

Butyltin trichloride

sc-234250

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

Butyltin trichloride

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Company: Santa Cruz Biotechnology, Inc.
2145 Delaware Ave
Santa Cruz, CA 95060

Telephone: 800.457.3801 or 831.457.3800

Emergency Tel: **CHEMWATCH: From within the US and Canada: 877-715-9305**

Emergency Tel: **From outside the US and Canada: +800 2436 2255 (1-800-CHEMCALL) or call +613 9573 3112**

PRODUCT USE

Used in hot end glass coating. Used as per manufacturers Directions.

SYNONYMS

C4-H9-Cl3-Sn, CH₃(CH₂)₃SnCl₃, "stannane, butyltrichloro-", "butylstannium trichloride", "monobutyltin trichloride", "tin, n-butyl-, trichloride", "organotin compound", "Teoglass (misspelling)"

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

	Min	Max	
Flammability:	1		
Toxicity:	2		
Body Contact:	4		
Reactivity:	1		
Chronic:	2		
			Min/Nil=0 Low=1 Moderate=2 High=3 Extreme=4



CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Causes burns.

Risk of serious damage to eyes.

Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.

Harmful by inhalation, in contact with skin and if swallowed.

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

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.

■ The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion.

■ Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and esophagus. Immediate pain and difficulties in swallowing and speaking may also be evident. Swelling of the epiglottis may make it difficult to breathe which may result in suffocation. More severe exposure may result in vomiting blood and thick mucus, shock, abnormally low blood pressure, fluctuating pulse, shallow respiration and clammy skin, inflammation of stomach wall, and rupture of esophageal tissue. Untreated shock may eventually result in kidney failure. Severe cases may result in perforation of the stomach and abdominal cavity with consequent infection, rigidity and fever. There may be severe narrowing of the esophageal or pyloric sphincters; this may occur immediately or after a delay of weeks to years. There may be coma and convulsions, followed by death due to infection of the abdominal cavity, kidneys or lungs.

■ Subchronic exposures to mono-, di- and tri- and tetra-substituted organotin compounds may elicit toxic response in the central nervous, immune and renal systems, the liver and bile duct and the skin.

■ The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion.

EYE

■ The material can produce chemical burns to the eye following direct contact. Vapors or mists may be extremely irritating.

■ If applied to the eyes, this material causes severe eye damage.

■ Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns. Mild burns of the epithelia generally recover rapidly and completely. Severe burns produce long-lasting and possibly irreversible damage. The appearance of the burn may not be apparent for several weeks after the initial contact. The cornea may ultimately become deeply opaque resulting in blindness.

■ Organotin compounds may be strong irritants, and acute conjunctivitis may result from eye splashes, even when followed by immediate lavage; corneal opacities have also been observed.

■ The material can produce severe chemical burns to the eye following direct contact. Vapors or mists may be extremely irritating.

SKIN

■ Skin contact with the material may be harmful; systemic effects may result following absorption.

■ The material can produce chemical burns following direct contact with the skin.

■ Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue.

■ Irritation following contact with organotin compounds may be delayed, in certain cases chemical burns and dermatitis may result. Rate of absorption may be increased if product is in solution.

■ 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.

■ The material can produce severe chemical burns following direct contact with the skin.

■ This material can cause inflammation of the skin on contact in some persons.

INHALED

■ Inhalation of vapors or aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful.

■ Inhalation hazard is increased at higher temperatures.

■ Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness. Swelling of the lungs can occur, either immediately or after a delay; symptoms of this include chest tightness, shortness of breath, frothy phlegm and cyanosis. Lack of oxygen can cause death hours after onset.

■ The acute toxicity of inhaled organotin compounds resembles that found by other means of exposure.

■ The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.

■ Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation of larynx and bronchi, chemical pneumonitis and pulmonary edema.

CHRONIC HEALTH EFFECTS

■ Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.

This material can cause serious damage if one is exposed to it for long periods. It can be assumed that it contains a substance which can produce severe defects. This has been demonstrated via both short- and long-term experimentation.

Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.

Both tributyltins (TBT) and dibutyltins (DBT) have negative effects on the reproductive system in mammals. In line with these facts, TBT and TPT were given the highest category in a European review of endocrine disrupting chemicals (BKH, 2000): "Evidence for endocrine disruption in living organisms". TBT was also classified as "Evidence of potential to cause endocrine disruption in humans".

Organotins are also toxic by other mechanisms. For instance, several organotins are strongly immunosuppressive, display developmental and reproductive effects and are neurotoxic

TPT is classified as category 3 carcinogenic in the EU, but as category 2 (probable human carcinogenic) by the USEPA (EFSA, 2004). DBT may actually be more toxic than TBT to certain enzyme systems. Immunotoxic and developmental effects in mammals may also be more sensitive to DBT than to TB. Both TBT and TPT may be classified as Persistent, Bioaccumulative and Toxic (PBT) and very Persistent, very Bioaccumulative (vPvB) substances according to certain, whereas DBT and dioctyl tin (DOT) may be classified as PBT

For human health, there are no epidemiological studies on chronic low level exposure available It has been suggested that toxicity was equal for DBT, TBT, DOT and TPT for humans, and proposed a group TDI of 0.1 µg Sn (kg Bw and d)⁻¹.

Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs. Chronic exposure may inflame the skin or conjunctiva.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
butyltin trichloride	1118-46-3	>99
dibutyltin dichloride	683-18-1	<0.5
tributyltin chloride	1461-22-9	<0.5
hydrolyses to produce		
hydrogen chloride	7647-01-0	

Section 4 - FIRST AID MEASURES

SWALLOWED

-
- For advice, contact a Poisons Information Center or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- 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.
- Transport to hospital or doctor without delay.

EYE

- If this product comes in contact with the eyes:
 - Immediately hold eyelids apart and flush the eye continuously with 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.
 - Continue flushing until advised to stop by the Poisons Information Center or a doctor, or for at least 15 minutes.
 - Transport to hospital or doctor without delay.
 - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin or hair contact occurs:
 - Immediately flush body and clothes with large amounts of water, using safety shower if available.
 - Quickly remove all contaminated clothing, including footwear.
 - Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Center.
 - Transport to hospital, or doctor.

