

2,4,6-Tribromophenol

sc-254349



The Power is Question

Material Safety Data Sheet

Hazard Alert Code
Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

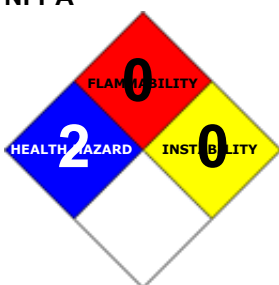
PRODUCT NAME

2,4,6-Tribromophenol

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Company: Santa Cruz Biotechnology, Inc.

Address:

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

Intermediate. Disinfectant. Fire retardant

SYNONYMS

C6-H3-Br3-O, HOC6H2Br3, "phenol, 2, 4, 6-tribromo-", "phenol, 2, 4, 6-tribromo-", bromol, tri-bromophenol

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

May cause SENSITIZATION by skin contact.

Harmful by inhalation and if swallowed.

Irritating to eyes, respiratory system and skin.

May cause long-term adverse effects in the environment.

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.

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.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- 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

- Inhalation of dusts, generated by the material, during the course of normal handling, may be harmful.
- The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.
- Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.
- Gross anatomical changes in the lung with congestion are characteristic of bromo- and iodo- phenol exposure; submucosal (petechial) haemorrhage are also common.

CHRONIC HEALTH EFFECTS

- Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.

Skin contact with the material is more likely to cause a sensitization reaction in some persons compared to the general population.

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

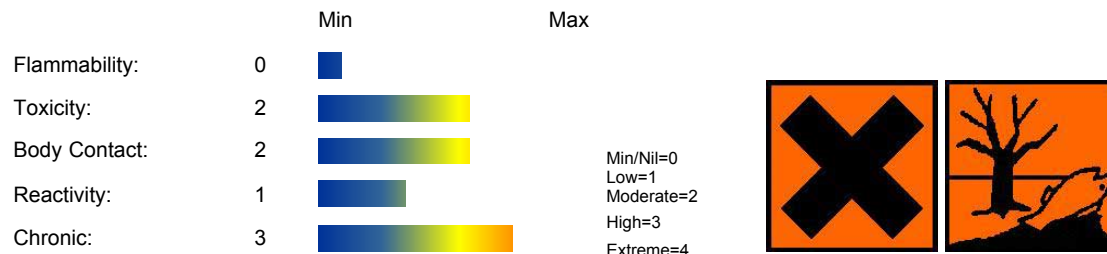
There is some evidence that human exposure to the material may result in developmental toxicity. This evidence is based on animal studies where effects have been observed in the absence of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not secondary non-specific consequences of the other toxic effects.

Chronic intoxication with ionic bromides, historically, has resulted from medical use of bromides but not from environmental or occupational exposure; depression, hallucinosis, and schizophreniform psychosis can be seen in the absence of other signs of intoxication. Bromides may also induce sedation, irritability, agitation, delirium, memory loss, confusion, disorientation, forgetfulness (aphasias), dysarthria, weakness, fatigue, vertigo, stupor, coma, decreased appetite, nausea and vomiting, diarrhoea, hallucinations, an acne like rash on the face, legs and trunk, known as bronchoderma (seen in 25-30% of case involving bromide ion), and a profuse discharge from the nostrils (coryza). Ataxia and generalised hyperreflexia have also been observed. Correlation of neurologic symptoms with blood levels of bromide is inexact. The use of substances such as brompheniramine, as antihistamines, largely reflect current day usage of bromides; ionic bromides have been largely withdrawn from therapeutic use due to their toxicity. Several cases of foetal abnormalities have been described in mothers who took large doses of bromides during pregnancy.

Prolonged contact with chlorinated diphenyl ethers may cause skin irritation, weight loss and liver injury. Repeated absorption has produced liver damage in animals.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS



| NAME | CAS RN | % |
|----------------------|----------|-----|
| 2,4,6-tribromophenol | 118-79-6 | >98 |

Section 4 - FIRST AID MEASURES

SWALLOWED

-
- IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
- Where Medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:
 - For advice, contact a Poisons Information Center or a doctor.
 - Urgent hospital treatment is likely to be needed.
 - If conscious, give water to drink.
 - INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

NOTE: Wear a protective glove when inducing vomiting by mechanical means.

- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

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

- For acute or short term repeated exposures to phenols/ cresols:
 - Phenol is absorbed rapidly through lungs and skin. [Massive skin contact may result in collapse and death]*
 - [Ingestion may result in ulceration of upper respiratory tract; perforation of esophagus and/or stomach, with attendant complications, may occur. Esophageal stricture may occur.]*
 - An initial excitatory phase may present. Convulsions may appear as long as 18 hours after ingestion. Hypotension and ventricular tachycardia that require vasopressor and antiarrhythmic therapy, respectively, can occur.
 - Respiratory arrest, ventricular dysrhythmias, seizures and metabolic acidosis may complicate severe phenol exposures so the initial attention should be directed towards stabilization of breathing and circulation with ventilation, intubation, intravenous lines, fluids and cardiac monitoring as indicated.
 - [Vegetable oils retard absorption; do NOT use paraffin oils or alcohols. Gastric lavage, with endotracheal intubation, should be repeated until phenol odor is no longer detectable; follow with vegetable oil. A saline cathartic should then be given.]* ALTERNATELY: Activated charcoal (1g/kg) may be given. A cathartic should be given after oral activated charcoal.
 - [Severe poisoning may require slow intravenous injection of methylene blue to treat methemoglobinemia.
 - [Renal failure may require hemodialysis.]*
 - Most absorbed phenol is biotransformed by the liver to ethereal and glucuronide sulfates and is eliminated almost completely after 24 hours. [Ellenhorn and Barceloux: Medical Toxicology] *[Union Carbide]

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker who has been exposed to the Exposure Standard (ES or TLV):

| Determinant | Index | Sampling Time | Comments |
|-------------------------|----------------------|---------------|----------|
| 1.Total phenol in blood | 250 gm/gm creatinine | End of shift | B, NS |

B: Background levels occur in specimens collected from subjects NOT exposed

NS: Non-specific determinant; also seen after exposure to other materials.

Section 5 - FIRE FIGHTING MEASURES

| | |
|-----------------------------|----------------|
| Vapour Pressure (mmHG): | Negligible |
| Upper Explosive Limit (%): | Not available. |
| Specific Gravity (water=1): | Not available |
| 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 breathing apparatus plus protective gloves.
 - 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.
 - 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), carbon dioxide (CO₂), hydrogen bromide, other pyrolysis products typical of burning organic material.

Flame retardants may not themselves be immune from combustion but will quickly self-extinguish under fire normal conditions. Their thermal degradation products may be required to break the combustion cycle of materials in which they are found. When materials burn they introduce flammable gases into the immediate environment, The gas flame itself is maintained by the action of high energy "radicals" (that is H⁺ and OH⁻ in the gas phase) which decompose molecules to give free carbon.

This free carbon may react with oxygen in air to "burn" to CO₂, generating heat energy. Halogenated flame retardants act by effectively removing the H⁺ and OH⁻ radicals in the gas flame phase. This considerably slows or prevents the burning process, thus reducing heat generation and, as a result, the production of further gaseous material. The halogenated flame retardants release bromine or chlorine as free radicals (Br⁻ or Cl⁻ as appropriate) which react with the flammable gases to give off HBr or HCl. These then react with the high energy H⁺ or OH⁻ radicals to give water and the much lower energy Br⁻ or Cl⁻ radicals which then become available to begin a new cycle of H⁺ and OH⁻ radical removal. Because chlorine (from chlorinated retardants) is released over a wider range of temperatures than bromine, it is present in the flame zone at lower concentrations and is thus less effective.

