

Phthalic anhydride

sc-203189

Material Safety Data Sheet



The Power to Question

Hazard Alert Code
Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

Phthalic anhydride

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

Used in production of alkyd resins, a range of phthalate plasticisers, polyesters, synthesis of phenolphthalein and other phthalein dyes, pharmaceutical intermediates, insecticides.

SYNONYMS

C8-H4-O3, "1, 2-benzenedicarboxylic acid anhydride", "1, 2-benzenedicarboxylic acid anhydride", "1, 3-dioxophthalan", "1, 3-dioxophthalan", "1, 3-dihydro-1, 3-dioxoisobenzofuran", "1, 3-dihydro-1, 3-dioxoisobenzofuran", "1, 3-isobenzofurandione", "1, 3-isobenzofurandione", phthalandione, "1, 3-phthalandione", "1, 3-phthalandione", "phthalic acid anhydride", "phthalic anhydride solid", molten, "Araldite HT901 Vulkalant B/C Reatrdet AK Retarder PD"

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Harmful if swallowed.

Risk of serious damage to eyes.

May cause SENSITIZATION by inhalation and skin contact.

Irritating to respiratory system and skin.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

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

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.
- Contact with phthalic anhydride may result in conjunctival oedema. Symptoms include pain, tearing and photophobia. Air concentrations of 30 mg/m³ (5 ppm) were associated produced conjunctivitis in workers.
- 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.

SKIN

- This material can cause inflammation of the skin on contact in some persons.
- The material can produce chemical burns following direct contact with the skin.
- Skin contact is not thought to produce harmful health effects (as classified using animal models). Systemic harm, however, has been identified following exposure of animals by at least one other route and the material may still produce health damage following entry through wounds, lesions or abrasions. Good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.
- In extreme exposures phthalic anhydride may stain the skin brown or yellow. Skin sensitisation with occasional urticaria and eczematous response are reported frequently in the literature.
- Molten material is capable of causing burns.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- 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.
- 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

- If inhaled, this material can irritate the throat and lungs of some persons.
 - The material is not thought to produce adverse health effects following inhalation (as classified using animal models). Nevertheless, adverse effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.
 - Phthalic anhydride vapour, fume or dust is a primary irritant. Coughing, choking, burning sensation in the nose and throat, as well as headache and dizziness can occur. Air concentrations of 25 mg/m³ (4 ppm) produced signs of mucous membrane irritation. Excessive exposure may cause inflammation of the respiratory tract, nasal bleeding and ulceration, loss of smell, hoarseness, bronchitis and blood changes. Pulmonary oedema with a tightness in chest, dizziness and cyanosis may occur after a 6 to 8 hour latent period.
- Workers exposed to mixtures of phthalic anhydride and phthalic acid developed conjunctivitis, nasal discharge, atrophy of the nasal mucosa, hoarseness, cough, occasional bloody sputum, bronchitis and emphysema. Several cases of bronchial asthma were reported. 48 workers exposed to phthalic anhydride several times a day during a 10- to 30-minute period (at concentrations ranging from 3 to 13 mg/m³ as a TWA for breathing zone samples) showed rhinitis, bronchitis and asthma.
- Processing for an overly long time or processing at overly high temperatures may cause generation and release of highly irritating vapors, which irritate eyes, nose, throat, causing red itching eyes, coughing, sore throat.
 - 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.
 - 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.
 - Usually handled as molten liquid which requires worker thermal protection and increases hazard of vapor exposure. CAUTION: Vapors may be irritating.

CHRONIC HEALTH EFFECTS

- Inhaling this product is more likely to cause a sensitization reaction in some persons compared to the general population. 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.
- The latent period of respiratory symptoms produced by phthalic anhydride exposure ranged from 1 month to 16 years. Long term exposure can cause bronchial irritation and chronic coughs. Chronic exposure by inhalation or skin contact can cause allergic sensitisation.
- Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.
- 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.
- Respiratory sensitization may result in allergic/asthma like responses; from coughing and minor breathing difficulties to bronchitis with wheezing, gasping.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS

		Min	Max	
Flammability:	1			
Toxicity:	2			
Body Contact:	3			
Reactivity:	1			
Chronic:	2			
			Min/Nil=0 Low=1 Moderate=2 High=3 Extreme=4	
NAME		CAS RN		%
phthalic anhydride		85-44-9		>98
maleic anhydride		108-31-6		>0.05

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.

For THERMAL burns:

- Do NOT remove contact lens
- Lay victim down, on stretcher if available and pad BOTH eyes, make sure dressing does not press on the injured eye by placing thick pads under dressing, above and below the eye.
- Seek urgent medical assistance, or transport to hospital.