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.

NOTES TO PHYSICIAN

- For acute or short term repeated exposures to strong acids:
 - Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
 - Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
 - Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
 - Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the dessicating action of the acid on proteins in specific tissues.

INGESTION:

- Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.

- DO NOT attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.
- Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:

- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:

- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. DO NOT use neutralizing agents or any other additives. Several liters of saline are required.
- Cycloplegic drops, (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist).

[Ellenhorn and Barceloux: Medical Toxicology].

Scanty animal data indicate that BAL may be useful against dialkyl but not trialkyl organotin compounds. D-penicillamine is thought to be inactive. GOSELIN, SMITH HODGE: Clinical Toxicology of Commercial Products, 5th Ed Dimercaprol is suggested to be an effective antidote for dialkyltin poisoning and has been reported to prevent the accumulation of alpha-keto acids produced by dialkyltin compounds. It does not however appear to protect rats from the general toxic effects of triethyltin compounds. This may be due to the fact that dialkyltin compounds, at least up to dihexyl derivatives, react readily with sulfhydryl groups and trialkyltin compounds do not. Surgical decompression was considered to be the only treatment that offered any benefit in human cases of cerebral edema caused by trialkyl compounds. Tin and Organotin Compounds: A Preliminary Review. ENVIRONMENTAL HEALTH CRITERIA: World Health Organization Geneva 1980.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	<0.1 @ 25 C
Upper Explosive Limit (%):	Not available
Specific Gravity (water=1):	1.693
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA

-
- 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 fire fighting procedures suitable for surrounding area.
- 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.
- Equipment should be thoroughly decontaminated after use.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

- Combustion products include: carbon monoxide (CO).
 - Combustible.
 - Slight fire hazard when exposed to heat or flame.
 - Acids may react with metals to produce hydrogen, a highly flammable and explosive gas.
 - 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. May emit corrosive fumes.
- , carbon dioxide (CO₂), hydrogen chloride, phosgene, metal oxides, other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY

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

PERSONAL PROTECTION

- Glasses:
- Full face- shield.
- Gloves:
- Respirator:
- Type AB-P Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

■

- 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:acidic compounds, organic

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

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

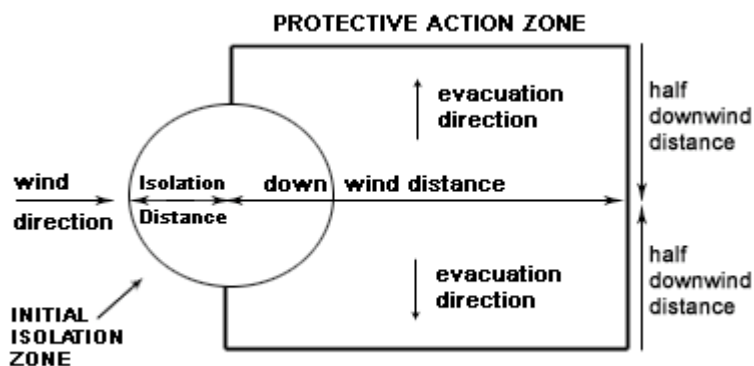
W: Effectiveness reduced when windy

Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;

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

- DO NOT touch the spill material
- Clear area of personnel and move upwind.
- 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.
- Consider evacuation.
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Neutralize/decontaminate residue.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL



From IERG (Canada/Australia)	
Isolation Distance	25 meters
Downwind Protection Distance	250 meters

From US Emergency Response Guide 2000 Guide 153

FOOTNOTES

1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.

2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.

4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.

5 Guide 153 is taken from the US DOT emergency response guide book.

6 IERG information is derived from CANUTEC - Transport Canada.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

hydrogen

chloride

AEGL Type	10 min	30 min	60 min	4 hr	8 hr
1	1.8	1.8	1.8	1.8	GALSYN~
2	100	43	22	11	GALSYN~
3	620	210	100	26	GALSYN~

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.
- WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
- 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.
- Launder contaminated clothing before re-use.
- 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 are maintained.

RECOMMENDED STORAGE METHODS

- DO NOT use aluminum or galvanized containers.

Check regularly for spills and leaks.

- Lined metal can, Lined metal pail/drum
- Plastic pail
- Polyliner drum
- Packing as recommended by manufacturer.
- Check all containers are clearly labeled and free from leaks.

For low viscosity materials

- Drums and jerricans must be of the non-removable head type.
- Where a can is to be used as an inner package, the can must have a screwed enclosure.

For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):

- Removable head packaging;
- Cans with friction closures and
- low pressure tubes and cartridges may be used.

- Where combination packages are used, and the inner packages are of glass, porcelain or stoneware, there must be sufficient inert cushioning material in contact with inner and outer packages unless the outer packaging is a close fitting molded plastic box and the substances are not incompatible with the plastic.

STORAGE REQUIREMENTS

-
- Store in original containers.
- Keep containers securely sealed.
- 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
US - Alaska Limits for Air Contaminants	butyltin trichloride (Tin oxide (as Sn))		2						
Canada - Northwest Territories Occupational Exposure Limits (English)	butyltin trichloride (Tin, inorganic compounds, except SnH and SnO (as Sn))		2		4				
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	butyltin trichloride (Tin, inorganic compounds, (as Sn) (except SnH ₄ and SnO ₂))	-	2	-	4				
US - Minnesota Permissible Exposure Limits (PELs)	butyltin trichloride (Tin, organic compounds (as Sn))		0.1						