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:
Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

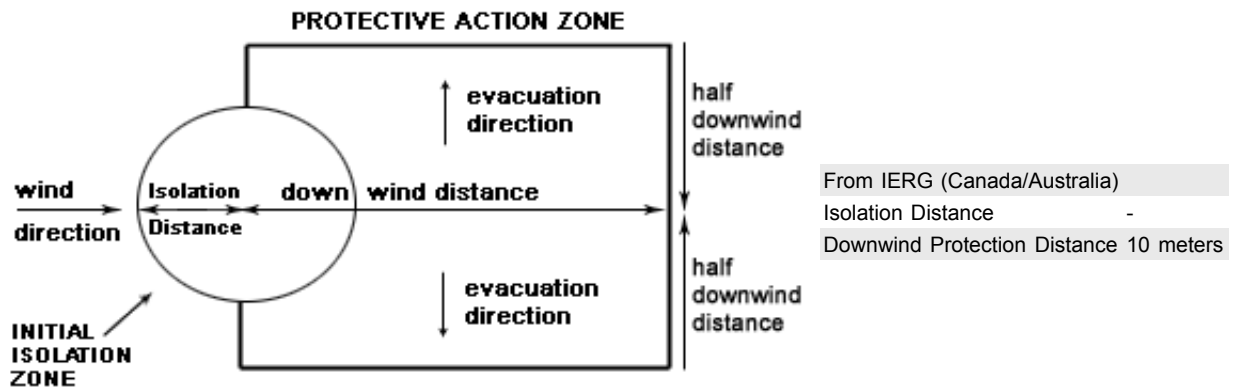
MINOR SPILLS

- Environmental hazard - contain spillage.
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Control personal contact by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable, labelled container for waste disposal.

MAJOR SPILLS

- Environmental hazard - contain spillage.
- Moderate hazard.
- CAUTION: Advise personnel in area.
- Alert Emergency Responders and tell them location and nature of hazard.
- Control personal contact by wearing protective clothing.
- Prevent, by any means available, spillage from entering drains or water courses.
- Recover product wherever possible.
- IF DRY: Use dry clean up procedures and avoid generating dust. Collect residues and place in sealed plastic bags or other containers for disposal. IF WET: Vacuum/shovel up and place in labelled containers for disposal.
- ALWAYS: Wash area down with large amounts of water and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL



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 171 is taken from the US DOT emergency response guide book.
- 6 IERG information is derived from CANUTEC - Transport Canada.

ACUTE EXPOSURE GUIDELINE LEVELS (AEG) (in ppm)

AEG 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

-
- 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.
- DO NOT allow material to contact humans, exposed food or food utensils.
- 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.

Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.

- Do NOT cut, drill, grind or weld such containers
- In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

RECOMMENDED STORAGE METHODS

-
- Polyethylene or polypropylene container.
- Check all containers are clearly labelled and free from leaks.

STORAGE REQUIREMENTS

- 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 | 2,4,6-tribromophenol (Kerosene/Jet fuels, as total hydrocarbon vapour) | | 200 | | | | | | |
| Canada - Ontario Occupational Exposure Limits | 2,4,6-tribromophenol (Diesel fuel, as total hydrocarbons, vapour and aerosol) | | 100 | | | | | | Skin |
| Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits | 2,4,6-tribromophenol (Diesel fuel as total hydrocarbons, (vapour)) | | 100 | | 150 | | | | Skin |
| Canada - Alberta Occupational Exposure Limits | 2,4,6-tribromophenol (Diesel fuel, as total hydrocarbons) | | 100 | | | | | | |
| US - Oregon Permissible Exposure Limits (Z3) | 2,4,6-tribromophenol (Inert or Nuisance Dust: (d) Total dust) | | 10 | | | | | | * |