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.

In case of burns:

- Immediately apply cold water to burn either by immersion or wrapping with saturated clean cloth.
- DO NOT remove or cut away clothing over burnt areas. DO NOT pull away clothing which has adhered to the skin as this can cause further injury.
- DO NOT break blister or remove solidified material.
- Quickly cover wound with dressing or clean cloth to help prevent infection and to ease pain.
- For large burns, sheets, towels or pillow slips are ideal; leave holes for eyes, nose and mouth.
- DO NOT apply ointments, oils, butter, etc. to a burn under any circumstances.
- Water may be given in small quantities if the person is conscious.
- Alcohol is not to be given under any circumstances.
- Reassure.
- Treat for shock by keeping the person warm and in a lying position.
- Seek medical aid and advise medical personnel in advance of the cause and extent of the injury and the estimated time of arrival of the patient.

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.
- If dust is inhaled, remove from contaminated area.
- Encourage patient to blow nose to ensure clear breathing passages.
- Ask patient to rinse mouth with water but to not drink water.
- Seek immediate medical attention.

Inhalation of vapors or aerosols (mists, fumes) may cause lung edema. Corrosive substances may cause lung damage (e.g. lung edema, fluid in the lungs). As this reaction may be delayed up to 24 hours after exposure, affected individuals need

complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested. Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered. This must definitely be left to a doctor or person authorized by him/her. (ICSC13719).

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].

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Negligible @ 20
Upper Explosive Limit (%):	10.4
Specific Gravity (water=1):	1.50
Lower Explosive Limit (%):	1.7

EXTINGUISHING MEDIA

-
- Do NOT direct a solid stream of water or foam into burning molten material; this may cause spattering and spread the fire.
- 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

-
- 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 rigid containers.
- May emit acrid smoke and corrosive fumes.

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

NOTE: Burns with intense heat. Produces melting, flowing, burning liquid and dense acrid black smoke.

CARE: Contamination of heated / molten liquid with water may cause violent steam explosion, with scattering of hot contents.

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.

Full face- shield.

Gloves:

Respirator:

Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

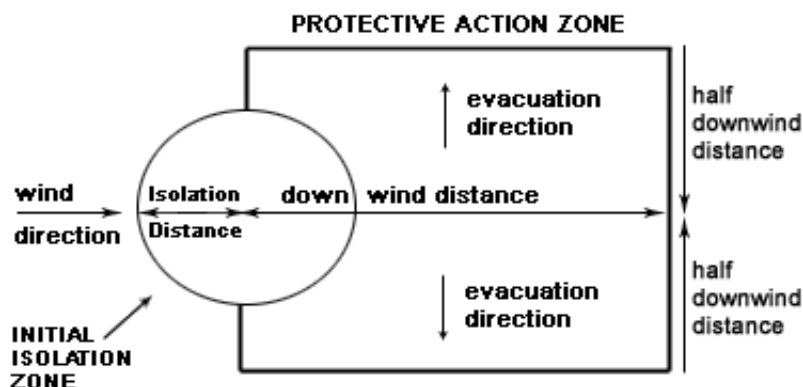
MINOR SPILLS

-
- 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.
- Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material.
- Check regularly for spills and leaks.

MAJOR SPILLS

-
- 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

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 156 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)

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



- The greatest potential for injury caused by molten materials occurs during purging of machinery (moulders, extruders etc.)
- It is essential that workers in the immediate area of the machinery wear eye and skin protection (such as full face, safety glasses, heat resistant gloves, overalls and safety boots) as protection from thermal burns.
- Fumes or vapors emitted from hot melted materials, during converting operations, may condense on overhead metal surfaces or exhaust ducts. The condensate may contain substances which are irritating or toxic. Avoid contact of that material with the skin. Wear rubber or other impermeable gloves when cleaning contaminated areas.
- Avoid process temperatures above decomposition temperatures. Overheating may occur at excessively high cylinder heats, overworking of the melt by wrong screw configuration, or by long dwell time in the machine. Under such conditions, thermal emissions and heat-degradation products might, without proper ventilation, reach hazardous concentrations in the converting area. Hot purgings should be collected only as thin flat strands to allow for rapid cooling. Hot purgings should be cooled by quenching in water in a well-ventilated area.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Avoid contact with moisture.
- 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

