

p-Toluenesulfonic acid monohydrate

sc-203343

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

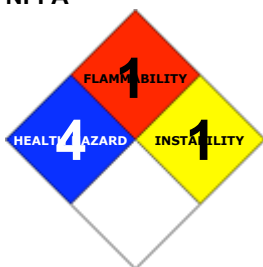
PRODUCT NAME

p-Toluenesulfonic acid monohydrate

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

■ The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation. Manufacture of dyes, organic synthesis and as a catalyst. Used in solution as accelerator, hardener, catalyst for amino and phenolic resins in coatings, foundry binders.

SYNONYMS

C7-H10-O4-S, "para-toluene-sulphonic acid monohydrate", "p-toluene sulfonic acid", "p-toluene sulfonic acid", "methylbenzenesulphonic/methylbenzenesulfonic acid", "toluenesulfonic/ toluenesulphonic acid", "methylphenylsulphonic/ methylphenylsulfonic", "tolylsulphuric acid", "tolylsulfonic acid", "PTSA TSA", "tosic acid"

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Causes burns.

Risk of serious damage to eyes.

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sc-203343

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Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

- The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion.
- The material has NOT been classified as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence. The material may still be damaging to the health of the individual, following ingestion, especially where pre-existing organ (e.g. liver, kidney) damage is evident. Present definitions of harmful or toxic substances are generally based on doses producing mortality (death) rather than those producing morbidity (disease, ill-health). Gastrointestinal tract discomfort may produce nausea and vomiting. In an occupational setting however, unintentional ingestion is not thought to be cause for concern.
- 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

- If applied to the eyes, this material causes severe eye damage.
- The material can produce chemical burns to the eye following direct contact. Vapors or mists may be extremely irritating.
- The liquid produces a high level of eye discomfort and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
- 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.
- The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

SKIN

- The material can produce chemical burns following direct contact with the skin.
- Skin contact is not thought to have harmful health effects, however the material may still produce health damage following entry through wounds, lesions or abrasions.
- 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.
- 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.
- 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.

INHALED

- If inhaled, this material can irritate the throat and lungs of some persons.
- 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.
- Not normally a hazard due to non-volatile nature of product.
- Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.
- The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing.

Before starting consider control of exposure by mechanical ventilation.

- Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness. Swelling of the lungs can occur, either immediately or after a delay; symptoms of this include chest tightness, shortness of breath, frothy phlegm and cyanosis. Lack of oxygen can cause death hours after onset.
- The material may produce respiratory tract irritation, and result in damage to the lung including reduced lung function.
- High concentrations cause inflamed airways and watery swelling of the lungs with edema.

CHRONIC HEALTH EFFECTS

- 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

p-Toluenesulfonic acid monohydrate

sc-203343



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Material Safety Data Sheet

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

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.

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.

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.

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 inhaling this product is more likely to cause a sensitization reaction in some persons compared to the general population.

Strong inorganic acid mists containing sulfuric acid can cause cancer.

Exposure to Sulfonates can cause an imbalance in cellular salts and therefore cellular function. Airborne sulfonates may be responsible for respiratory allergies and, in some instances, minor dermal allergies.

Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. [PATTYS].

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS

	Min	Max
Flammability:	1	
Toxicity:	0	
Body Contact:	3	
Reactivity:	1	
Chronic:	3	

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4



NAME	CAS RN	%
toluene-4-sulfonic acid monohydrate	6192-52-5	>98
sulfuric acid	7664-93-9	<2
toluene	108-88-3	<0.5

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.

p-Toluenesulfonic acid monohydrate

sc-203343

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

SKIN

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

INHALED

- - If fumes or combustion products are inhaled remove from contaminated area.
 - Lay patient down. Keep warm and rested.
 - Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
 - Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
 - Transport to hospital, or doctor.

NOTES TO PHYSICIAN

- For acute or short term repeated exposures to strong acids:
 - Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
 - Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
 - Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
 - Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating 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
Upper Explosive Limit (%):	Not available
Specific Gravity (water=1):	1.4 approx
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA

- - Water spray or fog.
 - Foam.
 - Dry chemical powder.
 - BCF (where regulations permit).
 - Carbon dioxide.

FIRE FIGHTING

- - Alert Emergency Responders and tell them location and nature of hazard.

p-Toluenesulfonic acid monohydrate

sc-203343

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

- 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 solid which burns but propagates flame with difficulty.
- Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.
- Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge 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.
- 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), sulfur oxides (SO_x), other pyrolysis products typical of burning organic material.

Contains low boiling substance: Closed containers may rupture due to pressure buildup under fire conditions.

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:

Type AE-P Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

-
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Wear protective clothing, gloves, safety glasses and dust respirator.
- Use dry clean up procedures and avoid generating dust.
- Sweep up or vacuum up (consider explosion-proof machines designed to be grounded during storage and use).
- Place in clean drum then flush area with water.