| | | | |
|--|--|---------|------|
| US OSHA Permissible Exposure Levels (PELs) - Table Z3 | 2,4,6-tribromophenol (Inert or Nuisance Dust: (d) Respirable fraction) | 5 | |
| US OSHA Permissible Exposure Levels (PELs) - Table Z3 | 2,4,6-tribromophenol (Inert or Nuisance Dust: (d) Total dust) | 15 | |
| US - Hawaii Air Contaminant Limits | 2,4,6-tribromophenol (Particulates not otherwise regulated - Total dust) | 10 | |
| US - Hawaii Air Contaminant Limits | 2,4,6-tribromophenol (Particulates not otherwise regulated - Respirable fraction) | 5 | |
| US - Oregon Permissible Exposure Limits (Z3) | 2,4,6-tribromophenol (Inert or Nuisance Dust: (d) Respirable fraction) | 5 | * |
| US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants | 2,4,6-tribromophenol (Particulates not otherwise regulated Respirable fraction) | 5 | |
| US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants | 2,4,6-tribromophenol (Particulates not otherwise regulated (PNOR)(f)- Respirable fraction) | 5 | |
| US - Michigan Exposure Limits for Air Contaminants | 2,4,6-tribromophenol (Particulates not otherwise regulated, Respirable dust) | 5 | |
| Canada - British Columbia Occupational Exposure Limits | 2,4,6-tribromophenol (Diesel fuel, as total hydrocarbons, Inhalable) | 100 (V) | Skin |

MATERIAL DATA

2,4,6-TRIBROMOPHENOL:

■ It is the goal of the ACGIH (and other Agencies) to recommend TLVs (or their equivalent) for all substances for which there is evidence of health effects at airborne concentrations encountered in the workplace.

At this time no TLV has been established, even though this material may produce adverse health effects (as evidenced in animal experiments or clinical experience). Airborne concentrations must be maintained as low as is practically possible and occupational exposure must be kept to a minimum.

NOTE: The ACGIH occupational exposure standard for Particles Not Otherwise Specified (P.N.O.S) does NOT apply.

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.

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

■ NOTE: The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.

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.

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.

- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocautchouc
- polyvinyl chloride

Gloves should be examined for wear and/ or degradation constantly.

OTHER

-
- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.
- Eye wash unit.
-
- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

RESPIRATOR

■

| Protection Factor | Half-Face Respirator | Full-Face Respirator | Powered Air Respirator |
|-------------------|----------------------|----------------------|------------------------|
| 10 x PEL | P1 | - | PAPR-P1 |
| | Air-line* | - | - |
| 50 x PEL | Air-line** | P2 | PAPR-P2 |
| 100 x PEL | - | P3 | - |
| | - | Air-line* | - |
| 100+ x PEL | - | Air-line** | PAPR-P3 |

* - Negative pressure demand ** - Continuous flow

Explanation of Respirator Codes:

Class 1 low to medium absorption capacity filters.

Class 2 medium absorption capacity filters.

Class 3 high absorption capacity filters.

PAPR Powered Air Purifying Respirator (positive pressure) cartridge.

Type A for use against certain organic gases and vapors.

Type AX for use against low boiling point organic compounds (less than 65°C).

Type B for use against certain inorganic gases and other acid gases and vapors.

Type E for use against sulfur dioxide and other acid gases and vapors.

Type K for use against ammonia and organic ammonia derivatives

Class P1 intended for use against mechanically generated particulates of sizes most commonly encountered in industry, e.g. asbestos, silica.

Class P2 intended for use against both mechanically and thermally generated particulates, e.g. metal fume.

Class P3 intended for use against all particulates containing highly toxic materials, e.g. beryllium.

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 is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:

(a): particle dust respirators, if necessary, combined with an absorption cartridge;

(b): filter respirators with absorption cartridge or canister of the right type;

(c): fresh-air hoods or masks

- Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

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

| Type of Contaminant: | Air Speed: |
|--|------------------------------|
| 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 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 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

Solid.

Does not mix with water.

| | | | |
|---------------------------|----------------|--------------------------------|-----------------|
| State | Divided solid | Molecular Weight | 330.83 |
| Melting Range (°F) | 201.2- 204.8 | Viscosity | Not Applicable |
| Boiling Range (°F) | 471.2 | Solubility in water (g/L) | Partly miscible |
| Flash Point (°F) | Not available | pH (1% solution) | Not applicable |
| Decomposition Temp (°F) | Not available. | pH (as supplied) | Not applicable |
| Autoignition Temp (°F) | Not available | Vapour Pressure (mmHG) | Negligible |
| Upper Explosive Limit (%) | Not available. | Specific Gravity (water=1) | Not available |
| Lower Explosive Limit (%) | Not available | Relative Vapor Density (air=1) | 11.4 |
| Volatile Component (%vol) | Negligible | Evaporation Rate | Not applicable |

APPEARANCE

Soft off-white to pink flakes with sweet taste and penetrating bromine odour; do not mix well with water (1:14000). Soluble in alcohol, chloroform, ether, glycerol oils and caustic alkali solutions. Brominated diphenyl ethers (PBDEs) are by-products in the manufacture of brominated phenols

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

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

STORAGE INCOMPATIBILITY

- Avoid reaction with oxidizing agents.