- 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

TWA TWA STEL STEL Peak Peak TWA

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
Canada - British Columbia Occupational Exposure Limits	phthalic anhydride (Phthalic anhydride)	1							S
Canada - Ontario Occupational Exposure Limits	phthalic anhydride (Phthalic anhydride)	1	6						
US - Minnesota Permissible Exposure Limits (PELs)	phthalic anhydride (Phthalic anhydride)	1	6						
US ACGIH Threshold Limit Values (TLV)	phthalic anhydride (Phthalic anhydride)	1							TLV Basis: upper respiratory tract, eye & skin irritation
US NIOSH Recommended Exposure Limits (RELs)	phthalic anhydride (Phthalic anhydride)	1	6						
Canada - Alberta Occupational Exposure Limits	phthalic anhydride (Phthalic anhydride)	1	6.1						
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	phthalic anhydride (Phthalic anhydride)	1	6						
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	phthalic anhydride (Phthalic anhydride)	2	12						
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	phthalic anhydride (Phthalic anhydride)	1	6						
US - California Permissible Exposure Limits for Chemical Contaminants	phthalic anhydride (Phthalic anhydride)	1	6						
US - Idaho - Limits for Air Contaminants	phthalic anhydride (Phthalic anhydride)	2	12						
US OSHA Permissible Exposure Levels (PELs) - Table Z1	phthalic anhydride (Phthalic anhydride)	2	12						
US - Hawaii Air Contaminant Limits	phthalic anhydride (Phthalic anhydride)	1	6						
US - Alaska Limits for Air Contaminants	phthalic anhydride (Phthalic anhydride)	1	6						
US - Michigan Exposure Limits for Air Contaminants	phthalic anhydride (Phthalic anhydride)	1	6						
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	phthalic anhydride (Phthalic anhydride)	1	6	4	24				
US - Washington Permissible exposure limits of air contaminants	phthalic anhydride (Phthalic anhydride)	1		3					
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	phthalic anhydride (Phthalic anhydride)	1		2					SEN
Canada - Prince Edward Island Occupational Exposure Limits	phthalic anhydride (Phthalic anhydride)	1							TLV Basis: upper respiratory tract, eye & skin irritation
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	phthalic anhydride (Phthalic anhydride)	2	12						
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	phthalic anhydride (Phthalic anhydride)	1	6,1						
US - Oregon Permissible Exposure Limits (Z1)	phthalic anhydride (Phthalic anhydride)	2	12						
Canada - Northwest Territories Occupational Exposure Limits (English)	phthalic anhydride (Phthalic anhydride)	1	6	4	24				
Canada - Nova Scotia Occupational Exposure Limits	phthalic anhydride (Phthalic anhydride)	1							TLV Basis: upper respiratory tract, eye & skin irritation

Canada - Alberta Occupational Exposure Limits	maleic anhydride (Maleic anhydride)	0.1	0.4		
Canada - British Columbia Occupational Exposure Limits	maleic anhydride (Maleic anhydride)	0.1		S	
Canada - Ontario Occupational Exposure Limits	maleic anhydride (Maleic anhydride)	0.1			
US ACGIH Threshold Limit Values (TLV)	maleic anhydride (Maleic anhydride)	0.1			TLV Basis: eye, upper respiratory tract & skin irritation
US NIOSH Recommended Exposure Limits (RELs)	maleic anhydride (Maleic anhydride)	0.25	1		
US - Minnesota Permissible Exposure Limits (PELs)	maleic anhydride (Maleic anhydride)	0.25	1		
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	maleic anhydride (Maleic anhydride)	0.25	1		
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	maleic anhydride (Maleic anhydride)	0.25	1		
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	maleic anhydride (Maleic anhydride)	0.25	1		
US - California Permissible Exposure Limits for Chemical Contaminants	maleic anhydride (Maleic anhydride; cis-butenedioic anhydride)	0.1	0.4		
US - Idaho - Limits for Air Contaminants	maleic anhydride (Maleic anhydride)	0.25	1		
US - Hawaii Air Contaminant Limits	maleic anhydride (Maleic anhydride)	0.25	1		
US - Alaska Limits for Air Contaminants	maleic anhydride (Maleic anhydride)	0.25	1		
US - Michigan Exposure Limits for Air Contaminants	maleic anhydride (Maleic anhydride)	1			
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	maleic anhydride (Maleic anhydride)	0.25	1	0.25	1
US - Washington Permissible exposure limits of air contaminants	maleic anhydride (Maleic anhydride)	0.25		0.75	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	maleic anhydride (Maleic anhydride)	0.1		0.3	SEN
US - Oregon Permissible Exposure Limits (Z1)	maleic anhydride (Maleic anhydride)	0.25	1		
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	maleic anhydride (Maleic anhydride)	0.25	1		
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	maleic anhydride (Maleic anhydride)	0.25	1		
US OSHA Permissible Exposure Levels (PELs) - Table Z1	maleic anhydride (Maleic anhydride)	0.25	1		
Canada - Northwest Territories Occupational Exposure Limits (English)	maleic anhydride (Maleic anhydride)	0.25	1	0.75	3
Canada - Nova Scotia Occupational Exposure Limits	maleic anhydride (Maleic anhydride)	0.1			TLV Basis: eye, upper respiratory tract & skin irritation
Canada - Prince Edward Island Occupational Exposure Limits	maleic anhydride (Maleic anhydride)	0.1			TLV Basis: eye, upper respiratory tract & skin irritation

