

MATERIAL SAFETY DATA SHEET

SULPHURIC ACID 10 - 50 %

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Brenntag Canada Inc.
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WHMIS#: 00060800
Index: GCD3389/07D
Effective Date: 2007 November 02
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Website: <http://www.brenntag.ca>

EMERGENCY TELEPHONE NUMBERS (FOR EMERGENCIES INVOLVING CHEMICAL SPILLS OR RELEASE)

Toronto, ON (416) 226-6117
Edmonton, AB (780) 424-1754

Montreal, QC (514) 861-1211
Calgary, AB (403) 263-8660

Winnipeg, MB (204) 943-8827
Vancouver, BC (604) 685-5036

PRODUCT IDENTIFICATION

Product Name: Sulphuric Acid 10 - 50 %.
Chemical Name: Sulphuric Acid.
Synonyms: Oil of Vitriol; Hydrogen Sulphide; Battery Acid.
Chemical Family: Inorganic Acid.
Molecular Formula: H₂SO₄.
Product Use: Fertilizer. Dyestuff. Electrical Batteries. Pulp and paper industry. Chemical intermediate.

WHMIS Classification / Symbol:

D-1A: Very Toxic (acute effects)
E: Corrosive



READ THE ENTIRE MSDS FOR THE COMPLETE HAZARD EVALUATION OF THIS PRODUCT.

2. COMPOSITION, INFORMATION ON INGREDIENTS (Not Intended As Specifications)

<i>Ingredient</i>	<i>CAS#</i>	<i>ACGIH TLV</i>	<i>% Concentration</i>
Sulphuric acid	7664-93-9	0.2 mg/m ³ *A2	10 - 50

A2 = Suspected Human Carcinogen (ACGIH-A2).

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Corrosive! May be fatal if inhaled or swallowed. Toxic effects may be delayed. Causes severe skin and eye burns. Mists or sprays are extremely irritating to eyes and respiratory tract. Prolonged or repeated exposure may cause discoloration and erosion of teeth. See "Other Health Effects" Section. Reacts with water. Can decompose at high temperatures forming toxic gases. Contents may develop pressure on prolonged exposure to heat.

POTENTIAL HEALTH EFFECTS

Inhalation: Corrosive! Product may cause severe irritation of the nose, throat and respiratory tract. Repeated and/or prolonged exposures may cause productive cough, running nose, bronchopneumonia, pulmonary oedema (fluid build-up in lungs), and reduction of pulmonary function. Prolonged or repeated exposure may cause discoloration and erosion of teeth. See "Other Health Effects" Section.

Skin Contact:	Corrosive! Burns can occur if not promptly removed. Concentrated solutions may cause pain and deep and severe burns to the skin. Prolonged and repeated exposure to dilute solutions often causes irritation, redness, pain and drying and cracking of the skin. Toxic effects may be delayed. Avoid handling when the skin is moist, wet or abraded.
Skin Absorption:	Skin absorption is a secondary concern to the continual destruction of tissue while the product is in contact with the skin.
Eye Contact:	Extremely corrosive! This product causes corneal scarring and clouding. Glaucoma, cataracts and permanent blindness may occur.
Ingestion:	Corrosive! This product causes severe burning and pain in the mouth, throat and abdomen. Vomiting, diarrhea and perforation of the esophagus and stomach lining may occur. Prolonged or repeated exposure may cause discoloration and erosion of teeth.
Other Health Effects:	Corrosive effects on the skin and eyes may be delayed, and damage may occur without the sensation or onset of pain. Strict adherence to first aid measures following any exposure is essential. May cause liver damage, kidney damage and cardiovascular effects. Signs and symptoms of kidney damage generally progress from oliguria, to blood in the urine, to total renal failure. Liver damage is characterized by the loss of appetite, jaundice (yellowish skin colour), and occasional pain in the upper left-hand side of the abdomen.

