

area if it can be done without risk. Cool containers with water spray until well after the fire is out. Do not get water directly on material. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

FLASH POINT: none

AUTOIGNITION: none

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Avoid contact with combustible materials. Do not touch spilled material. Do not get water inside container. Stop leak if possible without personal risk. Reduce vapors with water spray. Do not get water directly on material. Only personnel trained for the hazards of this material should perform clean up and disposal. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Avoid contact with water or moisture. NFPA 430 Code for the Storage of Liquid and Solid Oxidizing Materials. Notify State Emergency Response Commission for storage or use at amounts greater than or equal to the TPQ (U.S. EPA SARA Section 302). SARA Section 303 requires facilities storing a material with a TPQ to participate in local emergency response planning (U.S. EPA 40 CFR 355.30). Store with acids. See original container for storage recommendations. Keep separated from incompatible substances.

HANDLING: Handle as a corrosive liquid. When mixing, slowly add to water to minimize heat generation and spattering. Keep emergency spill kit near storage and use areas.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

SULFURIC ACID:

1 mg/m³ OSHA TWA

0.2 mg/m³ ACGIH TWA (thoracic particulate)

3 mg/m³ ACGIH STEL

1 mg/m³ NIOSH recommended TWA 10 hour(s)

0.1 mg/m³ DFG MAK (peak limitation category - I, with excursion factor of 1) (momentary value - 0.2 mg/m³) (inhalable dust fraction)

UK OES (Chemical Hazard Alert Notice issued) (OES has been withdrawn)

MEASUREMENT METHOD: Silica gel tube (with special coating); Sodium bicarbonate/Sodium carbonate; Ion chromatography; NIOSH IV # 7903, Inorganic Acids

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use.
Any chemical cartridge respirator with acid gas cartridge(s).
Any chemical cartridge respirator with a full facepiece and acid gas cartridge(s).
Any air-purifying respirator with a full facepiece and an acid gas canister.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid

APPEARANCE: clear

COLOR: colorless

TEXTURE: viscous

ODOR: Not available

BOILING POINT: Not available

FREEZING POINT: Not available

VAPOR PRESSURE: Not available

VAPOR DENSITY (air=1): <0.3 @ 25 C
SPECIFIC GRAVITY (water=1): 1.840
WATER SOLUBILITY: miscible
PH: <3 (SULFURIC ACID)
VOLATILITY: Not available
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not available
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

10. STABILITY AND REACTIVITY

REACTIVITY: May react with evolution of heat on contact with water.

CONDITIONS TO AVOID: Avoid contact with combustible materials. Keep dry.

Dangerous gases may accumulate in confined spaces. Keep out of water supplies and sewers.

INCOMPATIBILITIES: acids, amines, bases, combustible materials, halogenated compounds, metals, metal carbide, metal salts, oxidizing materials, peroxides, reducing agents

SULFURIC ACID:

ACETALDEHYDE: Violently polymerized by concentrated acid.
ACETIC ANHYDRIDE: Temperature and pressure increase in closed container.
ACETONE + NITRIC ACID: Violent decomposition.
ACETONE + POTASSIUM DICHROMATE: Ignition.
ACETONE CYANHYDRIN: Pressure increase with possible explosive rupture of vessel.
ACETONITRILE: Violent exotherm on heating; sulfur trioxide reduces initiation temperature.
ACROLEIN: Temperature and pressure increase in closed container.
ACRYLONITRILE: Vigorous exothermic polymerization.
ALCOHOL: Exothermic reaction and contraction of volume.
ALCOHOLS AND HYDROGEN PEROXIDE: Possible explosion.
ALLYL ALCOHOL: Temperature and pressure increase in closed container.
ALLYL CHLORIDE: Violent polymerization.
ALKYL NITRATES: May cause violent reaction.
2-AMINOETHANOL: Temperature and pressure increase in closed container.
AMMONIUM HYDROXIDE: Temperature and pressure increase in closed container.
AMMONIUM IRON(III) SULFATE DODECAHYDRATE: Violent, exothermic reaction on heating.
AMMONIUM TRIPERCHROMATE: Fire or explosion hazard.
ANILINE: Temperature and pressure increase in closed container.
BASES: Violent reaction.
BENZYL ALCOHOL: May decomposes explosively at about 180 C.
BROMATES + METALS: Possible ignition.
BROMINE PENTAFLUORIDE: Violent reaction with possible ignition.
TERT-BUTYL-M-XYLENE: Violent exothermic reaction without agitation.
N-BUTYRALDEHYDE: Temperature and pressure increase in closed container.
CARBIDES: Hazardous mixture.
CESIUM ACETYLIDE: Ignition on contact.
1-CHLORO-2,3-EPOXYPROPANE: Violent interaction.
4-CHLORONITROBENZENE AND SULFUR TRIOXIDE: Possible explosive reaction.
CHLORATES: All chlorates, when brought in contact with sulfuric acid may give off explosive chlorine dioxide gas. A violent explosion is usual.
CHLORATES + METALS: Possible ignition.
CHLORINE TRIFLUORIDE: Violent reaction.
CHLOROSULFONIC ACID: Temperature and pressure increase in closed container.
CHROMATES: Fire and explosion hazard.
COATINGS: Attacked.
COMBUSTIBLE MATERIALS (FINELY DIVIDED): May ignite.
COPPER: Evolution of sulfur dioxide.
CUPROUS NITRIDE: Violent reaction.
2-CYANO-4-NITROBENZENEDIAZONIUM HYDROGEN SULFATE: Exothermic reaction.
2-CYANO-2-PROPANOL: Violent reaction with increase in pressure.
CYCLOPENTADIENE: Violent or explosive reaction.
CYCLOPENTANONE OXIME: Violent reaction.
1,3-DIAZIDOBENZENE: Ignition followed by explosive reaction.
DIETHYLAMINE: Exothermic reaction.
DIISOBUTYLENE: Temperature and pressure increase in closed container.
DIMETHYLBENZYL CARBINOL + HYDROGEN PEROXIDE: Explodes.
DIMETHOXYANTHRAQUINONE: Exothermic reaction above 150 C.
4-DIMETHYLAMINOBENZALDEHYDE: Exothermic reaction.
2,5-DINITRO-3-METHYLBENZOIC ACID + SODIUM AZIDE: Explosive reaction.
1,5-DINITRONAPHTHALENE + SULFUR: Exothermic reaction.
EPICHLOROHYDRIN: Violent reaction.
ETHOXYLATED NONYLPHENOL: Possible ignition.
ETHANOL + HYDROGEN PEROXIDE: Possible explosion.