US - California Permissible Exposure Limits for Chemical Contaminants	butyltin trichloride (Tin, organic compounds, as Sn)	0.1	0.2	
US NIOSH Recommended Exposure Limits (RELs)	butyltin trichloride (Tin (organic compounds, as Sn))	0.1		[*Note: The REL applies to all organic tin compounds except Cyhexatin.]; [skin]
Canada - Ontario Occupational Exposure Limits	butyltin trichloride (Tin, organic compounds of (as tin))	0.1		Skin
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	butyltin trichloride (Tin, organic compounds (as Sn))	0.1		
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	butyltin trichloride (Tin, organic compounds (as Sn))	0.1		
US - Idaho - Limits for Air Contaminants	butyltin trichloride (Tin (organic compounds) as (Sn))	0.1		
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	butyltin trichloride (Tin, organic compounds (as Sn))	0.1		
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	butyltin trichloride (Tin, (as Sn): organic compounds)	0.1	0.2	Skin
US - Hawaii Air Contaminant Limits	butyltin trichloride (Tin, organic compounds (as Sn))	0.1	0.2	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	butyltin trichloride (Tin, organic compounds (as Sn) - Skin)	0.1	0.2	
US - Washington Permissible exposure limits of air contaminants	butyltin trichloride (Tin (as Sn) - Organic compounds)	0.1	0.3	
Canada - Nova Scotia Occupational Exposure Limits	butyltin trichloride (Tin - Organic compounds (as Sn))	0.1	0.2	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	butyltin trichloride (Tin, organic compounds (as Sn))	0.1		
US - Alaska Limits for Air Contaminants	butyltin trichloride (Tin, organic compounds (as Sn))	0.1		
Canada - Northwest Territories Occupational Exposure Limits (English)	butyltin trichloride (Tin, organic4 compounds2 (as Sn) - Skin)	0.1	0.2	
US ACGIH Threshold Limit Values (TLV)	butyltin trichloride (Tin - Organic compounds (as Sn))	0.1	0.2	
Canada - Alberta Occupational Exposure Limits	butyltin trichloride (Tin, as Sn: Organic compounds)	0.1	0.2	
Canada - British Columbia Occupational Exposure Limits	butyltin trichloride (Tin - Organic compounds, as Sn)	0.1	0.2	Skin
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	butyltin trichloride (Tin: Organic compounds (as Sn))	0.1	0.2	
US - Oregon Permissible Exposure Limits (Z-1)	butyltin trichloride (Tin (organic compounds))	0.1		

Canada - Prince Edward Island Occupational Exposure Limits	butyltin trichloride (Tin - Organic compounds (as Sn))	0.1	0.2	
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	butyltin trichloride (Tin, organic compounds (as Sn))	0.1		
US - Alaska Limits for Air Contaminants	dibutyltin dichloride (Tin oxide (as Sn))	2		
Canada - Northwest Territories Occupational Exposure Limits (English)	dibutyltin dichloride (Tin, inorganic compounds, except SnH and SnO (as Sn))	2	4	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	dibutyltin dichloride (Tin, inorganic compounds, (as Sn) (except SnH4 and SnO2))	2	4	
US - Minnesota Permissible Exposure Limits (PELs)	dibutyltin dichloride (Tin, organic compounds (as Sn))	0.1		
US - California Permissible Exposure Limits for Chemical Contaminants	dibutyltin dichloride (Tin, organic compounds, as Sn)	0.1	0.2	
US NIOSH Recommended Exposure Limits (RELs)	dibutyltin dichloride (Tin (organic compounds, as Sn))	0.1		[*Note: The REL applies to all organic tin compounds except Cyhexatin.]; [skin]
Canada - Ontario Occupational Exposure Limits	dibutyltin dichloride (Tin, organic compounds of (as tin))	0.1		Skin
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	dibutyltin dichloride (Tin, organic compounds (as Sn))	0.1		
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	dibutyltin dichloride (Tin, organic compounds (as Sn))	0.1		
US - Idaho - Limits for Air Contaminants	dibutyltin dichloride (Tin (organic compounds) as (Sn))	0.1		
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	dibutyltin dichloride (Tin, organic compounds (as Sn))	0.1		
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	dibutyltin dichloride (Tin, (as Sn): organic compounds)	0.1	0.2	Skin
US - Hawaii Air Contaminant Limits	dibutyltin dichloride (Tin, organic compounds (as Sn))	0.1	0.2	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	dibutyltin dichloride (Tin, organic compounds (as Sn) - Skin)	0.1	0.2	
US - Washington Permissible exposure limits of air contaminants	dibutyltin dichloride (Tin (as Sn) - Organic compounds)	0.1	0.3	
Canada - Nova Scotia Occupational Exposure Limits	dibutyltin dichloride (Tin - Organic compounds (as Sn))	0.1	0.2	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	dibutyltin dichloride (Tin, organic compounds (as Sn))	0.1		

US - Alaska Limits for Air Contaminants	dibutyltin dichloride (Tin, organic compounds (as Sn))	0.1		
Canada - Northwest Territories Occupational Exposure Limits (English)	dibutyltin dichloride (Tin, organic4 compounds2 (as Sn) - Skin)	0.1	0.2	
US ACGIH Threshold Limit Values (TLV)	dibutyltin dichloride (Tin - Organic compounds (as Sn))	0.1	0.2	
Canada - Alberta Occupational Exposure Limits	dibutyltin dichloride (Tin, as Sn: Organic compounds)	0.1	0.2	
Canada - British Columbia Occupational Exposure Limits	dibutyltin dichloride (Tin - Organic compounds, as Sn)	0.1	0.2	Skin
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	dibutyltin dichloride (Tin: Organic compounds (as Sn))	0.1	0.2	
US - Oregon Permissible Exposure Limits (Z-1)	dibutyltin dichloride (Tin (organic compounds))	0.1		
Canada - Prince Edward Island Occupational Exposure Limits	dibutyltin dichloride (Tin - Organic compounds (as Sn))	0.1	0.2	
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	dibutyltin dichloride (Tin, organic compounds (as Sn))	0.1		
Canada - British Columbia Occupational Exposure Limits	dibutyltin dichloride (Tri-n-Butyltin compounds)	0.05		
US - Alaska Limits for Air Contaminants	tributyltin chloride (Tin oxide (as Sn))	2		
Canada - Northwest Territories Occupational Exposure Limits (English)	tributyltin chloride (Tin, inorganic compounds, except SnH and SnO (as Sn))	2	4	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	tributyltin chloride (Tin, inorganic compounds, (as Sn) (except SnH4 and SnO2))	2	4	
US - Minnesota Permissible Exposure Limits (PELs)	tributyltin chloride (Tin, organic compounds (as Sn))	0.1		
US - California Permissible Exposure Limits for Chemical Contaminants	tributyltin chloride (Tin, organic compounds, as Sn)	0.1	0.2	
US NIOSH Recommended Exposure Limits (RELs)	tributyltin chloride (Tin (organic compounds, as Sn))	0.1		[*Note: The REL applies to all organic tin compounds except Cyhexatin.]; [skin]
Canada - Ontario Occupational Exposure Limits	tributyltin chloride (Tin, organic compounds of (as tin))	0.1		Skin
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	tributyltin chloride (Tin, organic compounds (as Sn))	0.1		
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	tributyltin chloride (Tin, organic compounds (as Sn))	0.1		
US - Idaho - Limits for Air Contaminants	tributyltin chloride (Tin (organic compounds) as (Sn))	0.1		