4. FIRST AID MEASURES

FIRST AID PROCEDURES

Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Oxygen administration may be beneficial in this situation but should only be administered by personnel trained in its use. Obtain medical attention IMMEDIATELY.
Skin Contact:	Prompt removal of the material from the skin is essential. Remove all contaminated clothing and immediately wash the exposed areas with copious amounts of water for a minimum of 30 minutes or up to 60 minutes for critical body areas. Obtain medical attention IMMEDIATELY.
Eye Contact:	Immediately flush eyes with running water for a minimum of 30 minutes, preferably up to 60 minutes. Hold eyelids open during flushing. If irritation persists, repeat flushing. Do not transport victim until the recommended flushing period is completed unless flushing can be continued during transport.
Ingestion:	Do not attempt to give anything by mouth to an unconscious person. IMMEDIATELY contact local Poison Control Centre. If victim is alert and not convulsing, rinse mouth out and give 1 to 2 glasses of milk. Water may be used if milk is not available but it is not as effective. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more milk or water. IMMEDIATELY transport victim to an emergency facility.
Note to Physicians:	Do not attempt to neutralize the acid with weak bases since the exothermic reaction may extend the corrosive injury. Do not use buffering agents (e.g., antacids) they produce significant exothermic reactions without significantly altering the pH. Since reexposure of the mucosa to acid is harmful, be careful to avoid further vomiting and limit fluid to one to two glasses for an adult. (3) Due to the severely irritating or corrosive nature of the material, swallowing may lead to ulceration and inflammation of the upper alimentary tract with hemorrhage and fluid loss. Also, perforation of the esophagus or stomach may occur, leading to mediastinitis or peritonitis and the resultant complications. (3) Mucosal injury following ingestion of this corrosive material may contraindicate the induction of vomiting in the treatment of possible intoxication. Similarly, if gastric lavage is performed, intubation should be done with great care. If oral burns are present or a corrosive ingestion is suspected by the patient's history, perform esophagoscopy as soon as possible. Scope should not be passed beyond the first burn because of the risk of perforation. This product contains materials that may cause severe pneumonitis if aspirated. If ingestion has occurred less than 2 hours earlier, carry out careful gastric lavage; use endotracheal cuff if available, to prevent aspiration. Observe patient for respiratory difficulty from aspiration pneumonitis. Give artificial resuscitation and appropriate chemotherapy if respiration is depressed. Medical conditions that may be aggravated by exposure to this product include diseases of the skin, eyes or respiratory tract, preexisting liver and kidney disorders.

5. FIRE-FIGHTING MEASURES

Flashpoint (°C)	Autoignition Temperature (°C)	Flammability Limits in Air (%):	
		LEL	UEL
Non-combustible (does not burn).	Not applicable.	Not applicable.	Not applicable.
Flammability Class (WHMIS):	Not regulated.		
Hazardous Combustion Products:	Thermal decomposition products are toxic and may include oxides of sulphur and irritating gases.		
Unusual Fire or Explosion Hazards:	Avoid direct contact of this product with water as this can cause a violent exothermic reaction. Closed containers exposed to heat may explode. Reacts with most metals to produce hydrogen gas which could make an explosive mixture with air.		
Sensitivity to Mechanical Impact:	Not expected to be sensitive to mechanical impact.		
Rate of Burning:	Not available.		
Explosive Power:	Not available.		
Sensitivity to Static Discharge:	Not expected to be sensitive to static discharge.		
EXTINGUISHING MEDIA			
Fire Extinguishing Media:	Do not use water. Use media appropriate for surrounding fire and/or materials.		
FIRE FIGHTING INSTRUCTIONS			
Instructions to the Fire Fighters:	Fire-exposed containers should be kept cool by spraying with water to reduce pressure. Spilled acid may cause floors and contact surfaces to be come slippery.		
Fire Fighting Protective Equipment:	Use self-contained breathing apparatus and protective clothing. Protective clothing for skin and eye protection should be worn to protect against corrosive materials.		

6. ACCIDENTAL RELEASE MEASURES

Information in this section is for responding to spills, leaks or releases in order to prevent or minimize the adverse effects on persons, property and the environment. There may be specific reporting requirements associated with spills, leaks or releases, which change from region to region.

Containment and Clean-Up Procedures: In all cases of leak or spill contact vendor at Emergency Number shown on the front page of this MSDS. See Section 13, "Deactivating Chemicals". Wear protective clothing. Do not use combustible materials such as sawdust as an absorbent. Spilled acid may cause floors and contact surfaces to be come slippery. Collect product for recovery or disposal. For release to land, or storm water runoff, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Ventilate enclosed spaces. Notify applicable government authority if release is reportable or could adversely affect the environment.