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.

p-Toluenesulfonic acid monohydrate

sc-203343



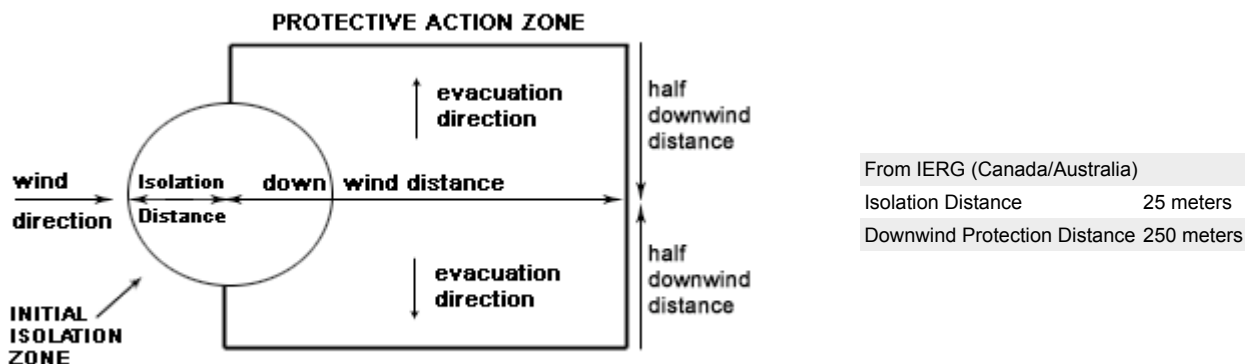
The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

- 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



FOOTNOTES

- 1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
- 2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.
- 3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.
- 4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.
- 5 Guide 153 is taken from the US DOT emergency response guide book.
- 6 IERG information is derived from CANUTEC - Transport Canada.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

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

- Contains low boiling substance:
Storage in sealed containers may result in pressure buildup causing violent rupture of containers not rated appropriately.
- Check for bulging containers.
- Vent periodically
- Always release caps or seals slowly to ensure slow dissipation of vapors
- Avoid all personal contact, including inhalation.

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

- 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.

RECOMMENDED STORAGE METHODS

- DO NOT use aluminum or galvanized containers.

Check regularly for spills and leaks.

STORAGE REQUIREMENTS

-
- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X: Must not be stored together
 O: May be stored together with specific preventions
 +: May be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC	Notes
US - Oregon Permissible Exposure Limits (Z3)	toluene-4-sulfonic acid monohydrate (Inert or Nuisance Dust: (d) Total dust)		10						*
US OSHA Permissible Exposure Levels (PELs) - Table Z3	toluene-4-sulfonic acid monohydrate (Inert or Nuisance Dust: (d) Respirable fraction)		5						
US OSHA Permissible Exposure Levels (PELs) - Table Z3	toluene-4-sulfonic acid monohydrate (Inert or Nuisance Dust: (d) Total dust)		15						

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key:		EXTREME	HIGH	MODERATE	LOW
US - Hawaii Air Contaminant Limits	toluene-4-sulfonic acid monohydrate (Particulates not otherwise regulated - Total dust)		10		
US - Hawaii Air Contaminant Limits	toluene-4-sulfonic acid monohydrate (Particulates not otherwise regulated - Respirable fraction)		5		
US - Oregon Permissible Exposure Limits (Z3)	toluene-4-sulfonic acid monohydrate (Inert or Nuisance Dust: (d) Respirable fraction)		5		*
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	toluene-4-sulfonic acid monohydrate (Particulates not otherwise regulated Respirable fraction)		5		
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	toluene-4-sulfonic acid monohydrate (Particulates not otherwise regulated (PNOR)(f)- Respirable fraction)		5		
US - Michigan Exposure Limits for Air Contaminants	toluene-4-sulfonic acid monohydrate (Particulates not otherwise regulated, Respirable dust)		5		
US - Minnesota Permissible Exposure Limits (PELs)	sulfuric acid (Sulfuric acid)		1		
Canada - Ontario Occupational Exposure Limits	sulfuric acid (Sulfuric acid, thoracic)		0.2		
US NIOSH Recommended Exposure Limits (RELs)	sulfuric acid (Sulfuric acid)		1		
Canada - Alberta Occupational Exposure Limits	sulfuric acid (Sulphuric acid)		1	3	
Canada - British Columbia Occupational Exposure Limits	sulfuric acid (Sulfuric acid, Thoracic Revised 2004)		0.2 (M)		A2, 1
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	sulfuric acid (Sulfuric acid)		1		
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	sulfuric acid (Sulfuric acid)		1		
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	sulfuric acid (Sulfuric acid)		1		
US - Idaho - Limits for Air Contaminants	sulfuric acid (Sulfuric acid)		1		