US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	tributyltin chloride (Tin, organic compounds (as Sn))	0.1			
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	tributyltin chloride (Tin, (as Sn): organic compounds)	0.1	0.2		Skin
US - Hawaii Air Contaminant Limits	tributyltin chloride (Tin, organic compounds (as Sn))	0.1	0.2		
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	tributyltin chloride (Tin, organic compounds (as Sn) - Skin)	0.1	0.2		
US - Washington Permissible exposure limits of air contaminants	tributyltin chloride (Tin (as Sn) - Organic compounds)	0.1	0.3		
Canada - Nova Scotia Occupational Exposure Limits	tributyltin chloride (Tin - Organic compounds (as Sn))	0.1	0.2		
US OSHA Permissible Exposure Levels (PELs) - Table Z1	tributyltin chloride (Tin, organic compounds (as Sn))	0.1			
US - Alaska Limits for Air Contaminants	tributyltin chloride (Tin, organic compounds (as Sn))	0.1			
Canada - Northwest Territories Occupational Exposure Limits (English)	tributyltin chloride (Tin, organic4 compounds2 (as Sn) - Skin)	0.1	0.2		
US ACGIH Threshold Limit Values (TLV)	tributyltin chloride (Tin - Organic compounds (as Sn))	0.1	0.2		
Canada - Alberta Occupational Exposure Limits	tributyltin chloride (Tin, as Sn: Organic compounds)	0.1	0.2		
Canada - British Columbia Occupational Exposure Limits	tributyltin chloride (Tin - Organic compounds, as Sn)	0.1	0.2		Skin
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	tributyltin chloride (Tin: Organic compounds (as Sn))	0.1	0.2		
US - Oregon Permissible Exposure Limits (Z-1)	tributyltin chloride (Tin (organic compounds))	0.1			
Canada - Prince Edward Island Occupational Exposure Limits	tributyltin chloride (Tin - Organic compounds (as Sn))	0.1	0.2		
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	tributyltin chloride (Tin, organic compounds (as Sn))	0.1			
Canada - British Columbia Occupational Exposure Limits	hydrogen chloride (Hydrogen chloride Revised 2003)			2	
Canada - Ontario Occupational Exposure Limits	hydrogen chloride (Hydrogen chloride)			2	
US - Minnesota Permissible Exposure Limits (PELs)	hydrogen chloride (Hydrogen chloride)			5	7
US ACGIH Threshold Limit Values (TLV)	hydrogen chloride (Hydrogen chloride)			2	TLV Basis: upper respiratory tract irritation
US NIOSH Recommended Exposure Limits (RELs)	hydrogen chloride (Hydrogen chloride)			5	7
Canada - Alberta Occupational Exposure Limits	hydrogen chloride (Hydrogen chloride)			2	3

US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	hydrogen chloride (Hydrogen chloride)		5	7	
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	hydrogen chloride (Hydrogen chloride)	(C)5 (C)7			
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	hydrogen chloride (Hydrogen chloride)		5	7	
US - California Permissible Exposure Limits for Chemical Contaminants	hydrogen chloride (Hydrogen chloride; muriatic acid)		5	7	
US - Idaho - Limits for Air Contaminants	hydrogen chloride (Hydrogen chloride)		5	7	
US - Hawaii Air Contaminant Limits	hydrogen chloride (Hydrogen chloride)		5	7	
US - Alaska Limits for Air Contaminants	hydrogen chloride (Hydrogen chloride)		5	7	
US - Michigan Exposure Limits for Air Contaminants	hydrogen chloride (Hydrogen chloride)		5	7	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	hydrogen chloride (Hydrogen chloride)	5 7 - -			
US - Washington Permissible exposure limits of air contaminants	hydrogen chloride (Hydrogen chloride)		5.0		
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	hydrogen chloride (Hydrogen chloride)		2		
US - Oregon Permissible Exposure Limits (Z-1)	hydrogen chloride (Hydrogen chloride)		5	7	
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	hydrogen chloride (Hydrogen chloride)		5	7	
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	hydrogen chloride (Hydrogen chloride)		5	7,5	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	hydrogen chloride (Hydrogen chloride)		5	7	
Canada - Northwest Territories Occupational Exposure Limits (English)	hydrogen chloride (Hydrogen chloride)		5	7.5	
Canada - Nova Scotia Occupational Exposure Limits	hydrogen chloride (Hydrogen chloride)		2		TLV Basis: upper respiratory tract irritation
Canada - Prince Edward Island Occupational Exposure Limits	hydrogen chloride (Hydrogen chloride)		2		TLV Basis: upper respiratory tract irritation
EMERGENCY EXPOSURE LIMITS					
Material	Revised IDLH Value (mg/m3)		Revised IDLH Value (ppm)		
butyltin trichloride	25				
dibutyltin dichloride	25				
tributyltin chloride	25				
hydrogen chloride			50		