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
phthalic anhydride	60	
maleic anhydride	10	

MATERIAL DATA

MALEIC ANHYDRIDE:

PHthalic ANHYDRIDE:

■ for maleic anhydride:

Odour Threshold Value: 0.25-0.32 ppm

Exposure at or below the TLV-TWA is expected to minimise the potential for respiratory, dermal and ocular irritation in nonsensitised workers.

The limit may not be protective for workers who have developed an asthmatic/ respiratory sensitisation-like response to maleic anhydride or structurally related compounds such as phthalic anhydride.

Maleic anhydride concentrations of 1.2-2 ppm produced nasal irritation within 1 minute, in volunteers, followed by ocular irritation after 15-20 minutes. The minimal concentration of maleic anhydride in air that is associated with conjunctival and upper respiratory tract irritation was 0.25 to 0.38 ppm. A concentration of 0.22 ppm (0.9 mg/m3) was said to have no discernible adverse effect.

Odour Safety Factor(OSF)

OSF=0.31 (MALEIC ANHYDRIDE).

PHthalic ANHYDRIDE:

■ Phthalic anhydride produces irritation and sensitisation of the skin and respiratory tract as well as severe eye irritation. By comparison with other industrial acid anhydrides such as tetrachlorophthalic anhydride and maleic acid anhydride, it produces less irritation on an equivalent weight basis. Exposure at or below the TLV-TWA is thought to reduce the significant risk of respiratory, skin and eye irritation.

Measurements in factories processing phthalic anhydride indicate that exposure to concentrations in a range above 1.5 to 3.0 mg/m3 frequently leads to rhinitis, conjunctivitis and asthma. It cannot, however, be deduced from the available data whether the changes are caused by continuous exposure or whether they result from peak exposures.

Odour Safety Factor(OSF)

OSF=19 (o-PHTHALIC ANHYDRIDE).

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.

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.

- When handling hot materials wear heat resistant, elbow length gloves.
- Rubber gloves are not recommended when handling hot objects, materials
- Protective gloves eg. Leather gloves or gloves with Leather facing

OTHER

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

Usually handled as molten liquid which requires worker thermal protection and increases hazard of vapor exposure. CAUTION: Vapors may be irritating.

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

-
- 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

■ For molten materials:

Provide mechanical ventilation; in general such ventilation should be provided at compounding/ converting areas and at fabricating/ filling work stations where the material is heated. Local exhaust ventilation should be used over and in the vicinity of machinery involved in handling the molten material.

Keep dry!!

Processing temperatures may be well above boiling point of water, so wet or damp material may cause a serious steam explosion if used in unvented equipment.

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

Solid.
Corrosive.
Acid.

State	Divided solid	Molecular Weight	148.12
Melting Range (°F)	269.6	Viscosity	Not Applicable
Boiling Range (°F)	563	Solubility in water (g/L)	Reacts
Flash Point (°F)	305.6	pH (1% solution)	Not available.
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	1056.2	Vapour Pressure (mmHG)	Negligible @ 20
Upper Explosive Limit (%)	10.4	Specific Gravity (water=1)	1.50
Lower Explosive Limit (%)	1.7	Relative Vapor Density (air=1)	5.2
Volatile Component (%vol)	Not available.	Evaporation Rate	Not available

APPEARANCE

■ Use may require material be molten. Molten or heated material may be compounded, moulded or extruded. White crystalline needles or flakes with slight characteristic odour. Soluble in hot water, alcohol and carbon disulfide. Sublimes at 284 C. May be transported as molten liquid. Only phthalic anhydride with more than 0.05% maleic anhydride is subject to the provisions of the Road and Rail Transport Code.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