7. HANDLING AND STORAGE

HANDLING

Handling Practices: Exposure to any mist or aerosol during the use of this product should be avoided and, in any case, keep exposures below the occupational exposure limit for Sulphuric Acid. (3) Do not store or transport with food or feed. Use normal "good" industrial hygiene and housekeeping practices. Containers exposed to heat may be under internal pressure. These should be cooled and carefully vented before opening. A face shield and apron should be worn. When diluting, add this material/product to water in small amounts to avoid splattering. Never add water to this material/product.

Ventilation Requirements: See Section 8, "Engineering Controls".

Other Precautions: Use only with adequate ventilation and avoid breathing aerosols (vapours or mists). Avoid contact with eyes, skin or clothing. Wash thoroughly with soap and water after handling. Wash contaminated clothing thoroughly before re-use.

Acid mist is most likely to be generated at the vents of process or storage tanks, especially during filling operations. The use of compressed air to force acids from delivery trucks is of special concern. Scrubbing the exhaust of these vents is highly recommended. Jurisdictional regulations should be consulted to determine required practices.

STORAGE

Storage Temperature (°C): See below.

Ventilation Requirements:	Ventilation should be corrosion proof.
Storage Requirements:	Store in a clean, cool well ventilated area, away from organic chemicals, strong bases, strong acids, metal powders, carbides, sulfides, and any readily oxidizable material. Protect from direct sunlight. Protect against physical damage. Avoid moisture contamination. Hygroscopic. Substances that readily absorb water are termed "Hygroscopic". Storage tanks should be in a contained area to control any spills or leaks. Storage area should be equipped with acid-resistant floors, sumps and should have controlled drainage to a recovery tank.
Special Materials to be Used for Packaging or Containers:	Materials of construction for storing the product include: carbon steel, stainless steel, plastics, polyethylene, nylon, Teflon, viton or ceramic. Equipment for storage, handling or transport should NOT be made from the following material, or, where applicable, its alloys: aluminum, copper, cast iron, CPVC, Epoxy, nylon, silicone, titanium and mild steel. Attacks some types of rubber, plastics and coatings. Reacts with most metals to produce hydrogen gas which could make an explosive mixture with air. Confirm suitability of any material before using. Storage tanks for sulphuric acid of 93% - 99% are usually fabricated from carbon steel. At normal temperatures there is some attack on the steel resulting in the evolution of hydrogen gas and the formation of iron sulphate, most of which settles to the bottom of the tank. Wall thickness should be carefully calculated to provide corrosion allowance for the high specific gravity of the acid. (3)

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Recommendations listed in this section indicate the type of equipment, which will provide protection against overexposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

ENGINEERING CONTROLS

Engineering Controls:	Local exhaust ventilation required. Ventilation should be corrosion proof. Make up air should be supplied to balance air that is removed by local or general exhaust ventilation. Ventilate low lying areas such as sumps or pits where dense vapours may collect. For personnel entry into confined spaces (i.e. bulk storage tanks) a proper procedure must be followed. It must include consideration of, among other things, ventilation, testing of tank atmosphere, provision and maintenance of SCBA, and emergency rescue. Use the "buddy" system. The second person should be in view and trained and equipped to execute a rescue. (4)
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PERSONAL PROTECTIVE EQUIPMENT (PPE)

Eye Protection:	Safety glasses with side shields are recommended to prevent eye contact. Use full face-shield and chemical safety goggles when there is potential for contact. Contact lenses should not be worn when working with this material.
Skin Protection:	Gloves and protective clothing made from butyl rubber, neoprene, PVC or viton should be impervious under conditions of use. Prior to use, user should confirm impermeability. Discard contaminated gloves.
Respiratory Protection:	No specific guidelines available. A NIOSH/MSHA-approved full facepiece air-purifying respirator equipped with acid gas, dust, mist, fume cartridges for concentrations up to 10 mg/m ³ Sulphuric Acid. Charcoal filters should not be used as they are not compatible with oxidizers. An air-supplied respirator if concentrations are higher or unknown. If while wearing a respiratory protection, you can smell, taste or otherwise detect anything unusual, or in the case of a full facepiece respirator you experience eye irritation, leave the area immediately. Check to make sure the respirator to face seal is still good. If it is, replace the filter, cartridge or canister. If the seal is no longer good, you may need a new respirator. (4) Sulphuric Acid : Immediately Dangerous to Life and Health (IDLH) value: 15 mg/m ³ . The purpose of establishing an IDLH value is to ensure that the worker can escape from a given contaminated environment in the event of failure of the most protective respiratory equipment. In the event of failure of respiratory protective equipment, every effort should be made to exit immediately. (4)
Other Personal Protective Equipment:	Wear an impermeable apron and boots. Locate safety shower and eyewash station close to chemical handling area. Take all precautions to avoid personal contact.