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key:	EXTREME	HIGH	MODERATE	LOW
US - California Permissible Exposure Limits for Chemical Contaminants	sulfuric acid (Sulfuric acid)	1	3	
US ACGIH Threshold Limit Values (TLV)	sulfuric acid (Sulfuric acid)	0.2		TLV Basis: pulmonary function. A2 = as contained in strong inorganic acid mists
US - Hawaii Air Contaminant Limits	sulfuric acid (Sulfuric acid)	1	3	
US - Alaska Limits for Air Contaminants	sulfuric acid (Sulfuric acid)	1		
US - Michigan Exposure Limits for Air Contaminants	sulfuric acid (Sulfuric acid)	1		
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	sulfuric acid (Sulphuric acid)	- 1 -	1	
US - Washington Permissible exposure limits of air contaminants	sulfuric acid (Sulfuric acid)	1	3	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	sulfuric acid (Sulphuric acid, (thoracic fraction++))	0.2	0.6	T20, strong acid mists only
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	sulfuric acid (Sulfuric acid)	1		
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	sulfuric acid (Sulfuric acid)	1	3	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	sulfuric acid (Sulfuric acid)	1		
Canada - Prince Edward Island Occupational Exposure Limits	sulfuric acid (Sulfuric acid)	0.2		TLV Basis: pulmonary function. A2 = as contained in strong inorganic acid mists
US - Oregon Permissible Exposure Limits (Z1)	sulfuric acid (Sulfuric acid)	1		
Canada - Northwest Territories Occupational Exposure Limits (English)	sulfuric acid (Sulphuric acid)	1	3	
Canada - Nova Scotia Occupational Exposure Limits	sulfuric acid (Sulfuric acid)	0.2		TLV Basis: pulmonary function. A2 = as contained in strong inorganic acid mists
US - Minnesota Permissible Exposure Limits (PELs)	toluene (Toluene)	100	375	150 560
Canada - Ontario Occupational Exposure Limits	toluene (Toluene, also known as Methylbenzene)	20		
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)	toluene (TOLUENE)	0.08		

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key:	EXTREME	HIGH	MODERATE	LOW
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US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)	toluene (TOLUENE)	1					
US NIOSH Recommended Exposure Limits (RELs)	toluene (Toluene)	100	375	150	560		
US ACGIH Threshold Limit Values (TLV)	toluene (Toluene)	20					TLV Basis: Visual impairment; female reproductive system; pregnancy loss. The BEI is based on previous TLV-TWA
Canada - British Columbia Occupational Exposure Limits	toluene (Toluene Revised 2007, 2008)	20					R
Canada - Alberta Occupational Exposure Limits	toluene (Toluene (Toluol))	50	188				
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	toluene (Toluene)	100	375	150	580		
US - Idaho - Acceptable Maximum Peak Concentrations	toluene (Toluene (Z37.12-1967))	200				300	
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	toluene (Toluene*)	100	375	150	560	300	
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	toluene (Toluene)		See Table Z-2				
US - Idaho - Limits for Air Contaminants	toluene (Toluene)		[2]				
US - Michigan Exposure Limits for Air Contaminants	toluene (Toluene)	100	375	150	560		
US - Alaska Limits for Air Contaminants	toluene (Toluene)	100	375	150	560		
Canada - Northwest Territories Occupational Exposure Limits (English)	toluene (Toluene (Toluol) - Skin)	100	375	150	560		
US - Washington Permissible exposure limits of air contaminants	toluene (Toluene)	100		150			
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	toluene (Toluene (toluol) - Skin)	100	375	150	560		
US - Hawaii Air Contaminant Limits	toluene (Toluene (Toluol))	100	375	150	560		
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	toluene (Toluene (toluol))	50		60			Skin
US - Oregon Permissible Exposure Limits (Z2)	toluene (Toluene (Z37.12-1967))	100				300	*

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

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Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	toluene (Toluene)	50	188	
US OSHA Permissible Exposure Levels (PELs) - Table Z2	toluene (Toluene (Z37.12-1967))			300
Canada - Prince Edward Island Occupational Exposure Limits	toluene (Toluene)	20		TLV Basis: Visual impairment; female reproductive system; pregnancy loss. The BEI is based on previous TLV-TWA
Canada - Nova Scotia Occupational Exposure Limits	toluene (Toluene)	20		TLV Basis: Visual impairment; female reproductive system; pregnancy loss. The BEI is based on previous TLV-TWA
US - Wyoming Toxic and Hazardous Substances Table Z-2 Acceptable ceiling concentration, Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift	toluene (Toluene (Z37.12-1967))	200		300

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
sulfuric acid	15	
toluene		500

ODOR SAFETY FACTOR (OSF)

OSF=17 (toluene-4-sulfonic acid monohydrate)

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

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

The Odor Safety Factor (OSF) is defined as:

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

Classification into classes follows:

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

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

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

MATERIAL DATA

SULFURIC ACID:

■ 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

p-Toluenesulfonic acid monohydrate

sc-203343

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

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.

NOTE: Detector tubes for sulfuric acid, measuring in excess of 1 mg/m³, are commercially available.

Based on controlled inhalation studies the TLV-TWA is thought to be protective against the significant risk of pulmonary irritation and incorporates a margin of safety so as to prevent injury to the skin and teeth seen in battery workers acclimated to workplace concentrations of 16 mg/m³. Experimental evidence in normal unacclimated humans indicates the recognition, by all subjects, of odour, taste or irritation at 3 mg/m³ or 5 mg/m³. All subjects reported these levels to be objectionable but to varying degrees.

TOLUENE:

■ For toluene:

Odour Threshold Value: 0.16-6.7 (detection), 1.9-69 (recognition)

NOTE: Detector tubes measuring in excess of 5 ppm, are available.

