is not expected to adsorb to suspended solids and sediment. Volatilisation from water surfaces is expected based upon a Henry's Law constant of 5×10^{-6} atm-m³/mole. Using this Henry's Law constant and an estimation method, volatilisation half-lives for a model river and model lake are 3 and 39 days, respectively. An estimated BCF = 3, from a log Kow of -0.31 suggests bioconcentration in aquatic organisms is low. Hydrolysis and photolysis in sunlit surface waters is not expected to be an important environmental fate process for ethanol since this compound lacks functional groups that hydrolyse or absorb light under environmentally relevant conditions. Ethanol was degraded with half-lives on the order of a few days in aquatic studies conducted using microcosms constructed with a low organic sandy soil and groundwater, indicating it is unlikely to be persistent in aquatic environments(8).

ATMOSPHERIC FATE: Ethanol, which has an extrapolated vapor pressure of 59.3 mm Hg at 25 deg C, is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase ethanol is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 5 days, calculated from its rate constant of 3.3×10^{-12} m³/molecule-sec at 25 deg C.

Ecotoxicity:

log Kow : -0.31- -0.32

Half-life (hr) air : 144

Half-life (hr) H₂O surface water : 144

Henry's atm m³ /mol: 6.29E-06

BOD 5 if unstated: 0.93-1.67,63%

COD : 1.99-2.11,97%

ThOD : 2.1

CARBON DIOXIDE:

■ log Kow (Sangster 1997):	0.83
----------------------------	------

■ For carbon dioxide:

Environmental fate:

Carbon dioxide in earth's atmosphere is considered a trace gas currently occurring at an average concentration of about 385 parts per million by volume or 582 parts per million by mass. The mass of the Earth atmosphere is 5.14×10^{18} kg, so the total mass of atmospheric carbon dioxide is 3.0×10^{15} kg (3,000 gigatonnes). Atmospheric concentrations of carbon dioxide fluctuate slightly with the change of the seasons, driven primarily by seasonal plant growth.

Due to human activities such as the combustion of fossil fuels and deforestation, the concentration of atmospheric carbon dioxide has increased by about 35% since preindustrial times. In 1999, 2,244,804,000 (= 2.2×10^9) metric tons of CO₂ were produced in the U.S. as a result of electric energy generation. This is an output rate of 0.6083 kg (1.341 pounds) per kWh.

There is about 50 times as much carbon dissolved in the oceans in the form of CO₂ and CO₂ hydration products as exists in the atmosphere. The oceans act as an enormous carbon sink, having "absorbed about one-third of all human-generated CO₂ emissions to date." Generally, gas solubility decreases as water temperature increases. Accordingly the ability of the oceans to absorb carbon dioxide from the atmosphere decreases as ocean temperatures rise.

Carbon dioxide is soluble in water, in which it spontaneously interconverts between CO₂ and H₂CO₃ (carbonic acid). The relative concentrations of CO₂, H₂CO₃, and the deprotonated forms HCO₃⁻ (bicarbonate) and CO₃²⁻ (carbonate) depend on the pH. In neutral or slightly alkaline water (pH > 6.5), the bicarbonate form predominates (>50%) becoming the most prevalent (>95%) at the pH of seawater, while in very alkaline water (pH > 10.4) the predominant (>50%) form is carbonate. The bicarbonate and carbonate forms are very soluble, such that air-equilibrated ocean water (mildly alkaline with typical pH = 8.2 - 8.5) contains about 120 mg of bicarbonate per liter.

Most of the CO₂ taken up by the ocean forms carbonic acid. Some is consumed in photosynthesis by organisms in the water, and a small proportion of that sinks and leaves the carbon cycle. There is considerable concern that as a result of increased CO₂ in the atmosphere the acidity of seawater has been increasing and may adversely affect organisms living in the water. In particular, with increasing acidity, the availability of carbonates for forming shells decreases.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
diethyl pyrocarbonate	HIGH		LOW	HIGH
ethanol	LOW	MED	LOW	HIGH
carbon dioxide	LOW		LOW	HIGH

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

! Puncture containers to prevent re-use and bury at an authorized landfill.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction,
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible or consult manufacturer for recycling options.
- Consult Waste Management Authority for disposal.
- Bury or incinerate residue at an approved site.
- Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - TRANSPORTATION INFORMATION

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: DOT, IATA, IMDG

Section 15 - REGULATORY INFORMATION

diethyl pyrocarbonate (CAS: 1609-47-8) is found on the following regulatory lists;

"Canada Domestic Substances List (DSL)", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US Food Additive Database", "US Toxic Substances Control Act (TSCA) - Inventory"

Regulations for ingredients

ethanol (CAS: 64-17-5) is found on the following regulatory lists;

"Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada ARET (Accelerated Reduction / Elimination of Toxics) Substance List", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 18: List of products to which the Code does not apply", "IMO MARPOL 73/78 (Annex II) - List of Other Liquid Substances", "IMO Provisional Categorization of Liquid Substances - List 2: Pollutant only mixtures containing at least 99% by weight of components already assessed by IMO", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Air Transport Association (IATA) Dangerous Goods Regulations", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - Alaska Limits for Air Contaminants", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California Permissible Exposure Limits for Chemical Contaminants", "US - California Proposition 65 - Priority List for the Development of MADLs for Chemicals Causing Reproductive Toxicity", "US - California Proposition 65 - Reproductive Toxicity", "US - Connecticut Hazardous Air Pollutants", "US - Hawaii Air Contaminant Limits", "US - Idaho - Limits for Air Contaminants", "US - Maine Chemicals of High Concern List", "US - Massachusetts Oil & Hazardous Material List", "US - Michigan Exposure Limits for Air Contaminants", "US - Minnesota Hazardous Substance List", "US - Minnesota Permissible Exposure Limits (PELs)", "US - New Jersey Right to Know Hazardous Substances", "US - Oregon Permissible Exposure Limits (Z1)", "US - Pennsylvania - Hazardous Substance List", "US - Rhode Island Hazardous Substance List", "US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants", "US - Washington Permissible exposure limits of air contaminants", "US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants", "US ACGIH Threshold Limit Values (TLV)", "US ACGIH Threshold Limit Values (TLV) - Carcinogens", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes", "US EPA High Production Volume Program Chemical List", "US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives", "US Food Additive Database", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide", "US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants", "US Toxic Substances Control Act (TSCA) - Inventory"

carbon dioxide (CAS: 124-38-9) is found on the following regulatory lists;

"Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)", "CODEX General Standard for Food Additives (GSFA) - Additives Permitted for Use in

Food in General, Unless Otherwise Specified, in Accordance with GMP", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - Alaska Limits for Air Contaminants", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California Permissible Exposure Limits for Chemical Contaminants", "US - Hawaii Air Contaminant Limits", "US - Idaho - Limits for Air Contaminants", "US - Massachusetts Oil & Hazardous Material List", "US - Michigan Exposure Limits for Air Contaminants", "US - Minnesota Hazardous Substance List", "US - Minnesota Permissible Exposure Limits (PELs)", "US - New Jersey Right to Know Hazardous Substances", "US - Oregon Permissible Exposure Limits (Z1)", "US - Pennsylvania - Hazardous Substance List", "US - Rhode Island Hazardous Substance List", "US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants", "US - Washington Permissible exposure limits of air contaminants", "US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants", "US ACGIH Threshold Limit Values (TLV)", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US EPA High Production Volume Program Chemical List", "US Food Additive Database", "US NFPA 30B Manufacture and Storage of Aerosol Products - Chemical Heat of Combustion", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide", "US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants", "US Toxic Substances Control Act (TSCA) - Inventory", "US TSCA Section 8 (a) Inventory Update Rule (IUR) - Partial Exemptions"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Inhalation may produce health damage*.
 - Cumulative effects may result following exposure*.
 - Repeated exposure potentially causes skin dryness and cracking*.
 - Vapors potentially cause drowsiness and dizziness*.
- * (limited evidence).

REPRODUCTIVE HEALTH GUIDELINES

■ Established occupational exposure limits frequently do not take into consideration reproductive end points that are clearly below the thresholds for other toxic effects. Occupational reproductive guidelines (ORGs) have been suggested as an additional standard. These have been established after a literature search for reproductive no-observed-adverse-effect-level (NOAEL) and the lowest-observed-adverse-effect-level (LOAEL). In addition the US EPA's procedures for risk assessment for hazard identification and dose-response assessment as applied by NIOSH were used in the creation of such limits. Uncertainty factors (UFs) have also been incorporated.

Ingredient	ORG	UF	Endpoint	CR	Adeq TLV
ethanol	1880 mg/m3	NA	NA	NA	Yes
carbon dioxide	1800 mg/m3	10	D/R	NA	-

■ These exposure guidelines have been derived from a screening level of risk assessment and should not be construed as unequivocally safe limits. ORGS represent an 8-hour time-weighted average unless specified otherwise. CR = Cancer Risk/10000; UF = Uncertainty factor; TLV believed to be adequate to protect reproductive health; LOD: Limit of detection Toxic endpoints have also been identified as: D = Developmental; R = Reproductive; TC = Transplacental carcinogen Jankovic J., Drake F.: A Screening Method for Occupational Reproductive Health Risk: American Industrial Hygiene Association Journal 57: 641-649 (1996).

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■ Classification of the mixture and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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