ODOR SAFETY FACTOR (OSF)

OSF=1.3 (HYDROGEN CHLORIDE)

■ 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

BUTYLTIN TRICHLORIDE:

DIBUTYLTIN DICHLORIDE:

TRIBUTYLTIN CHLORIDE:

■ Exposure limits with "skin" notation indicate that vapor and liquid may be absorbed through intact skin. Absorption by skin may readily exceed vapor inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard. The no/lowest-observed-adverse-effect levels (NOAELs or LOAELs) in inhalation studies involving tri-n-butyltin chloride and bromide are 0.3-0.4 ppm (2-4 mg/m³) based on changes in the lungs, heart, liver, kidneys, nervous system and reproductive system in rodents. Oral administration of organotin compounds has induced toxicity in a number of differing organ systems, organs and lungs. The LOAEL for triethyltin bromide was 0.4 mg triethyltin/kg/day as 5 ppm in drinking water. The LOAELs for the most critical organ sites in rats (i.e. the cellular immune response and CNS effects) are 0.15 and 0.23 mg/tin/kg body weight/day. Experience with ingested tri- and diethyltins in the treatment of staphylococcal infections, osteomyelitis, anthrax and acne suggests that humans react in a manner similar to rodents, but that the human is more sensitive to absorbed organic tin. The recommended TLV-TWA is thought to minimize the potential for adverse effects on immune function and the central nervous system. A STEL is also recommended to minimize acute symptoms such as eye and respiratory tract irritation, headaches and/or nausea. Based on an exposure to 0.1 mg/m³, a 70-kg worker breathing 10 m³ of air/8hr workday and assuming complete retention of the inhaled dose, would receive a daily exposure of 14.3 ug tin/kg body weight of an organotin compound. A skin notation was recommended based on animal data and the potential danger of enhanced absorption due to damaged skin present in many exposed workers.

BUTYLTIN TRICHLORIDE:

DIBUTYLTIN DICHLORIDE:

TRIBUTYLTIN CHLORIDE:

■ Exposure limits with "skin" notation indicate that vapor and liquid may be absorbed through intact skin. Absorption by skin may readily exceed vapor inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard.

HYDROGEN CHLORIDE:

■ for hydrogen chloride:

Odour Threshold Value: 0.262 ppm (detection), 10.06 ppm (recognition)

NOTE: Detector tubes for hydrochloric acid, measuring in excess of 1 ppm, are available commercially.

Hydrogen chloride is a strong irritant to the eyes, mucous membranes and skin. Chronic exposure produces a corrosive action on the teeth. Reports of respiratory irritation following short-term exposure at 5 ppm have led to the recommended TLV-C. There is no indication that skin contact with hydrogen chloride elicits systemic poisoning and a skin designation has not been applied.

Exposure of humans to hydrogen chloride at 50 to 100 ppm for 1 hour is reported to be barely tolerable; 35 ppm caused irritation of the throat on short exposure and 10 ppm was the maximal concentration for prolonged exposure. It has been stated that hydrogen chloride at concentrations of 5 ppm is immediately irritating.

Odour Safety Factor(OSF)

OSF=1.3 (HYDROGEN CHLORIDE).

PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

-
- Chemical goggles.
- Full face shield.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

HANDS/FEET

- Wear chemical protective gloves, eg. PVC.

Wear safety footwear or safety gumboots, eg. Rubber.

- When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.

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.

- Neoprene rubber gloves

OTHER

-
- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

RESPIRATOR

- Full face respirator with supplied air.

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	AB-1 P	-
1000	50	-	AB-1 P
5000	50	Airline*	-
5000	100	-	AB-2 P
10000	100	-	AB-3 P
	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

■ General exhaust is adequate under normal operating conditions. Local exhaust ventilation may be required in special circumstances. If risk of overexposure exists, wear an approved respirator. An approved respirator (supplied air type) may be required in special circumstances. Correct fit is essential to ensure adequate protection. Provide adequate ventilation in warehouses and enclosed storage areas.

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.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Corrosive.

Acid.

State	LIQUID	Molecular Weight	282.17
Melting Range (°F)	-81.4	Viscosity	Not Available
Boiling Range (°F)	379.4	Solubility in water (g/L)	Reacts
Flash Point (°F)	347	pH (1% solution)	Not available
Decomposition Temp (°F)	Not Available	pH (as supplied)	1.0
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	<0.1 @ 25 C
Upper Explosive Limit (%)	Not available	Specific Gravity (water=1)	1.693
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	>1
Volatile Component (%vol)	Not available	Evaporation Rate	Not available

APPEARANCE

Colourless to light brown liquid with a pungent odour; reacts with water to produce hydrogen chloride.

log Kow 0.05

Material	Value
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Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

-
- Contact with alkaline material liberates heat
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY

■ Reacts with mild steel, galvanized steel / zinc producing hydrogen gas which may form an explosive mixture with air.

Segregate from alcohol, water.

- Avoid strong acids, bases.

Segregate from alkalis, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

- Keep dry
- NOTE: May develop pressure in containers; open carefully. Vent periodically.

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

Section 11 - TOXICOLOGICAL INFORMATION

butyltin trichloride

TOXICITY AND IRRITATION

TRIBUTYLTIN CHLORIDE:

DIBUTYLTIN DICHLORIDE:

- unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.
- The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
- unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Oral (rat) LD50: 2140 mg/kg	Skin (rabbit): 0.75 mg/24h-SEVERE
	Eye (rabbit): 0.05 mg/24h-SEVERE

- 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.