High concentrations of toluene in the air produce depression of the central nervous system (CNS) in humans. Intentional toluene exposure (glue-sniffing) at maternally-intoxicating concentration has also produced birth defects. Foetotoxicity appears at levels associated with CNS narcosis and probably occurs only in those with chronic toluene-induced kidney failure. Exposure at or below the recommended TLV-TWA is thought to prevent transient headache and irritation, to provide a measure of safety for possible disturbances to human reproduction, the prevention of reductions in cognitive responses reported amongst humans inhaling greater than 40 ppm, and the significant risks of hepatotoxic, behavioural and nervous system effects (including impaired reaction time and incoordination). Although toluene/ethanol interactions are well recognised, the degree of protection afforded by the TLV-TWA among drinkers is not known.

Odour Safety Factor(OSF)

OSF=17 (TOLUENE).

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

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.

OTHER

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

RESPIRATOR

■ Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key:	EXTREME	HIGH	MODERATE	LOW
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contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

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

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

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

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

ENGINEERING CONTROLS

- 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.
- 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:
 - particle dust respirators, if necessary, combined with an absorption cartridge;
 - filter respirators with absorption cartridge or canister of the right type;
 - 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.

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key:	EXTREME	HIGH	MODERATE	LOW
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Mixes with water.
Corrosive.
Acid.

State	Divided solid	Molecular Weight	190.22
Melting Range (°F)	284	Viscosity	Not Applicable
Boiling Range (°F)	428	Solubility in water (g/L)	Soluble
Flash Point (°F)	Not Available	pH (1% solution)	2 approx
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)	1.4 approx
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	> 1.0
Volatile Component (%vol)	<0.5	Evaporation Rate	Non volatile

APPEARANCE

White pinkish crystalline acidic solid. Slight characteristic odour Soluble in water, alcohol and ether.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Contact with alkaline material liberates heat

STORAGE INCOMPATIBILITY

- Reacts with mild steel, galvanized steel / zinc producing hydrogen gas which may form an explosive mixture with air.
- Avoid strong bases.

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

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

Section 11 - TOXICOLOGICAL INFORMATION

toluene-4-sulfonic acid monohydrate

TOXICITY AND IRRITATION

TOLUENE:

SULFURIC ACID:

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

TOXICITY	IRRITATION
Oral (rat) LD50: 2480 mg/kg	Nil Reported
TOXICITY	IRRITATION
SULFURIC ACID:	
Oral (rat) LD50: 2140 mg/kg	Eye (rabbit): 1.38 mg SEVERE
Inhalation (rat) LC50: 510 mg/m ³ /2h	Eye (rabbit): 5 mg/30sec SEVERE
Inhalation (human) TCLo: 3 mg/m ³ /24w	

■ 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

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

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.

WARNING: For inhalation exposure ONLY: This substance has been classified by the IARC as Group 1: CARCINOGENIC TO HUMANS.

Occupational exposures to strong inorganic acid mists of sulfuric acid:

TOLUENE:

Oral (human) LDLo: 50 mg/kg	Skin (rabbit):20 mg/24h-Moderate
Oral (rat) LD50: 636 mg/kg	Skin (rabbit):500 mg - Moderate
Inhalation (human) TCLo: 100 ppm	Eye (rabbit):0.87 mg - Mild
Inhalation (man) TCLo: 200 ppm	Eye (rabbit): 2mg/24h - SEVERE
Inhalation (rat) LC50: 26700 ppm/1h	Eye (rabbit):100 mg/30sec - Mild
Dermal (rabbit) LD50: 12124 mg/kg	

■ 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.

For toluene:

Acute Toxicity

Humans exposed to intermediate to high levels of toluene for short periods of time experience adverse central nervous system effects ranging from headaches to intoxication, convulsions, narcosis, and death. Similar effects are observed in short-term animal studies.

Humans - Toluene ingestion or inhalation can result in severe central nervous system depression, and in large doses, can act as a narcotic. The ingestion of about 60 mL resulted in fatal nervous system depression within 30 minutes in one reported case.

Constriction and necrosis of myocardial fibers, markedly swollen liver, congestion and haemorrhage of the lungs and acute tubular necrosis were found on autopsy.

Central nervous system effects (headaches, dizziness, intoxication) and eye irritation occurred following inhalation exposure to 100 ppm toluene 6 hours/day for 4 days.

Exposure to 600 ppm for 8 hours resulted in the same and more serious symptoms including euphoria, dilated pupils, convulsions, and nausea . Exposure to 10,000-30,000 ppm has been reported to cause narcosis and death

Toluene can also strip the skin of lipids causing dermatitis

Animals - The initial effects are instability and incoordination, lachrymation and sniffles (respiratory exposure), followed by narcosis. Animals die of respiratory failure from severe nervous system depression. Cloudy swelling of the kidneys was reported in rats following inhalation exposure to 1600 ppm, 18-20 hours/day for 3 days

Subchronic/Chronic Effects:

Repeat doses of toluene cause adverse central nervous system effects and can damage the upper respiratory system, the liver, and the kidney. Adverse effects occur as a result from both oral and the inhalation exposures. A reported lowest-observed-effect level in humans for adverse neurobehavioral effects is 88 ppm.