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

Section 11 - TOXICOLOGICAL INFORMATION

2,4,6-tribromophenol

TOXICITY AND IRRITATION

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

| TOXICITY | IRRITATION |
|-----------------------------|--------------|
| Oral (rat) LD50: 2000 mg/kg | Nil Reported |

■ Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's edema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Other allergic skin reactions, e.g. contact urticaria, involve antibody-mediated immune reactions. The significance of the contact allergen is not simply determined by its sensitization potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitizing substance which is widely distributed can be a more important allergen than one with stronger sensitizing potential with which few individuals come into contact. From a clinical point of view, substances are noteworthy if they produce an allergic test reaction in more than 1% of the persons tested.

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.

The primary health concerns revolve around the potential of polybrominated fire retardants (PBFRs) to act as carcinogens, endocrine disruptors and neurodevelopmental toxicants based on data for some members of this class of chemicals. In addition, their structural similarities to the polychlorinated diphenyl ethers (PCDEs), nitrofen and polychlorinated biphenyls (PCBs) lends further support to concerns for health effects exerted by these chemicals.

Three PBFRs, the penta-, octa- and decabromodipheyl ethers (BDPE)s, have been and remain of significant commercial interest.

Nonetheless, the field of PBFRs is expanding and a diverse range of these chemicals are now available. Emphasis on the health effects of PBFRs is directed to certain chemical compounds within this class, namely decabromodipheyl ether (DBDPE), pentabromodipheyl ether (PeBDPE), octabromodipheyl ether (OBDPE) and hexabromocyclododecane (HBCD). Also discussed are the polybrominated biphenyls (PCBs) and tris(2,3-dibromopropylphosphate (TDBPP), though no longer used, due to their significant adverse health effects.

The PBFRs are a structurally diverse group of chemical compounds, some of which share similarities in chemical structure while others vary significantly. Pharmacokinetic studies are limited for most of the chemicals. However, the available information indicates that some brominated flame retardants such as tetrabromodiphenyl ether (TBDPE), HBCD, TDBPP and PBBs are readily absorbed via the gastrointestinal tract. Data available for the polybrominated diphenyl ethers (PBDPE)s and PBBs indicate that the degree of gastrointestinal absorption is inversely proportional to the level of bromination. Dermal absorption has also been reported for TDBPP.

They are generally of low acute toxicity with no or slight and transient irritation to the skin and eyes of experimental animals. Inhalation studies in animals revealed that exposure to PBDPEs caused transient respiratory difficulties.

Like the PBDPEs, tetrabromobisphenol A (TBBPA) and its derivatives have low acute and repeated dose toxicity. They are neither skin or eye irritants nor skin sensitisers in experimental animals. Reversible respiratory effects were reported following inhalation exposure.

With a few exceptions, mutagenicity studies indicate that the majority of the PBRs are neither mutagenic to microbial or eukaryotic organisms nor genotoxic in experimental in vivo and in vitro systems. TBDPE and HBCD caused an increase in the recombination frequency in some cell lines.

Of the commercially and commonly used PBFRs, penta- and tetra-bromodiphenyl ethers appear to be of greatest significance where health effects are concerned.