EXPOSURE GUIDELINES

SUBSTANCE	ACGIH TLV	OSHA PEL		NIOSH REL	
	(STEL)	(TWA)	(STEL)	(TWA)	(STEL)
Sulphuric acid	---	1 mg/m ³	---	1 mg/m ³	---

9. PHYSICAL AND CHEMICAL PROPERTIES (Not intended as Specifications)

Physical State:	Liquid.
Appearance:	Colourless to pale yellow, viscous liquid.
Odour:	Strong, pungent odour.
Odour Threshold (ppm):	0.2. (3)
Boiling Range (°C):	109 - 127. (3)
Melting/Freezing Point (°C):	-36 - 37. (3)
Vapour Pressure (mm Hg at 20° C):	0.52 - 4.60. (3)
Vapour Density (Air = 1.0):	3.4. (4)
Relative Density (g/cc):	1.21 - 1.38. (3)
Bulk Density:	1 210 - 1 380 kg/m3.
Viscosity:	25 cPs (25°C). (4)
Evaporation Rate (Butyl Acetate = 1.0):	Not available.
Solubility:	Soluble in water, ethanol, acetone, chloroform, diethyl ether and benzene.
% Volatile by Volume:	Not available.
pH:	0.3. (3)
Coefficient of Water/Oil Distribution:	Not available.
Volatile Organic Compounds (VOC):	Not applicable.

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY

Under Normal Conditions:	Stable.
Under Fire Conditions:	Not flammable.
Hazardous Polymerization:	Will not occur.
Conditions to Avoid:	High temperatures, sparks, open flames and all other sources of ignition. Avoid contact with water. Do not store in humid places. Hygroscopic. Substances that readily absorb water are termed "Hygroscopic".
Materials to Avoid:	Violently reactive with: Sodium Chlorite. Reducing agents. Strong bases. Combustibles. Metals. Alkali metals and their hydroxides. Organic materials. Aluminum and its alloys. Copper and its alloys. Cast Iron. Mild steel. Titanium. Attacks some types of rubber, plastics and coatings. Reacts with most metals to produce hydrogen gas which could make an explosive mixture with air.
Decomposition or Combustion Products:	Thermal decomposition products are toxic and may include oxides of sulphur and irritating gases.

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL DATA:

SUBSTANCE	LD50 (Oral, Rat)	LD50 (Dermal, Rabbit)	LC50 (Inhalation, Rat, 4h)
Sulphuric acid	2,140 mg/kg (1)	---	255 mg/m ³ (1)

Carcinogenicity Data: Although no direct link has been established between exposure to Sulphuric Acid, itself, and cancer in man, the World Health Organization (WHO) and International Agency for Research on Cancer (IARC) have concluded that occupational exposure to strong inorganic acid mists containing Sulphuric Acid is carcinogenic to man, causing cancer of the larynx (the voice box) and, to a lesser extent, the lung. Exposure to any mist or aerosol during the use of this product should be avoided and, in any case, keep exposures below the occupational exposure limit for Sulphuric Acid. (3)

Sulphuric Acid as aerosol or mist is classified as a suspected carcinogen by ACGIH (American Conference of Governmental Industrial Hygienists) and IARC.

Reproductive Data: No adverse reproductive effects are anticipated.

Mutagenicity Data: There were no mutagenicity studies specific for Sulphuric Acid. However, there are established effects of reduced pH in mutagenicity testing, as would be caused by Sulphuric Acid. These effects are an artifact of low pH and are not necessarily due to biological effects of Sulphuric Acid itself. (4)