ETHYLENE CYANOHYDRIN: Violent reaction.
ETHYLENE DIAMINE: Temperature and pressure increase in closed container.
ETHYLENE GLYCOL: Temperature and pressure increase in closed container.
ETHYLENIMINE: Temperature and pressure increase in closed container.
FULMINATES: Extremely hazardous mixture.
HEXALITHIUM DISILICIDE: Incandescent reaction.
HYDROCHLORIC ACID: Temperature and pressure increase in closed container.
HYDROGEN PEROXIDE (>50%): Explosive reaction after evaporation.
HYDROFLUORIC ACID: Temperature and pressure increase in closed container.
INDANE + NITRIC ACID: Possible explosion.
IODINE HEPTAFLUORIDE: The acid becomes effervescent.
IRON: Possible explosion due to hydrogen gas from the acid-metal reaction.
ISOPRENE: Temperature and pressure increase in closed container.
LITHIUM SILICIDE: Incandescent reaction.
MERCURY NITRIDE: Explosion on contact.
MESITYL OXIDE: Temperature and pressure increase in closed container.
METALS: May liberate flammable hydrogen gas.
METALS (POWDERED): Extremely hazardous mixture.
METAL ACETYLIDES: Ignition reaction.
METAL CHLORATES: Violent explosion unless properly cooled.
METAL PERCHLORATES: Formation of explosive perchloric acid.
4-METHYLPYRIDINE: Exothermic reaction.
NITRAMIDE: May decompose explosively on contact.
NITRATES: Incompatible.
NITRIC ACID + GLYCERIDES: Explosion.
NITRIC ACID + ORGANIC MATERIAL: May cause violent reaction.
NITRIC ACID + TOLUENE: Possible violent reaction or explosion.
NITROARYL BASES AND DERIVATIVES: May cause violent reaction or explosion.
NITROBENZENE: Exothermic reaction at elevated temperatures.
3-NITROBENZENESULFONIC ACID: Exothermic reaction.
NITROMETHANE: Formation of explosive mixture.
N-NITROMETHYLAMINE: Explosive decomposition.
4-NITROTOLUENE: Explosive at 80 C.
ORGANICS: Violent exothermic reaction.
PENTASILVER TRIHYDROXYDIAMIDOPHOSPHATE: Explosion on contact.
PERCHLORATES: Possible explosion.
PERCHLORIC ACID: Formation of dangerous anhydrous perchloric acid.
PERMANGANATES: Formation of permanganic acid.
PERMANGANATES + BENZENE: Possible explosion.
1-PHENYL-2-METHYL-PROPYL ALCOHOL + HYDROGEN PEROXIDE: Possible explosion.
PHOSPHORUS (WHITE OR YELLOW): Ignition in contact with boiling acid.
PHOSPHORUS ISOCYANATE: Violent reaction.
PHOSPHORUS TRIOXIDE: Violent oxidation with possible ignition.
PICRATES: Extremely hazardous mixture.
PLASTICS: Attacked.
POLYSILOYLENE: Explosion on contact.
POTASSIUM: Explosive interaction.
POTASSIUM TERT-BUTOXIDE: Ignition.
POTASSIUM CHLORATE: Possible fire and explosion.
POTASSIUM PERMANGANATE: Possible explosion in the presence of moisture.
POTASSIUM PERMANGANATE + POTASSIUM CHLORIDE: Violent explosion.
PROPIOLACTONE (BETA): Temperature and pressure increase in closed container.
PROPYLENE OXIDE: Temperature and pressure increase in closed container.
3-PROPYNOL: Possible explosion unless adequately cooled.
PYRIDINE: Temperature and pressure increase in closed container.
REDUCING AGENTS: Reacts.
RUBBER: Attacked.
RUBIDIUM ACETYLIDE: Ignition on contact.
SILVER PERMANGANATE (MOIST): Explosive reaction.
SILVER PEROXOCHROMATE: Explosive reaction.
SODIUM: Explosive reaction with aqueous acid.
SODIUM CARBONATE: Violent reaction.
SODIUM CHLORATE: Possible fire or explosion.
SODIUM HYDROXIDE: Temperature and pressure increase in closed container.
SODIUM TETRAHYDROBORATE: Violent, exothermic reaction.
SODIUM THIOCYANATE: Violent exothermic with evolution of carbonyl sulfide.
STEEL: Possible explosion due to hydrogen gas from the acid-metal reaction.
STYRENE MONOMER: Temperature and pressure increase in closed container.
SUCROSE: Formation of carbon monoxide.
TETRAMETHYLBENZENES: Violent reaction in closed containers.
1,2,4,5-TETRAZINE: Violent decomposition on contact.
THALLIUM(I) AZIDIDITHIOCARBONATE: May explode on contact.
1,3,5-TRINITROSOHEXAHYDRO-1,3,5-TRIAZINE: Explosive decomposition on contact.
VINYL ACETATE: Temperature and pressure increase in closed container.
ZINC CHLORATE: Likely to cause fires and explosions.
ZINC IODIDE: Violent interaction.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: oxides of sulfur