Humans - Chronic occupational exposure and incidences of toluene abuse have resulted in hepatomegaly and liver function changes. It has also resulted in nephrotoxicity and, in one case, was a cardiac sensitiser and fatal cardiotoxin.

Neural and cerebellar dystrophy were reported in several cases of habitual "glue sniffing." An epidemiological study in France on workers chronically exposed to toluene fumes reported leukopenia and neutropenia. Exposure levels were not given in the secondary reference; however, the average urinary excretion of hippuric acid, a metabolite of toluene, was given as 4 g/L compared to a normal level of 0.6 g/L

Animals - The major target organs for the subchronic/chronic toxicity of toluene are the nervous system, liver, and kidney. Depressed immune response has been reported in male mice given doses of 105 mg/kg/day for 28 days. Toluene in corn oil administered to F344 male and female rats by gavage 5 days/week for 13 weeks, induced prostration, hypoactivity, ataxia, piloerection, lachrymation, excess salivation, and body tremors at doses 2500 mg/kg. Liver, kidney, and heart weights were also increased at this dose and histopathologic lesions were seen in the liver, kidneys, brain and urinary bladder. The no-observed-adverse effect level (NOAEL) for the study was 312 mg/kg (223 mg/kg/day) and the lowest-observed-adverse effect level (LOAEL) for the study was 625 mg/kg (446 mg/kg/day) .

Developmental/Reproductive Toxicity

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key: EXTREME HIGH MODERATE LOW

Exposures to high levels of toluene can result in adverse effects in the developing human foetus. Several studies have indicated that high levels of toluene can also adversely effect the developing offspring in laboratory animals.

Humans - Variable growth, microcephaly, CNS dysfunction, attentional deficits, minor craniofacial and limb abnormalities, and developmental delay were seen in three children exposed to toluene in utero as a result of maternal solvent abuse before and during pregnancy

Animals - Sternebral alterations, extra ribs, and missing tails were reported following treatment of rats with 1500 mg/m³ toluene 24 hours/day during days 9-14 of gestation. Two of the dams died during the exposure. Another group of rats received 1000 mg/m³ 8 hours/day during days 1-21 of gestation. No maternal deaths or toxicity occurred, however, minor skeletal retardation was present in the exposed fetuses. CFLP Mice were exposed to 500 or 1500 mg/m³ toluene continuously during days 6-13 of pregnancy. All dams died at the high dose during the first 24 hours of exposure, however none died at 500 mg/m³. Decreased foetal weight was reported, but there were no differences in the incidences of skeletal malformations or anomalies between the treated and control offspring.

Absorption - Studies in humans and animals have demonstrated that toluene is readily absorbed via the lungs and the gastrointestinal tract. Absorption through the skin is estimated at about 1% of that absorbed by the lungs when exposed to toluene vapor.

Dermal absorption is expected to be higher upon exposure to the liquid; however, exposure is limited by the rapid evaporation of toluene .

Distribution - In studies with mice exposed to radiolabeled toluene by inhalation, high levels of radioactivity were present in body fat, bone marrow, spinal nerves, spinal cord, and brain white matter. Lower levels of radioactivity were present in blood, kidney, and liver.

Accumulation of toluene has generally been found in adipose tissue, other tissues with high fat content, and in highly vascularised tissues .

Metabolism - The metabolites of inhaled or ingested toluene include benzyl alcohol resulting from the hydroxylation of the methyl group. Further oxidation results in the formation of benzaldehyde and benzoic acid. The latter is conjugated with glycine to yield hippuric acid or reacted with glucuronic acid to form benzoyl glucuronide. o-cresol and p-cresol formed by ring hydroxylation are considered minor metabolites

Excretion - Toluene is primarily (60-70%) excreted through the urine as hippuric acid. The excretion of benzoyl glucuronide accounts for 10-20%, and excretion of unchanged toluene through the lungs also accounts for 10-20%. Excretion of hippuric acid is usually complete within 24 hours after exposure.

CARCINOGEN

Sulfuric acid	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A2
STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID	US Environmental Defense Scorecard Recognized Carcinogens	Reference(s)	P65
STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	P65
Toluene	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
Toluene	US EPA Carcinogens Listing	Carcinogenicity	D
Toluene	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	D
Toluene	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4

REPROTOXIN

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

toluene	Canada - Ontario Occupational Exposure Limits - Skin	Notes	Skin
toluene	US AIHA Workplace Environmental Exposure Levels (WEELs) - Skin	Notes	Skin
toluene	Canada - Quebec Permissible Exposure Values for Airborne Contaminants - Skin (French)	Notes	Skin
toluene	Canada - British Columbia Occupational Exposure Limits - Skin	Notation	Skin
toluene	US - Hawaii Air Contaminant Limits - Skin Designation	Skin Designation	X
toluene	US - California Permissible Exposure Limits for Chemical Contaminants - Skin	Skin	X
toluene	US - California Permissible Exposure Limits for Chemical Contaminants - Skin	Skin	S
toluene	Canada - Alberta Occupational Exposure Limits - Skin	Substance Interaction	1

p-Toluenesulfonic acid monohydrate

sc-203343

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

SULFURIC ACID:

TOLUENE:

TOLUENE-4-SULFONIC ACID MONOHYDRATE:

■ DO NOT discharge into sewer or waterways.