Evidence indicates that the liver, and possibly the thyroid, are the organs most sensitive to these chemicals. According to available data, they are endocrine disruptors and neurodevelopmental toxicants in experimental animals. Whether neurodevelopmental effects are a consequence of changes in thyroid hormone levels or are caused by direct neurotoxicity remain to be elucidated. The absence of clinical, physiological and biochemical correlates precludes any conclusions as to the nature of the mechanisms involved. PeBDPE has been classified as a hazardous chemical, Harmful- Danger of Serious Damage to Health by Prolonged Exposure in Contact with Skin and if Swallowed. A similar toxicity profile is apparent for TBDPE. OBDPE is another chemical of concern due to its adverse effects on reproduction in experimental animals.

The two other groups with significant adverse health effects are TDBPP and PBBs. Although both have relatively low acute toxicity in experimental animals, evidence for carcinogenicity, endocrine disruption and reproductive effects exists. Little human data is available, however, epidemiological reports and follow up studies indicate that PBDPE, TDBPP and PBBs are absorbed and can be detected in the serum, adipose tissue and breast milk of directly and/or indirectly exposed individuals. The available evidence indicates that, in some countries, levels of these chemicals are increasing in animal and human tissues (including breast milk), which suggests they are bioaccumulative and persistent. Thyroid effects appear to be the major adverse health effect, with hypothyroidism seen in animals (e.g. OBDPE and PeBDPE, HBCD and PBB) and humans (e.g. DBDPE and deca-BB), although some PBFRs (e.g. DBDPE, TDBPP, HBCD and PBB) elicit carcinogenic effects in animal studies.

Blooming potential: Blooming is defined as the migration (or more appropriately, diffusion) of an ingredient (e.g., plasticiser or flame retardant) in rubber or plastic material to the outer surface after curing. It is sometimes incorrectly referred to as "leaching" or "degassing". Diffusion is generally considered to be a slow process. Blooming has been identified as a source of potential exposure (human and environmental) to PBFRs, particularly for low molecular weight additive PBFRs.

It is generally accepted that "reactive", PBFRs such as TBBPA (and derivatives) and esters of acrylic (propenoic) acid, which are directly incorporated into polymers (e.g., polyester or epoxy resins) via chemical reaction (i.e., covalent binding) have a low or negligible blooming potential, although such chemicals can also be used as non-reactive (i.e., additive) ingredients.

So-called "additive" PBFRs (e.g., PBDPEs, PBBs, HBCD) are more likely to be subject to blooming, as these compounds are not chemically bound to the polymer backbone. Additive PBFRs reside within the polymer matrix as discrete molecules, but may be subject to weak Van der Waals and electrostatic interaction both between PBFR molecules and with the polymer backbone. High molecular weight polymeric additive flame retardants such as brominated polystyrene are more likely to remain within the matrix due to the slow rate of diffusion. Other PBFRs may undergo both reactive and/or additive reactions with polymer matrices e.g., tetrabromophthalic anhydride and brominated polystyrenes. Increased temperature is also associated with an increase in the rate of PBFR migration. Release of PBFRs or degradation products may occur at high temperatures during thermal processing or recycling e.g. PBDPEs emissions have been reported during thermal recycling activities.

Side-reactions during manufacture of the parent compound may result in the production of trace amounts of polyhalogenated aromatic hydrocarbon(s). Halogenated phenols, and especially their alkali salts, can condense above 300 deg. C. to form polyphenoxypheyls or, in a very specific reaction, to form dibenzo-p-dioxins.

Polyhalogenated aromatic hydrocarbons (PHAHs) can cause effects on hormones and mimic thyroid hormone. Acne, discharge in the eye, eyelid swellings and visual disturbances may occur. Babies born to exposed mothers can also exhibit these effects. There is an increased risk of liver cancer among those who have taken PHAHs.