-
- Contact with alkaline material liberates heat

STORAGE INCOMPATIBILITY

- For phthalic anhydride:
 - Avoid storage with copper oxide.
 - Reacts violently with aniline, strong oxidisers, barium peroxide, calcium permanganate, 1,2-diaminoethane, 1,3-diphenyltriazene (explodes), ethanolamine, hypochlorous acid, nitric acid, peroxyacetic acid, sodium dichromate, sodium peroxide, sulfuric acid.
 - Incompatible with strong acids, acetic anhydride, alkalis, ammonia, amines, 1,3-bis(di-n-cyclopentadienyl iron)-2-propen-1-one, copper(II) nitrate, nitrating acid, permanganates, reducing agents, sodium nitrate, sodium nitrite, 4-toluenesulfonic acid.
 - Attacks some plastics, rubbers or coatings.
 - Flow or agitation of substance may generate electrostatic charges due to low conductivity
- Reacts with mild steel, galvanized steel / zinc producing hydrogen gas which may form an explosive mixture with air.
Avoid storage with reducing agents.
Segregate from alcohol, water.
Segregate from alkalis, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.
- Avoid strong acids, bases.
 - NOTE: May develop pressure in containers; open carefully. Vent periodically.

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

Section 11 - TOXICOLOGICAL INFORMATION

phthalic anhydride

TOXICITY AND IRRITATION

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

TOXICITY	IRRITATION
Oral (rat) LD50: 1530 mg/kg	Skin (rabbit): 500 mg/24h - Mild
Dermal (rabbit) LD50: >10000 mg/kg	Eye (rabbit): 100 mg - SEVERE
Oral (Mouse) LD50: 1500 mg/kg	EYE (RABBIT): 50 MG/24H - Moderate
Oral (Cat) LD50: 800 mg/kg	

■ 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.
Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms. Some people may

be genetically more prone than others, and exposure to other irritants may aggravate symptoms. Allergy causing activity is due to interactions with proteins.

Attention should be paid to atopic diathesis, characterized by increased susceptibility to nasal inflammation, asthma and eczema.

Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure.

For phthalic anhydride:

Acute toxicity: On contact with water, phthalic anhydride is rapidly hydrolyzed to phthalic acid. Unconjugated phthalic acid was found in the urine of humans exposed to phthalic anhydride by the inhalation route, demonstrating systemic absorption and elimination via the urine and the existence of phthalic acid as a hydrolysis product in vivo.

The oral LD50 in rats was 1530 mg/kg bw. Clinical signs at doses equal or higher than 500 mg/kg bw included sedation, imbalance, and bloodshot eyes. There were no reliable animal acute toxicity studies available for the inhalation and dermal routes of exposure.

In poorly documented human case reports, which provide no reliable information on exposure levels, headache, dizziness, nausea, epigastric burning and a feeling of suffocation were described after acute occupational exposure to phthalic anhydride dust or vapor.

In rabbits, phthalic anhydride was slightly irritating to the skin (OECD TG 404), and irritating to the eyes. In humans, effects on the eye after occupational exposure are described (including conjunctivitis, lacrimation, corneal ulceration, necrosis, and photophobia). For humans, phthalic anhydride in the form of vapor, fumes, or dust is a primary irritant to mucous membranes and the upper respiratory tract. Initial exposure produces coughing, sneezing, burning sensations in the nose and throat, and increased mucous secretion. Repeated or continued exposures may result in general inflammation of the respiratory tract, nasal ulceration and bleeding, atrophy of the mucous membranes (reversible), loss of smell, hoarseness, bronchitis, urticaria, and symptoms of allergic hypersensitivity.

Phthalic anhydride demonstrated skin sensitizing properties in animals, with positive results being observed in guinea pig tests according to OECD TG 406 and in local lymph node assays similar to OECD TG 429. Evidence that phthalic anhydride has respiratory sensitization potential has been demonstrated in an experimental guinea pig model.

In humans, there are a number of reports providing information on the respiratory sensitization potential of phthalic anhydride after occupational exposure. Workers were reported to suffer from work-related rhinitis, chronic productive bronchitis, and work-associated asthma. Phthalic anhydride sensitization is generally associated with either an asthma-rhinitis-conjunctivitis syndrome or with a delayed reaction and influenza-like symptoms and with increased IgG and/or phthalic anhydride specific IgE levels in the blood. Reports on skin reactions in humans are rare.