SULFURIC ACID:

TOLUENE-4-SULFONIC ACID MONOHYDRATE:

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

TOLUENE-4-SULFONIC ACID MONOHYDRATE:

SULFURIC ACID:

■ Sulfuric acid is soluble in water and remains indefinitely in the environment as sulfate.

Large discharges may contribute to the acidification of water and be fatal to aquatic life and soil micro-organisms. Large discharges may also contribute to the acidification of effluent treatment systems and injure sewage treatment organisms.

In water, sulfuric acid dissociates, and the sulfate anion may combine with other cations. In soil, the ions from sulfuric acid can adsorb to soil particles or leach into surface water and groundwater. Sulfates can be taken up by plants and be incorporated into the parenchyma of the plant.

The ions (sulfate, hydrogen) can adsorb to soil particles or be converted to gases. Anaerobic bacteria in sediments and soil can reduce sulfate to sulfur and hydrogen sulfide.

Sulfates, including sulfuric acid, are removed from the air by both dry and wet deposition processes. Wet deposition processes including rain-out (a process that occurs within the clouds) and washout (removal by precipitation below the clouds) contribute to the removal of sulfate from the atmosphere. In the stratosphere, sulfuric acid aerosols have lifetimes of about 14 and 2.4 days at altitudes of 15 and 20 km, respectively. At cloud level, the residence time is about 6 days, with shorter residence times in surface air.

Sulfuric acid is soluble in water and remains indefinitely in the environment as sulfate.

Large discharges may contribute to the acidification of water and be fatal to aquatic life and soil micro-organisms.

Large discharges may contribute to the acidification of effluent treatment systems and injure sewage treatment organisms. [ICI UK]

TOLUENE:

■ Hazardous Air Pollutant:	Yes
■ Fish LC50 (96hr.) (mg/l):	7.3- 22.8
■ BCF<100:	13.2 (EELS)
■ log Kow (Sangster 1997):	2.73
■ log Pow (Verschueren 1983):	2.69
■ BOD5:	5%
■ COD:	21%
■ ThOD:	3.13
■ Half- life Soil - High (hours):	528
■ Half- life Soil - Low (hours):	96
■ Half- life Air - High (hours):	104
■ Half- life Air - Low (hours):	10
■ Half- life Surface water - High (hours):	528
■ Half- life Surface water - Low (hours):	96
■ Half- life Ground water - High (hours):	672
■ Half- life Ground water - Low (hours):	168
■ Aqueous biodegradation - Aerobic - High (hours):	528
■ Aqueous biodegradation - Aerobic - Low (hours):	96
■ Aqueous biodegradation - Anaerobic - High (hours):	5040
■ Aqueous biodegradation - Anaerobic - Low (hours):	1344
■ Aqueous biodegradation - Removal secondary treatment - High (hours):	75%
■ Photolysis maximum light absorption - High (nano- m):	268

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key:	EXTREME	HIGH	MODERATE	LOW
■ Photolysis maximum light absorption - Low (nano- m):				253.5
■ Photooxidation half- life water - High (hours):				1284
■ Photooxidation half- life water - Low (hours):				321
■ Photooxidation half- life air - High (hours):				104
■ Photooxidation half- life air - Low (hours):				10

■ For toluene:

log Kow : 2.1-3
 log Koc : 1.12-2.85
 Koc : 37-260
 log Kom : 1.39-2.89
 Half-life (hr) air : 2.4-104
 Half-life (hr) H2O surface water : 5.55-528
 Half-life (hr) H2O ground : 168-2628
 Half-life (hr) soil : <48-240
 Henry's Pa m3 /mol: 518-694
 Henry's atm m3 /mol: 5.94E-03
 BOD 5 0.86-2.12, 5%
 COD : 0.7-2.52,21-27%
 ThOD : 3.13
 BCF : 1.67-380
 log BCF : 0.22-3.28

Environmental fate:

Transport: The majority of toluene evaporates to the atmosphere from the water and soil. It is moderately retarded by adsorption to soils rich in organic material (Koc = 259), therefore, transport to ground water is dependent on the soil composition. In unsaturated topsoil containing organic material, it has been estimated that 97% of the toluene is adsorbed to the soil and only about 2% is in the soil-water phase and transported with flowing groundwater. There is little retardation in sandy soils and 2-13% of the toluene was estimated to migrate with flowing water; the remainder was volatilised, biodegraded, or unaccounted for. In saturated deep soils with no soil-air phase, about 48% may be transported with flowing groundwater.