TOXICITY	IRRITATION
DIBUTYLTIN DICHLORIDE:	
Oral (rat) LD50: 100 mg/kg	Skin (rabbit): 2 mg/24h - SEVERE
Oral (mouse) LD50: 70 mg/kg	Eye (rabbit): 0.05 mg/24h-SEVERE
Intravenous (mouse) LD50: 180 mg/kg	
Oral (rabbit) LD50: 0.05 mg/kg	
Oral (Rat) LD50: 50 mg/kg	
Intravenous (Rat) LD: 10 mg/kg	
Intravenous (Rabbit) LD: 5 mg/kg	
Intravenous (Guinea pig) LD: 5 mg/kg	

■ The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

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.

Somnolence, vascular shock, chronic pulmonary oedema, impaired liver

function tests, foetotoxicity, specific developmental abnormalities

(craniofacial and musculoskeletal) recorded.

TRIBUTYLTIN CHLORIDE:

Oral (rat) LD50: 129 mg/kg	Eye (rabbit): 0.05 mg/24h-SEVERE
Oral (mouse) LD50: 60 mg/kg	
Oral (rabbit) LD50: 0.03 mg/kg	

Effects on fertility, foetotoxicity, foetoletality, specific

developmental abnormalities to the musculoskeletal system and behavioural

effects on new-born reported.

CARCINOGEN

Tin - Organic compounds (as Sn)	ND	Carcinogen Category	A4
Hydrochloric acid	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
Hydrogen chloride	ND	Carcinogen Category	A4

SKIN

butyltin trichloride	ND	Notes	Skin
butyltin trichloride	ND	Skin	Yes
butyltin trichloride	US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants - Skin	Skin Designation	X
butyltin trichloride	US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants - Skin	Skin Designation	X
butyltin trichloride	US - Washington Permissible exposure limits of air contaminants - Skin	Skin	X
butyltin trichloride	ND	Skin Designation	Yes

butyltin trichloride	ND	Notation	Skin
butyltin trichloride	US - Minnesota Permissible Exposure Limits (PELs) - Skin	Skin Designation	X
butyltin trichloride	US - Hawaii Air Contaminant Limits - Skin Designation	Skin Designation	X
butyltin trichloride	ND	Skin Designation	X
butyltin trichloride	US OSHA Permissible Exposure Levels (PELs) - Skin	Skin Designation	X
butyltin trichloride	ND	Skin	X
butyltin trichloride	US - California Permissible Exposure Limits for Chemical Contaminants - Skin	Skin	X
butyltin trichloride	US - California Permissible Exposure Limits for Chemical Contaminants - Skin	Skin	S
butyltin trichloride	Canada - Alberta Occupational Exposure Limits - Skin	Substance Interaction	1
dibutyltin dichloride	ND	Notes	Skin
dibutyltin dichloride	US - Hawaii Air Contaminant Limits - Skin Designation	Skin Designation	X
dibutyltin dichloride	ND	Skin	X
dibutyltin dichloride	US - California Permissible Exposure Limits for Chemical Contaminants - Skin	Skin	X

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

DIBUTYLTIN DICHLORIDE:

TRIBUTYLTIN CHLORIDE:

HYDROGEN CHLORIDE:

BUTYLTIN TRICHLORIDE:

- DO NOT discharge into sewer or waterways.

TRIBUTYLTIN CHLORIDE:

DIBUTYLTIN DICHLORIDE:

- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

DIBUTYLTIN DICHLORIDE:

TRIBUTYLTIN CHLORIDE:

BUTYLTIN TRICHLORIDE:

- Organotin compounds are characterized by a Sn⁴⁺ ion to which one to four organic ligands are attached. They are classified according to the type of organic ligand and the most common are butyltins, octyltins and phenyltins.

A large number of organotin substances are used in the society, and some of these are well-known environmental pollutants. The butyltins comprise on such group. Eco toxicity increases dramatically in the order methylbutyltin (MBT, RSn) < dibutyltin (DBT, R₂Sn) < tributyltin (TBT, R₃Sn) for certain endpoints.

Degradation of organotin compounds involves the breaking of the tin-carbon bond, which may occur by UV irradiation, or by biological or chemical cleavage. In water, for example, tributyltin can be degraded by photochemical and biological processes relatively rapidly; however, adsorption onto suspended particulate material in water followed by sedimentation is a key removal process. The adsorption behavior of Sn⁴⁺ ion and eight organotin species (tri-, di-, and monobutyltin; tri-, di-, and monomethyltin; and tri- and diphenyltin) were studied in a water-sediment system using artificial seawater and estuarine sediment.

Adsorption coefficients varied from 100.5 to 104.5 and showed the trend of Sn⁴⁺ > mono > di > tri in the same substituent series. Larger absorption coefficients were found for aromatic compounds than for aliphatic compounds. Releases of organotin compounds to air from various surfaces are, in general, not significant due to their low vapor pressures and rapid photodegradation at surfaces.

The speciation of organotin compounds is pH-dependent. At lower pHs, the cationic form will be the primary form, and as the pH is increased, the neutral hydroxide compounds will be the predominant species. In the environmentally relevant pH range (pH 5–9), the predominant organotin species will be the neutral hydroxide compounds (i.e., R₃SnOH, R₂Sn(OH)₂, and RSn(OH)₃). High concentrations of chloride favor the formation of chloro species. The pK_a values for trimethyltin, triethyltin, tributyltin, and triphenyltin cations are approximately 6.60, 6.81, 6.25, and 5.2, respectively. Degradation of organotin compounds in sediments is much slower than in water, and half-lives have been estimated to be several years. In addition to dealkylation of organotin compounds, methylation of tin and organotin compounds by chemical and/or biological means may occur. The contribution of methylation by biotic and abiotic mechanisms is not clear. This pathway may result in fully substituted and volatile tin compounds.

At ambient temperatures, the solubilities of organotin compounds range from 0.0001 to about 50 mg/L. Organotin compounds may partition from water to aquatic organisms. The bioavailability of organotin compounds via the food chain appears to be of minor importance for tributyltin and triphenyltin when compared to uptake via the water phase. Seven-day BCF values were derived for dibutyltin dichloride, dibutyltin dilaurate, tributyltin chloride, bis(tributyltin) oxide, and triphenyltin chloride for muscle, liver, kidney, and vertebra tissue of round crucian carp. The BCF values ranged from 12 in muscle to 5,012 in liver. For all organotin compounds, liver had the highest BCF values. The highest BCFs were found for the tributyltin compounds.