Repeat dose toxicity: Phthalic anhydride has been shown to have low repeated dose toxicity by the oral route in rats. The evidence of toxicity in a chronic rat study is limited to adverse effects on body-weight gain at the dose level of 1000 mg/kg bw/day. The NOAEL was at 500 mg/kg bw/day. It is noted that no hematology and clinical biochemistry examinations were performed in this study. A NOAEL could not be established in a chronic feeding study in mice because of pathological effects seen down to the lowest tested dose level (LOAELs: 12 019 ppm level in female mice = approximately 1717 mg/kg bw/day, and 16 346 ppm in male mice = approximately 2340 mg/kg bw/day; increased incidences of lung and kidney lymphocytosis in the males and females, and dose-related adrenal atrophy and mineralization of the thalamus in males. The LOAELs are time-weighted averages because a dose reduction in males from 25 000 to 12 500 ppm (= approximately 1785 mg/kg bw/day) and for females from 12 500 to 6250 ppm (= approximately 890 mg/kg bw/day) was necessary after 32 weeks of exposure due to reduced weight gains). There were no valid repeated dose studies available using the dermal or respiratory routes of exposure.

Genotoxicity: Phthalic anhydride was not mutagenic in the Ames test with and without metabolic activation (OECD TG 471). Chromosomal aberrations were induced in mammalian cells in vitro at the highest phthalic anhydride concentrations

(10 mM) only in the absence of S9 mix with concomitant marked cytotoxicity and compound precipitate. In vivo studies are not available. Overall, it can be concluded that phthalic anhydride is genotoxic in vitro at extremely high cytotoxic concentrations, and only in the absence of a metabolic activation system. This genotoxic effect is not expected to be relevant under in vivo conditions, where phthalic anhydride is rapidly hydrolyzed to the non-genotoxic phthalic acid.

Carcinogenicity: No evidence of carcinogenicity was seen in rats after exposure to approximately 1000 mg/kg bw/day of phthalic anhydride, or in male and female mice after exposure to 4670, and 3430 mg/kg bw/day, respectively, in comprehensive chronic (105-week) feeding studies.

Developmental toxicity: Phthalic acid was investigated in a developmental toxicity feeding study in rats and gave no evidence of embryotoxicity, or foetotoxicity at a non-maternally toxic dose level (1.25 % in feed = approximately 1000 mg/kg bw/day = NOAEL for maternal toxicity). Significant decreases in the weight of male fetuses and in the numbers of ossified centers of the caudal vertebrae were, however, found in the 5.0 % group, where maternal toxicity was also observed (NOAEL, developmental toxicity: 2.5 % in feed = approximately 1700 mg/kg bw/day). Based on the data of phthalic acid, the hydrolysis product of phthalic anhydride, it is concluded that, in the absence of maternal toxicity, phthalic anhydride is not a developmental toxicant.

Reproductive toxicity: No evidence of toxicity to reproductive organs was observed in comprehensive carcinogenicity studies in rats and mice, as no treatment-related changes were observed for any reproductive organ investigated during macroscopic and microscopic examination (NOAEL, rat: 1000 mg/kg bw/day; NOAEL (time-weighted average), mouse: 3430 (f), 4670 (m) mg/kg bw/day).

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

The material may cause 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.

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

Intraperitoneal (Guinea pig) LD50: 100 mg/kg

MALEIC ANHYDRIDE:

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

TOXICITY

Oral (rat) LD50: 400 mg/kg

Dermal (rabbit) LD50: 2620 mg/kg

IRRITATION

Eye (rabbit): 1% - SEVERE

■ 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.

Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms. Some people may be genetically more prone than others, and exposure to other irritants may aggravate symptoms. Allergy causing activity is due to interactions with proteins.

Attention should be paid to atopic diathesis, characterized by increased susceptibility to nasal inflammation, asthma and eczema.

Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure.

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 hyperactivity 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.

CARCINOGEN

Phthalic anhydride	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4
Maleic anhydride	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

MALEIC ANHYDRIDE:

PHTHALIC ANHYDRIDE:

- DO NOT discharge into sewer or waterways.
- Prevent, by any means available, spillage from entering drains or watercourses.

PHTHALIC ANHYDRIDE:

■ Hazardous Air Pollutant:	Yes
■ BCF<100:	5
■ Half- life Soil - High (hours):	0.45
■ Half- life Soil - Low (hours):	0.0089
■ Half- life Air - High (hours):	4847
■ Half- life Air - Low (hours):	485
■ Half- life Surface water - High (hours):	0.45
■ Half- life Surface water - Low (hours):	0.0089
■ Half- life Ground water - High (hours):	0.45
■ Half- life Ground water - Low (hours):	0.0089
■ Aqueous biodegradation - Aerobic - High (hours):	168
■ Aqueous biodegradation - Aerobic - Low (hours):	24
■ Aqueous biodegradation - Anaerobic - High (hours):	672
■ Aqueous biodegradation - Anaerobic - Low (hours):	96
■ Aqueous photolysis half- life - High (hours):	274
■ Aqueous photolysis half- life - Low (hours):	224
■ Photooxidation half- life air - High (hours):	4847
■ Photooxidation half- life air - Low (hours):	485
■ First order hydrolysis half- life (hours):	0.45