Transformation/Persistence:

Air - The main degradation pathway for toluene in the atmosphere is reaction with photochemically produced hydroxyl radicals. The estimated atmospheric half life for toluene is about 13 hours. Toluene is also oxidised by reactions with atmospheric nitrogen dioxide, oxygen, and ozone, but these are minor degradation pathways. Photolysis is not considered a significant degradative pathway for toluene

Soil - In surface soil, volatilisation to air is an important fate process for toluene. Biodegradation of toluene has been demonstrated in the laboratory to occur with a half life of about 1 hour. In the environment, biodegradation of toluene to carbon dioxide occurs with a typical half life of 1-7 days.

Water - An important fate process for toluene is volatilization, the rate of which depends on the amount of turbulence in the surface water. The volatilisation of toluene from static water has a half life of 1-16 days, whereas from turbulent water the half life is 5-6 hours. Degradation of toluene in surface water occurs primarily by biodegradation with a half life of less than one day under favorable conditions (presence of microorganisms, microbial adaptation, and optimum temperature). Biodegradation also occurs in shallow groundwater and in salt water at a reduced rate). No data are available on anaerobic degradation of toluene in deep ground water conditions where aerobic degradation would be minimal.

Biota - Bioaccumulation in most organisms is limited by the metabolism of toluene into more polar compounds that have greater water solubility and a lower affinity for lipids. Bioaccumulation in the food chain is predicted to be low.

Ecotoxicity:

Toluene has moderate acute toxicity to aquatic organisms; several toxicity values are in the range of greater than 1 mg/L and 100 mg/L.

Fish LC50 (96 h): fathead minnow (*Pimephales promelas*) 12.6-72 mg/l; *Lepomis macrochirus* 13-24 mg/l;

guppy (*Poecilia reticulata*) 28.2-59.3 mg/l; channel catfish (*Ictalurus punctatus*) 240 mg/l; goldfish (*Carassius auratus*): 22.8-57.68 mg/l

Crustaceans LC50 (96 h): grass shrimp (*Palaemonetes pugio*) 9.5 ppm, crab larvae stage (*Cancer magister*) 28 ppm; shrimp (*Crangon franciscorum*) 4.3 ppm; daggerblade grass shrimp (*Palaemonetes pugio*) 9.5 mg/l

Algae EC50 (24 h): green algae (*Chlorella vulgaris*) 245 mg/l (growth); (72 h) green algae (*Selenastrum capricornutum*) 12.5 mg/l (growth).

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
toluene-4-sulfonic acid monohydrate	acid HIGH		LOW	HIGH
sulfuric acid			LOW	
toluene	LOW	MED	LOW	MED

Section 13 - DISPOSAL CONSIDERATIONS

p-Toluenesulfonic acid monohydrate

sc-203343

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

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 toluene 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 U220 (waste code T).

Disposal Instructions

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

↓

- 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.

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

Section 14 - TRANSPORTATION INFORMATION



DOT:

Symbols:	None	Hazard class or Division:	8
Identification Numbers:	UN2585	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:

Alkyl sulfonic acids, solid or Aryl sulfonic acids, solid with not more than 5 percent free sulfuric acid

Air Transport IATA:

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	None
UN/ID Number:	2585	Packing Group:	III
Special provisions:	None		

Shipping Name: ARYLSULPHONIC ACIDS, SOLID

Maritime Transport IMDG:

IMDG Class:	8	IMDG Subrisk:	None
UN Number:	2585	Packing Group:	III
EMS Number:	F-A,S-B	Special provisions:	None
Limited Quantities:	5 kg		

p-Toluenesulfonic acid monohydrate

sc-203343

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

Shipping Name: ALKYL SULPHONIC ACIDS, SOLID or ARYL SULPHONIC ACIDS, SOLID with not more than 5% free sulphuric acid

Section 15 - REGULATORY INFORMATION

toluene-4-sulfonic acid monohydrate (CAS: 6192-52-5) is found on the following regulatory lists;

"Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)", "OECD Representative List of High Production Volume (HPV) Chemicals", "US DOE Temporary Emergency Exposure Limits (TEELs)"

Regulations for ingredients

sulfuric acid (CAS: 7664-93-9) is found on the following regulatory lists;

"Canada - Alberta Ambient Air Quality Objectives", "Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Industrial Hazardous Substances", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Saskatchewan Occupational Health and Safety Regulations - Designated Chemical Substances", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Controlled Drugs and Substances Act Schedule VI", "Canada Domestic Substances List (DSL)", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada 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 Air Transport Association (IATA) Dangerous Goods Regulations", "International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals", "United Nations Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances - Table II", "United Nations List of Precursors and Chemicals Frequently used in the Illicit Manufacture of Narcotic Drugs and Psychotropic Substances Under International Control - Table II", "US - Alaska Limits for Air Contaminants", "US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELs)", "US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)", "US - California Permissible Exposure Limits for Chemical Contaminants", "US - California Proposition 65 - Priority List for the Development of NSRLs for Carcinogens", "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 - Maine Chemicals of High Concern List", "US - Massachusetts Oil & Hazardous Material List", "US - Michigan Exposure Limits for Air Contaminants", "US - Minnesota Hazardous Substance List", "US - Minnesota Permissible Exposure Limits (PELs)", "US - New Jersey Right to Know Hazardous Substances", "US - Oregon Permissible Exposure Limits (Z1)", "US - Pennsylvania - Hazardous Substance List", "US - Rhode Island Hazardous Substance List", "US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants", "US - Washington Permissible exposure limits of air contaminants", "US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants", "US ACGIH Threshold Limit Values (TLV)", "US ACGIH Threshold Limit Values (TLV) - Carcinogens", "US 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 Drug Enforcement Administration (DEA) List I and II Regulated Chemicals", "US EPA Acute Exposure Guideline Levels (AEGs) - Interim", "US EPA High Production Volume Chemicals Additional List", "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 Food Additive Database", "US List of Lists - Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide", "US SARA Section 302 Extremely Hazardous Substances", "US Toxic Substances Control Act (TSCA) - Inventory"