CARCINOGEN

| BROMINE COMPOUNDS (ORGANIC OR INORGANIC) | US Environmental Defense Scorecard Suspected Carcinogens | Reference(s) | P65-MC |
|--|---|--------------|--------|
| SKIN | | | |
| 2,4,6-tribromophenol | Canada - Ontario Occupational Exposure Limits - Skin | Notes | Skin |
| 2,4,6-tribromophenol | US AIHA Workplace Environmental Exposure Levels (WEELs) - Skin | Notes | Skin |
| 2,4,6- | Canada - Quebec Permissible Exposure Values for Airborne Contaminants - | Notes | Skin |

| | | NOTES | SKIN |
|----------------------|---|-----------------------|------|
| tribromophenol | Skin (French) | | |
| 2,4,6-tribromophenol | Canada - British Columbia Occupational Exposure Limits - Skin | Notation | Skin |
| 2,4,6-tribromophenol | Canada - Alberta Occupational Exposure Limits - Skin | Substance Interaction | 1 |

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

2,4,6-TRIBROMOPHENOL:

■ On the basis of available evidence concerning either toxicity, persistence, potential to accumulate and or observed environmental fate and behaviour, the material may present a danger, immediate or long-term and /or delayed, to the structure and/ or functioning of natural ecosystems.

■ Toxic to aquatic organisms.

■ 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.

■ May cause long-term adverse effects in the aquatic environment.

■ for brominated phenols:

Transport and distribution: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere, both 2,4,6-tribromophenol (2,4,6-TBP) and pentabromophenol (PBP), which have estimated vapour pressures of 4×10^{-2} Pa (at 25 C) and 5×10^{-5} Pa (at 25 C), respectively, will exist in both the vapour and particulate phases in the ambient atmosphere. Particulate-phase 2,4,6-TBP and PBP will be removed from the atmosphere by wet and dry deposition.

Volatilisation of non-dissociated 2,4,6-TBP and PBP from water surfaces is not expected to be an important fate process, given estimated Henry's law constants of 3.6×10^{-3} Pa.m³/mol and 8.4×10^{-4} Pa.m³/mol, respectively. Comparable Henry's law constants for mono- and dibrominated phenols would also suggest little volatilization of these compounds.

Modelling brominated phenols using the PCKOC model (v.1.66) shows increasing soil sorption coefficients with increasing bromination. Estimated Koc is not sensitive to dissociation of phenols at different pHs. Anions generally do not adsorb to organic carbon and clay more strongly than their neutral counterparts.

If released to soil, all of the brominated phenols essentially stay there and will not be mobile. Release into water leaves significant proportions of the lower brominated phenols in water, although PBP partitions almost entirely to sediment. Release to air leads to almost complete partitioning to soil.

Transformation: Vapour-phase 2,4,6-TBP and PBP are degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals; the half-lives for this reaction in air were estimated to be 34 days and 36 days, respectively, calculated from rate constants of 4.8×10^{-13} cm³/molecule per second (at 25 C) and 4.5×10^{-13} cm³/molecule per second (at 25 C), respectively. Applying the AOP model (v.1.91), which uses comparable methodology, to a range of brominated phenols yields atmospheric half-lives of 13.2 h, 44.6 h, 22.5 days, and 23 days for 4-bromophenol (4-BP), 2,4-dibromophenol (2,4-DBP), 2,4,6-TBP, and PBP, respectively.

Direct photolysis by UV light indicated a half-life for 2,4,6-TBP of 4.6 h ; however, this is not expected to be a significant route of degradation, since the brominated phenols partition predominantly to soil/sediment, where UV levels are likely to be low.

2,4,6-TBP is not expected to undergo hydrolysis in the environment due to the lack of hydrolysable functional groups.

Abiotically, 2,4,6-TBP is considered to be stable in water and not hydrolysed, regardless of pH .

Brominated phenols are generally not readily biodegradable and will persist in the environment. However, adapted communities of microorganisms and specialist communities (such as anaerobic or sulfidogenic) may degrade the compounds. Debromination to lesser brominated phenols is common under anaerobic conditions.

Accumulation: Log Kow values for the bromophenols would give estimates for bioaccumulation potential that increase with increasing bromination. Predicted BCFs of 20, 24, 120, and 3100 are generated for 4-BP, 2,4-DBP, 2,4,6-TBP, and PBP, respectively.