■ For phthalic anhydride:

Koc : 36

Half-life (hr) air : 24

Half-life (hr) H₂O surface water : 0.0625

Henry's atm m³ /mol: 6.20E-09

BOD 5 1.2-26,73.46%

BCF : 5-4053

Degradation Biological: by soil microflora 2 days

Environmental fate:

Phthalic anhydride hydrolyzes in water at pH 6.8-7.24 with half-lives of 0.5 - 1 min at 25 C, forming phthalic acid that has dissociation constants of about 2.8 and 5.4. Any phthalic anhydride emitted into the air or into the terrestrial compartment would be rapidly hydrolyzed by humidity in the air or in the soil, respectively.

In the atmosphere phthalic anhydride is degraded by photochemically produced OH radicals. The half-life is calculated to be about 21 days. For phthalic acid a half-life of 13 days is estimated. Removal of phthalic acid in sea water was proved to be influenced by light. Phthalic anhydride is readily biodegradable. In an aquatic ready test system (aerobic) conducted according to OECD TG 301D, > 70 % biodegradation was reported after 30 days for phthalic anhydride as well as for its degradation product, phthalic acid.

Due to the rapid hydrolysis of phthalic anhydride in water, the distribution of the hydrolysis product phthalic acid is calculated. According to the Mackay fugacity model level I, the favorite target compartment of phthalic acid is water with 99.9 %. The calculated Henry's law constants (2.21×10^{-7} Pa m³/mol at 25 °C for phthalic acid, and 0.64 Pa m³/mol at 25 °C for phthalic anhydride) prove a low potential for volatilization from surface waters.

The bioconcentration factors (BCF) of 3.4 for phthalic anhydride and 3.2 for phthalic acid, calculated from the octanol-water partition coefficients, indicate that there is a low potential for bioaccumulation of phthalic anhydride and phthalic acid in aquatic organisms. Tests with ¹⁴C-phthalic acid in plants indicate a low potential of phthalic anhydride and phthalic acid for bioaccumulation in plants.

Experimentally obtained adsorption coefficients (K_{oc}) revealed a low sorption potential of phthalic acid. The experimentally achieved K_{oc} values were in the range of 2 to 31 depending on soil properties. In addition, calculated K_{oc} values were 11 for phthalic anhydride, and 73 for phthalic acid). These results indicate a low sorption potential of phthalic anhydride and phthalic acid onto the organic phase of soil or sediments.

Ecotoxicity:

for phthalic acid:

Fish LC50 (48 h): *Cyprinus carpio* >500 mg/l (nominal)

Fish LC50 (7 d): *Danio rerio* 560 mg/l (nominal)

Fish NOEC (60 d): *Oncorhynchus mykiss* (*S. gairdneri*) 10 mg/l (nominal)

Daphnia magna EC50 (24 h): 140 mg/l

Algae EC50 (72 h): *Desmodesmus subspicatus* => 100 mg/l; NOEC => 100 mg/l.

MALEIC ANHYDRIDE:

■ Hazardous Air Pollutant:	Yes
■ Fish LC50 (96hr.) (mg/l):	230- 240
■ BOD5:	0.4- 0.6

Half-life (hr) air: 1.7

Half-life (hr) H₂O surface water: 0.006

BOD 5 if unstated: 0.4-0.6

Toxicity Fish: LC50(96)5mg/L

Degradation Biological: sig

processes Abiotic: dissoc,Rxn OH*

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
phthalic anhydride	LOW	HIGH	MED	HIGH
maleic anhydride	HIGH		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)

B. Component Waste Numbers

When phthalic anhydride 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 U190 (waste code T).

When maleic anhydride 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 U147 (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.
- Treat and neutralize at an approved treatment plant.
- Treatment should involve: Mixing or slurring in water Neutralization with soda-lime or soda-ash followed by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
- 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:	UN2214	PG:	III
Label Codes:	8	Special provisions:	IB8, IP3, T1, TP33
Packaging: Exceptions:	154	Packaging: Non-bulk:	213
Packaging: Exceptions:	154	Quantity limitations: Passenger aircraft/rail:	25 kg
Quantity Limitations: Cargo aircraft only:	100 kg	Vessel stowage: Location:	A
Vessel stowage: Other:	None		

Hazardous materials descriptions and proper shipping names:
Phthalic anhydride with more than .05 percent maleic anhydride