Teratogenicity Data:	Sulphuric Acid was not teratogenic in mice or rabbits, but was slightly embryotoxic in rabbits (a minor rare skeletal variation). The animals were exposed to 5 and 20 mg/M3 (1.6 and 2.4 um respectfully) for 7 hours/day throughout pregnancy. Slight maternal toxicity was present at the highest dose in both species. (4)
Respiratory / Skin Sensitization Data:	None known.
Synergistic Materials:	None known.
Other Studies Relevant to Material:	<p>Human volunteers exposed for 5 - 15 minutes noticed no odour or irritation at concentrations of Sulphuric Acid below 1 mg/M3. At concentrations of 3 mg/M3 and 5 mg/M3 the exposure was found to be objectionable. A deep breath usually produced coughing and there were respiratory changes. In another study, volunteers with high exposures (39 mg/M3 dry mists and 21 mg/M3 wet mist) for 30 to 60 minutes experienced severe symptoms of irritation of the upper airways and signs of bronchial obstruction. These symptoms persisted for several days in two volunteers. A worker overcome by Sulphuric Acid fumes while working in a closed space experienced injury to the upper airways, fluid accumulation and bleeding in the lungs. At a six week follow-up, most lung function tests were normal. (4)</p> <p>Exposure to high concentrations (reported up to 16 mg/M3) caused dental erosion. Etching of the teeth may occur after a few weeks exposure, progressing to erosion after a few months exposure. Dental etching and erosion occurred about 4 times as frequently in a high exposure group (over 0.3 mg/M3) compared to a low exposure group (0.07 mg/M3). (4)</p> <p>Application of a 1 % solution caused tissue death (necrosis) in the eye. Application of a 5 % solution, rinsed with water, caused clouding of the cornea and irritation which cleared within 7 days; a 10 % solution caused severe irritation and damage which persisted to day 7. (4)</p> <p>Low concentrations of aerosols have produced changes in lung function. There is species variation in sensitivity with guinea pigs being the most sensitive, then rats and mice, with rabbits the most resistant. The aerosol toxicity was dependent on particle size. (4)</p> <p>No harmful changes were observed in rats following one week exposure to concentrations of Sulphuric Acid up to 100 mg/M3, while 30 mg/M3 caused fatal accumulation of fluid in the lungs of guinea pigs. The animals that died probably suffocated following laryngeal spasm. The lowest concentration at which guinea pigs showed increased airway resistance was 0.1 mg/M3. There were no cardiovascular effects in dogs exposed briefly to 8 mg/M3 or to 4 mg/M3 for 4 hours. (4)</p> <p>Chronic exposure to low concentrations by inhalation have produced changes in respiratory tissues and in measures of lung function. (4)</p> <p>In 3 studies, guinea pigs were exposed to Sulphuric Acid concentrations ranging from 0.1 to 26.5 mg/M3 and particle sizes that range from fine to coarse for periods of 18 to 140 days. Intermittent exposure produced only minimal lung changes while continuous exposures at lower concentrations (4 mg/M3) caused more extensive damage. Changes were most marked for exposures with particle size of 0.9 um. No effects were seen at the lowest concentration (0.1 mg/M3). (4)</p> <p>Monkeys were continuously exposed for 78 weeks to two different concentrations of Sulphuric Acid and two different particle sizes. Effects on pulmonary function and respiratory cells were seen at 4.79 mg/M3 (particle size of 0.73 um). At 0.48 mg/M3 (0.54 um) and 0.38 mg/M3 (2.15 um), only minimal effects were noted. In a guinea pig study, there were no effects following continuous exposure to 0.1 and 0.08 mg/M3 for 52 weeks. (4)</p> <p>Factors such as mucociliary clearance, alveolar defense mechanisms, cellular changes and lung function have been evaluated in many studies. While changes in these parameters have been demonstrated, it is not clear whether they relate to chronic lung disease. (4)</p>

12. ECOLOGICAL INFORMATION

Ecotoxicity:	Harmful to aquatic life at low concentrations. Toxicity is primarily associated with pH. Acidic soil conditions can develop with product present. Higher than normal toxic heavy metal concentrations can then occur in ground and surface waters.
	Sulphuric Acid:
	Fish toxicity: 24-hour TLm = 24.5 mg/L (Bluegill) (4)
	Fish toxicity: 48-hour TLm = 42 mg/L (Mosquito Fish) (4)
	Fish toxicity: 48-hour TLm = 49 mg/L (Bluegill) (4)
	48-hour LC50 (Flounder) = 100 - 300 mg/L (4)

Environmental Fate: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers. This product does not bioaccumulate in aquatic or terrestrial food chains.

Sulphuric Acid will ultimately react with calcium and magnesium in water to form Sulphate salts. Sulphuric Acid has led to increased weathering from soils and rocks so that the calcium ion rises in concentration in waters above pH 6 and also in those below pH 5. (4)

13. DISPOSAL CONSIDERATIONS

Deactivating Chemicals: Neutralize carefully with soda ash or sodium bicarbonate to a pH of 6 to 9. Check for a neutral pH using pH paper. Neutralization is expected to be exothermic. Vigorous effervescence results.