BCF values of 513 and 83 were measured in zebra fish (*Brachydanio rerio*) and fathead minnow (*Pimephales promelas*), respectively, for 2,4,6-TBP. These measured values suggest that the potential for bioconcentration of 2,4,6-TBP in aquatic organisms is moderate to high. Exposure of bluegills (*Lepomis macrochirus*) to 14C-labelled 2,4,6-TBP for 28 days resulted in 20-fold bioaccumulation in edible tissue and 140-fold bioconcentration in viscera. Plateau levels were reached by 3-7 days of exposure. The half-life for residues was less than 24 h following termination of exposure.

■ Contamination of chlorophenols in their manufacture by toxic species such as the dibenzo-p-dioxins and dibenzofurans raise concern in terms of their entry in the food chain.

■ DO NOT discharge into sewer or waterways.

■ The material is classified as an ecotoxin* because it is NOT readily biodegradable, the log octanol/ water partition coefficient (log Kow) is greater than or equal to 3.5 and for which the Fish LC50 (96 hours) is less than or equal to 10 mg/l.

Substances are considered to be readily biodegradable if the following levels of degradation are achieved in 28 days:

- In tests based on dissolved organic carbon: 70%
- In tests based on oxygen depletion or carbon dioxide generation: 60% of the theoretical maxima
- These levels of biodegradation must be achieved within 10 days of the start of biodegradation, which point is taken as the time when 10% of the substance has been degraded.

* 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.

Ecotoxicity

| Ingredient | Persistence: Water/Soil | Persistence: Air | Bioaccumulation | Mobility |
|----------------------|-------------------------|------------------|-----------------|----------|
| 2,4,6-tribromophenol | HIGH | | LOW | MED |

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

B. Component Waste Numbers

When 2,4,6-tribromophenol is present as a solid waste as a discarded commercial chemical product, off-specification species, as a container residue, or a spill residue, use EPA waste number U408 (waste code T).

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. 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.
- Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION



DOT:

| | | | |
|--|----------|--|---|
| Symbols: | G | Hazard class or Division: | 9 |
| Identification Numbers: | UN3077 | PG: | III |
| Label Codes: | 9 | Special provisions: | 8, 146, 335, B54, IB8, IP3, N20, T1, TP33 |
| Packaging: Exceptions: | 155 | Packaging: Non-bulk: | 213 |
| Packaging: Exceptions: | 155 | Quantity limitations: Passenger aircraft/rail: | No limit |
| Quantity Limitations: Cargo aircraft only: | No limit | Vessel stowage: Location: | A |
| Vessel stowage: Other: | None | | |

Hazardous materials descriptions and proper shipping names:

Environmentally hazardous substance, solid, n.o.s

Air Transport IATA:

| | | | |
|---------------------|------|--------------------|-----|
| ICAO/IATA Class: | 9 | ICAO/IATA Subrisk: | 9 |
| UN/ID Number: | 3077 | Packing Group: | III |
| Special provisions: | A97 | | |

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. *(CONTAINS 2,4,6-TRIBROMOPHENOL)

Maritime Transport IMDG:

| | | | |
|---------------------|---------|---------------------|-------------|
| IMDG Class: | 9 | IMDG Subrisk: | None |
| UN Number: | 3077 | Packing Group: | III |
| EMS Number: | F-A,S-F | Special provisions: | 274 909 944 |
| Limited Quantities: | 5 kg | | |

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.(contains 2,4,6-tribromophenol)

Section 15 - REGULATORY INFORMATION

2,4,6-tribromophenol (CAS: 118-79-6) is found on the following regulatory lists;

"Canada Domestic Substances List (DSL)", "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 EPA Master Testing List - Index I Chemicals Listed", "US EPA Master Testing List - Index II Chemicals Removed", "US Toxic Substances Control Act (TSCA) - Inventory", "US TSCA Section 12(b) - List of Chemical Substances Subject to Export Notification Requirements", "US TSCA Section 4 - HDD/HDF - Chemicals Required to Be Tested", "US TSCA Section 4/12 (b) - Sunset Date/Status", "US TSCA Section 8 (a) - Preliminary Assessment Information Rules (PAIR) - Reporting List", "US TSCA Section 8 (d) - Health and Safety Data Reporting"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Cumulative effects may result following exposure*.
- May be harmful to the fetus/ embryo*.

*(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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