Air Transport IATA:

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	None
UN/ID Number:	2214	Packing Group:	III
Special provisions:	A74		

Shipping Name: PHTHALIC ANHYDRIDE

Maritime Transport IMDG:

IMDG Class:	8	IMDG Subrisk:	None
UN Number:	2214	Packing Group:	III
EMS Number:	F-A,S-B	Special provisions:	169 939
Limited Quantities:	5 kg		

Shipping Name: PHTHALIC ANHYDRIDE with more than 0.05% of maleic anhydride

Section 15 - REGULATORY INFORMATION

phthalic anhydride (CAS: 85-44-9) is found on the following regulatory lists;

"Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Industrial Hazardous Substances", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Domestic Substances List (DSL)", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - Alaska Limits for Air Contaminants", "US - California 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 - 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 Permissible Exposure Limits (Z1)", "US - Pennsylvania - Hazardous Substance List", "US - Rhode Island Hazardous Substance List", "US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants", "US - Vermont Hazardous Constituents", "US - Vermont Hazardous wastes which are Discarded Commercial Chemical Products or Off-Specification Batches of Commercial Chemical Products or Spill Residues of Either", "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 Dangerous waste constituents list", "US - Washington Discarded Chemical Products List - ""U"" Chemical Products", "US - Washington Permissible exposure limits of air contaminants", "US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants", "US ACGIH Threshold Limit Values (TLV)", "US ACGIH Threshold Limit Values (TLV) - Carcinogens", "US CAA (Clean Air Act) - HON Rule - Organic HAPs (Hazardous Air Pollutants)", "US Clean Air Act - Hazardous Air Pollutants", "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 EPA High Production Volume Program Chemical List", "US EPA Master Testing List - Index I Chemicals Listed", "US EPCRA Section 313 Chemical List", "US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives", "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 499 Combustible Dusts", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261", "US RCRA (Resource Conservation & Recovery Act) - List of Hazardous Wastes", "US RCRA (Resource Conservation & Recovery Act) - Phase 4 LDR Rule - Universal Treatment Standards", "US Toxic Substances Control Act (TSCA) - Inventory"

Regulations for ingredients

maleic anhydride (CAS: 108-31-6) is found on the following regulatory lists;

"Canada - Alberta Occupational Exposure Limits","Canada - British Columbia Occupational Exposure Limits","Canada - Northwest Territories Occupational Exposure Limits (English)","Canada - Nova Scotia Occupational Exposure Limits","Canada - Ontario Occupational Exposure Limits","Canada - Prince Edward Island Occupational Exposure Limits","Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)","Canada - Saskatchewan Industrial Hazardous Substances","Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits","Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances","Canada Domestic Substances List (DSL)","Canada Ingredient Disclosure List (SOR/88-64)","Canada National Pollutant Release Inventory (NPRI)","Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)","Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)","GESAMP/EHS Composite List - GESAMP Hazard Profiles","IMO IBC Code Chapter 17: Summary of minimum requirements","IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk","International Council of Chemical Associations (ICCA) - High Production Volume List","OECD Representative List of High Production Volume (HPV) Chemicals","US - Alaska Limits for Air Contaminants","US - California 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 - 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 Permissible Exposure Limits (Z1)","US - Pennsylvania - Hazardous Substance List","US - Rhode Island Hazardous Substance List","US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants","US - Vermont Hazardous Constituents","US - Vermont Hazardous wastes which are Discarded Commercial Chemical Products or Off-Specification Batches of Commercial Chemical Products or Spill Residues of Either","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 Dangerous waste constituents list","US - Washington Discarded Chemical Products List - ""U"" Chemical Products","US - Washington Permissible exposure limits of air contaminants","US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants","US ACGIH Threshold Limit Values (TLV)","US ACGIH Threshold Limit Values (TLV) - Carcinogens","US ACGIH Threshold Limit Values (TLV) - Notice of Intended Changes","US CAA (Clean Air Act) - HON Rule - Organic HAPs (Hazardous Air Pollutants)","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 Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides","US DOE Temporary Emergency Exposure Limits (TEELs)","US EPA High Production Volume Program Chemical List","US EPA Master Testing List - Index I Chemicals Listed","US EPCRA Section 313 Chemical List","US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives","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 NIOSH Recommended Exposure Limits (RELs)","US OSHA Permissible Exposure Levels (PELs) - Table Z1","US RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261","US RCRA (Resource Conservation & Recovery Act) - List of Hazardous Wastes","US Toxic Substances Control Act (TSCA) - Inventory","US TSCA Section 8 (d) - Health and Safety Data Reporting"

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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