The use of tributyltin (TBT) in antifouling paints on ships has caused significant harm to the marine environment worldwide. Female molluscs are masculinized by TBT at levels as low as ca 1 ng/l, and this effect has severe consequences for their ability to reproduce.

Most investigations on the environmental occurrence of organotin substances have focused on TBT. However, other substances such as dibutyltin (DBT), dioctyltin and monobutyltin (MBT) are used in the society for other reasons and are found in other applications.

Most industrial organotin chemicals (OTCs) are composed of an organotin cation and one or several ligands, and most of these chemicals are reconverted to the organotin cation compounds in natural waters. The cation may form dissolved complexes with e.g. chloride in

seawater.

Therefore, their environmental partitioning properties such as K_d and K_h depend in part on the balancing anion in the environment. Hydrophobicity increases with increasing number of alkyl groups, and with increasing length of the alkyl chain. Organotins are moderately hydrophobic and associate strongly to particles in natural waters. In harbour sediments, $\log K_d$ in the range 3-4.3 have been measured for various OTCs, and the particle affinity increased in the order $MBT < DBT < TBT$. In various soils, however, the reverse pattern of K_d was observed. In organic soils, $\log K_d$ exceeded 4.0, whereas adsorption was less strong in mineral soils. In contrast to hydrophobic pollutants such as PCBs or PAHs (that partition to lipids in organic matter), OTCs are adsorbed to the functional groups of organic matter, e.g. phenolic and carboxylic groups.

Because organotins are generally cations, long-range atmospheric transport has generally not been considered as important. It has though been demonstrated that TBT forms highly volatile chloride species in seawater. One study has actually demonstrated the presence of organotins in air from rural sites, showing that long-range atmospheric transport of butyltins and octyltins do occur. MBT was the major species in precipitation and deposition. TBT mainly occurred in the gas phase and it is speculated that the source of butyltins may have been volatile TBT species. Subsequent dealkylation in the atmosphere may convert TBT to DBT and MBT.

Organotins are progressively dealkylated in nature, for instance:

$TBT \rightarrow DBT \rightarrow MBT \rightarrow Sn^{4+}$

Dealkylation proceeds both by photolysis and through enzymatical reactions. This is important to consider when monitoring data are evaluated, since the occurrence of, e.g., DBT may be due to direct release of DBT or to release of TBT that is subsequently dealkylated. Half-lives in soils and sediments are commonly one or a few years, but may be longer under reducing conditions, whereas half-lives in natural waters may range from a few days to several weeks.

Organotin compounds have been detected in various marine organisms, from evertebrates to mammals. In fish and marine mammals, TBT and TPT bioaccumulate more strongly in liver than in muscle. Bioaccumulation is often stronger in bivalves than in fish, a consequence of lower metabolic capacity in bivalves. Trisubstituted OTCs are more strongly bioaccumulated than the less lipophilic disubstituted OTCs. Because TBT is dealkylated in many organisms, DBT may be a major species in biota but not necessarily the organotin species that was assimilated. Most studies do not suggest that TBT is biomagnified in aquatic food-chain. However, TPT appears to be biomagnified fairly strongly in the aquatic food chain. The trisubstituted substances, TPT and in particular TBT, are widely held as the most toxic organotin substances. Numerous field studies have demonstrated a direct link between TBT and imposex in certain marine organisms, mainly molluscs. Imposex means that females are masculinized and this effect is severe because it directly influences the ability for organisms to reproduce. Imposex has been demonstrated in many coastal areas. These effects occur at very low levels (ca 1 ng/l) for certain organisms. It has been shown in laboratory that TBT causes masculinization also in fish. DBT and MBT does not cause imposex, but both TBT and DBT have negative effects on the reproductive system in mammals. In line with these facts, TBT and TPT were given the highest category in a European review of endocrine disrupting chemicals: "Evidence for endocrine disruption in living organisms". TBT was also classified as "Evidence of potential to cause endocrine disruption in humans".

■ Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

BUTYLtin TRICHLORIDE:

■ Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

■ Prevent, by any means available, spillage from entering drains or watercourses.

DIBUTYLtin DICHLORIDE:

BCF: 12-135

Bioaccumulation: low if any

$\log K_{ow}$ 0.05

TRIBUTYLtin CHLORIDE:

■ The material is classified as an ecotoxin* because the Fish LC50 (96 hours) is less than or equal to 0.1 mg/l

* Classification of Substances as Ecotoxic (Dangerous to the Environment)

Appendix 8, Table 1

Compiler's Guide for the Preparation of International Chemical Safety Cards: 1993 Commission of the European Communities.

HYDROGEN CHLORIDE:

■ Although inorganic chloride ions are not normally considered toxic they can exist in effluents at acutely toxic levels (chloride >3000 mg/l). The resulting salinity can exceed the tolerances of most freshwater organisms.

Inorganic chlorine eventually finds its way into the aqueous compartment and as such is bioavailable. Incidental exposure to inorganic chloride may occur in occupational settings where chemicals management policies are improperly applied. The toxicity of chloride salts depends on the counter-ion (cation) present; that of chloride itself is unknown. Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism, e.g. in congestive heart failure. Healthy individuals can tolerate the intake of large quantities of chloride provided that there is a concomitant intake of fresh water.

Although excessive intake of drinking-water containing sodium chloride at concentrations above 2.5 g/litre has been reported to produce hypertension, this effect is believed to be related to the sodium ion concentration.

Chloride concentrations in excess of about 250 mg/litre can give rise to detectable taste in water, but the threshold depends upon the associated cations. Consumers can, however, become accustomed to concentrations in excess of 250 mg/litre. No health-based guideline value is proposed for chloride in drinking-water.