toluene (CAS: 108-88-3) is found on the following regulatory lists;

"Canada - Alberta Ambient Air Quality Objectives", "Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Industrial Hazardous Substances", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Controlled Drugs and Substances Act Schedule VI", "Canada Domestic Substances List (DSL)", "Canada Environmental Quality Guidelines (EQGs) Water: Aquatic life", "Canada Environmental Quality Guidelines (EQGs) Water: Community", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Priority Substances List (PSL1, PSL 2)", "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

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

requirements", "IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "OECD Representative List of High Production Volume (HPV) Chemicals", "United Nations List of Precursors and Chemicals Frequently used in the Illicit Manufacture of Narcotic Drugs and Psychotropic Substances Under International Control - Table II", "US - Alaska Limits for Air Contaminants", "US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELs)", "US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)", "US - California Proposition 65 - Maximum Allowable Dose Levels (MADLs) for Chemicals Causing Reproductive Toxicity", "US - California Proposition 65 - Reproductive Toxicity", "US - California Toxic Air Contaminant List Category II", "US - Connecticut Hazardous Air Pollutants", "US - Hawaii Air Contaminant Limits", "US - Idaho - Acceptable Maximum Peak Concentrations", "US - Idaho - Limits for Air Contaminants", "US - Maine Chemicals of High Concern List", "US - Massachusetts Oil & Hazardous Material List", "US - Michigan Exposure Limits for Air Contaminants", "US - Minnesota Hazardous Substance List", "US - Minnesota Permissible Exposure Limits (PELs)", "US - New Jersey Right to Know Hazardous Substances", "US - Oregon Permissible Exposure Limits (Z1)", "US - Oregon Permissible Exposure Limits (Z2)", "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 - Wyoming Toxic and Hazardous Substances Table Z-2 Acceptable ceiling concentration, Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift", "US ACGIH Threshold Limit Values (TLV)", "US ACGIH Threshold Limit Values (TLV) - Carcinogens", "US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)", "US CAA (Clean Air Act) - HON Rule - Organic HAPs (Hazardous Air Pollutants)", "US CERCLA Priority List of Hazardous Substances", "US Clean Air Act - Hazardous Air Pollutants", "US Cosmetic Ingredient Review (CIR) Cosmetic ingredients found safe as used", "US CWA (Clean Water Act) - List of Hazardous Substances", "US CWA (Clean Water Act) - Priority Pollutants", "US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances", "US CWA (Clean Water Act) - Toxic 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 DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes", "US Drug Enforcement Administration (DEA) List I and II Regulated Chemicals", "US EPA Acute Exposure Guideline Levels (AEGLs) - Interim", "US EPA Carcinogens Listing", "US EPA High Production Volume Program Chemical List", "US EPA Master Testing List - Index I Chemicals Listed", "US EPA National Priorities List - Superfund Chemical Data Matrix (SCDM) - Hazard Ranking System - Hazardous Substance Benchmarks", "US EPA Voluntary Children's Chemical Evaluation Program (VCCPE)", "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 30B Manufacture and Storage of Aerosol Products - Chemical Heat of Combustion", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US OSHA Permissible Exposure Levels (PELs) - Table Z2", "US RCRA (Resource Conservation & Recovery Act) - Appendix IX to Part 264 Ground-Water Monitoring List 1", "US RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261", "US RCRA (Resource Conservation & Recovery Act) - List of Hazardous Inorganic and Organic Constituents 1", "US RCRA (Resource Conservation & Recovery Act) - List of Hazardous Wastes", "US RCRA (Resource Conservation & Recovery Act) - Phase 4 LDR Rule - Universal Treatment Standards", "US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants", "US Toxic Substances Control Act (TSCA) - Inventory", "US TSCA Section 8 (d) - Health and Safety Data Reporting", "WHO Guidelines for Drinking-water Quality - Guideline values for chemicals that are of health significance in drinking-water"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Cumulative effects may result following exposure*.
- Possible respiratory sensitizer*.
- Possible cancer-causing agent following repeated inhalation*.
- Vapors potentially cause drowsiness and dizziness*.

* (limited evidence).

REPRODUCTIVE HEALTH GUIDELINES

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

Ingredient	ORG	UF	Endpoint	CR	Adeq TLV
toluene	9.6 mg/m3	10	D	NA	-

p-Toluenesulfonic acid monohydrate

sc-203343



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

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

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■ Classification of the mixture and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

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

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