Waste Disposal Methods: Dispose of waste material at an approved (hazardous) waste treatment/disposal facility in accordance with applicable local, provincial and federal regulations. Do not dispose of waste with normal garbage, or to sewer systems. Reevaluation of the product may be required by the user at the time of disposal since the product uses, transformations, mixtures and processes may influence waste classification.

Safe Handling of Residues: See "Waste Disposal Methods".

Disposal of Packaging: Empty containers retain product residue (liquid and/or vapour) and can be dangerous. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. Do not expose such containers to heat, flame, sparks, static electricity, or other sources of ignition; they may explode and cause injury or death. Do not dispose of package until thoroughly washed out.

14. TRANSPORTATION INFORMATION

CANADIAN TDG ACT SHIPPING DESCRIPTION:

SULPHURIC ACID, Class 8, UN2796, PG II.
Label(s): Corrosives. Placard: Corrosives.
ERAP Index: -----, Exemptions: None known.
Do not store or transport with food or feed.

US DOT CLASSIFICATION (49CFR 172.101, 172.102):

SULPHURIC ACID, Class 8, UN2796, PG II.
Label(s): Corrosive. Placard: Corrosive.
CERCLA-RQ: 1 000 lb / 454 kg. Exemptions: Not available.
Do not store or transport with food or feed.

15. REGULATORY INFORMATION

CANADA

CEPA - NSNR: All constituents of this product are included on the DSL.
CEPA - NPRI: Sulphuric Acid.
Controlled Products Regulations Classification (WHMIS):
D-1A: Very Toxic (acute effects)
E: Corrosive

USA

Environmental Protection Act: All constituents of this product are included on the TSCA inventory.
OSHA HCS (29CFR 1910.1200): Highly Toxic, Corrosive.
NFPA: 3 Health, 0 Fire, 2 Reactivity (3)
HMIS: 3 Health, 0 Fire, 2 Reactivity (3)

INTERNATIONAL

The following component or components of this product appear on the European Inventory of Existing Commercial Chemical Substances: Sulphuric Acid.

16. OTHER INFORMATION

ADDITIONAL INFORMATION

The Baume Scale:

% H2SO4	Specific Gravity at 15.6 Degrees Celcius	Degrees Baume (3)
10.77	1.0741	10
11.89	1.0821	11
13.01	1.0902	12
14.13	1.0985	13
15.25	1.1069	14
16.38	1.1154	15
17.53	1.1240	16
18.71	1.1328	17
19.89	1.1417	18
21.07	1.1508	19
22.25	1.1600	20
23.43	1.1694	21
24.61	1.1789	22
25.81	1.1885	23
27.03	1.1983	24
28.22	1.2083	25
29.53	1.2185	26
30.79	1.2288	27
34.63	1.2609	30
41.27	1.3182	35
48.10	1.3810	40
49.47	1.3942	41
50.87	1.4087	42
52.26	1.4216	43
53.66	1.4356	44
56.48	1.4646	45
59.32	1.4948	48
60.75	1.5104	49
62.18	1.5263	50
65.13	1.5591	52
68.13	1.5934	54
71.17	1.6292	56
74.36	1.6667	58
77.67	1.7059	60
90.60	1.8239	65.5
93.00	1.8347	65.97
94.00	1.8381	66.1
98.00	1.8437	Not listed.

REFERENCES

1. RTECS-Registry of Toxic Effects of Chemical Substances, Canadian Centre for Occupational Health and Safety RTECS database.
2. Clayton, G.D. and Clayton, F.E., Eds., Patty's Industrial Hygiene and Toxicology, 3rd ed., Vol. IIA,B,C, John Wiley and Sons, New York, 1981.
3. Supplier's Material Safety Data Sheet(s).
4. CHEMINFO, through "CCINFOdisc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada.
5. Guide to Occupational Exposure Values, 2005, American Conference of Governmental Industrial Hygienists, Cincinnati, 2005.
6. Regulatory Affairs Group, Brenntag Canada Inc.
7. The British Columbia Drug and Poison Information Centre, Poison Managements Manual, Canadian Pharmaceutical Association, Ottawa, 1981.
8. NFPA 325M Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids, 1994 Edition, Quincy, MA, 1994.

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To obtain revised copies of this or other Material Safety Data Sheets, contact your nearest Brenntag Canada Regional office.

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