In humans, 88% of chloride is extracellular and contributes to the osmotic activity of body fluids. The electrolyte balance in the body is maintained by adjusting total dietary intake and by excretion via the kidneys and gastrointestinal tract. Chloride is almost completely absorbed in normal individuals, mostly from the proximal half of the small intestine. Normal fluid loss amounts to about 1.5-2 litres/day, together with about 4 g of chloride per day. Most (90 - 95%) is excreted in the urine, with minor amounts in faeces (4-8%) and sweat (2%).

Chloride increases the electrical conductivity of water and thus increases its corrosivity. In metal pipes, chloride reacts with metal ions to form soluble salts thus increasing levels of metals in drinking-water. In lead pipes, a protective oxide layer is built up, but chloride enhances galvanic corrosion. It can also increase the rate of pitting corrosion of metal pipes.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
butyltin trichloride	HIGH		LOW	MED
dibutyltin dichloride	HIGH		LOW	MED
tributyltin chloride	HIGH		HIGH	LOW
hydrogen chloride	LOW		LOW	HIGH

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information

Corrosivity characteristic: use EPA hazardous waste number D002 (waste code C)

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.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
- Treat and neutralize at an approved treatment plant. Treatment should involve: Neutralization with soda-ash or soda-lime followed by: Burial in a licensed land-fill or Incineration in a licensed apparatus
- Decontaminate empty containers with 5% aqueous sodium hydroxide or soda ash, followed by water. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION



DOT:

Symbols:	None	Hazard class or Division:	8
Identification Numbers:	UN3265	PG:	II
Label Codes:	8	Special provisions:	B2, IB2, T11, TP2, TP27
Packaging: Exceptions:	154	Packaging: Non-bulk:	202
Packaging: Exceptions:	154	Quantity limitations: Passenger aircraft/rail:	1 L
Quantity Limitations: Cargo aircraft only:	30 L	Vessel stowage: Location:	B
Vessel stowage: Other:	40	S.M.P.:	Severe

Hazardous materials descriptions and proper shipping names:

Corrosive liquid, acidic, organic, n.o.s.

Air Transport IATA:

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	None
UN/ID Number:	3265	Packing Group:	II
Special provisions:	A3		

Shipping Name: CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. *(CONTAINS BUTYLTIN TRICHLORIDE)

Maritime Transport IMDG:

IMDG Class:	8	IMDG Subrisk:	None
UN Number:	3265	Packing Group:	II
EMS Number:	F-A , S-B	Special provisions:	274
Limited Quantities:	1 L		

Shipping Name: CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.(contains butyltin trichloride)

Section 15 - REGULATORY INFORMATION



REGULATIONS

ND

Ingredient	CAS	% de minimus concentration
hydrogen chloride	7647-01-0	1.0

ND

Ingredient	CAS	RQ
hydrogen chloride	7647-01-0	5000 lb (2270 kg)

butyltin trichloride (CAS: 1118-46-3) is found on the following regulatory lists;

"Canada Domestic Substances List (DSL)", "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)", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals", "US EPA High Production Volume Chemicals 1994 List of Additions", "US Toxic Substances Control Act (TSCA) - Inventory"

Regulations for ingredients

dibutyltin dichloride (CAS: 683-18-1) is found on the following regulatory lists;

"Canada Domestic Substances List (DSL)", "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)", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals", "US EPA High Production Volume Program Chemical List", "US Toxic Substances Control Act (TSCA) - Inventory"

tributyltin chloride (CAS: 1461-22-9) is found on the following regulatory lists;

"Canada Domestic Substances List (DSL)", "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)", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - Maine Chemicals of High Concern List", "US EPA High Production Volume Program Chemical List", "US Toxic Substances Control Act (TSCA) - Inventory"

hydrogen chloride (CAS: 7647-01-0) is found on the following regulatory lists;

"Canada - Alberta Ambient Air Quality Objectives", "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 - Prince Edward Island Occupational Exposure Limits - Carcinogens", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Industrial Hazardous Substances", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Controlled Drugs and Substances Act Schedule VI", "Canada Domestic Substances List (DSL)", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Prohibited Toxic Substances, Schedule 2, Concentration Limits (English)", "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", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Council of Chemical Associations (ICCA) - High Production Volume List", "International Maritime Dangerous Goods Requirements (IMDG Code) - Goods Forbidden for Transport", "OECD Representative List of High Production Volume (HPV) Chemicals", "United Nations Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances - Table II", "United Nations List of Precursors and Chemicals Frequently used in the Illicit Manufacture of Narcotic Drugs and Psychotropic Substances Under International Control - Table II", "US - Alaska Limits for Air Contaminants", "US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELS)", "US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)", "US - California Permissible Exposure Limits for Chemical Contaminants", "US - California Toxic Air Contaminant List Category II", "US - Connecticut Hazardous Air Pollutants", "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 Hazardous Materials", "US - Oregon Permissible Exposure Limits (Z-1)", "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 List of Highly Hazardous Chemicals, Toxics and Reactives", "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 Clean Air Act - Hazardous Air Pollutants", "US CWA (Clean Water Act) - List of Hazardous Substances", "US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances", "US Department of Homeland Security Chemical Facility Anti-Terrorism Standards - Chemicals of

Interest", "US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US Drug Enforcement Administration (DEA) List I and II Regulated Chemicals", "US EPA Acute Exposure Guideline Levels (AEGLs) - Final", "US EPA High Production Volume Chemicals Additional List", "US EPA Master Testing List - Index I Chemicals Listed", "US EPCRA Section 313 Chemical List", "US Food Additive Database", "US List of Lists - Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act", "US NFPA 45 Fire Protection for Laboratories Using Chemicals - Flammability Characteristics of Common Compressed and Liquefied Gases", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA List of Highly Hazardous Chemicals, Toxics and Reactives", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide", "US SARA Section 302 Extremely Hazardous Substances", "US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants", "US Toxic Substances Control Act (TSCA) - Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

■ Cumulative effects may result following exposure*.

* (limited evidence).

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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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