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

SULFURIC ACID:

IRRITATION DATA:

250 ug eyes-rabbit severe; 5 mg/30 second(s) rinsed eyes-rabbit severe

TOXICITY DATA:

135 mg/kg oral-man LDLo; 3 mg/m³/24 week(s) inhalation-human TCLO; 1 mg/m³/3 hour(s) inhalation-human TCLO; 135 mg/kg unreported-man LDLo; 2140 mg/kg oral-rat LD50; 510 mg/m³/2 hour(s) inhalation-rat LC50; 320 mg/m³/2 hour(s) inhalation-mouse LC50; 18 mg/m³ inhalation-guinea pig LC50; 320 mg/m³ inhalation-mouse LC50; 510 mg/m³ inhalation-rat LC50; 65 mg/m³/30 minute(s) inhalation-guinea pig LCLo; 461 mg/m³/7 hour(s) inhalation-mouse LCLo; 461 mg/m³/7 hour(s) inhalation-rat LCLo; 461 mg/m³/7 hour(s) inhalation-rabbit LCLo; 461 mg/m³/7 hour(s) inhalation-cat LCLo; 18 mg/m³/8 hour(s) inhalation-guinea pig LC50; 8 mg/m³/5 day(s) inhalation-guinea pig TCLO; 0.6 mg/m³ inhalation-human TCLO; 0.73 mg/m³ inhalation-human TCLO; 0.63 mg/m³ inhalation-human TCLO; 3 mg/m³/5 minute(s) inhalation-human TCLO; 784 ug/m³/24 hour(s)-84 day(s) continuous inhalation-rat TCLO; 900 ug/m³/21 hour(s)-89 week(s) intermittent inhalation-dog TCLO; 2 mg/m³/23 hour(s)-78 week(s) intermittent inhalation-monkey TCLO; 30 mg/m³/7 day(s) continuous inhalation-guinea pig TCLO; 1.8 mg/m³/24 hour(s)-65 day(s) continuous inhalation-rat TCLO; 4 mg/m³/24 hour(s)-18 day(s) continuous inhalation-guinea pig TCLO; 2.4 mg/m³/24 hour(s)-78 week(s) continuous inhalation-monkey TCLO; 0.1 mg/m³/5 day(s)-26 week(s) intermittent inhalation-horse, donkey TCLO; 0.9 mg/m³/21 hour(s)-620 day(s) intermittent inhalation-dog TCLO; 2.4 mg/m³/24 hour(s)-78 week(s) continuous inhalation-monkey TCLO

CARCINOGEN STATUS: Sulfuric acid has not been specifically evaluated by IARC. However, strong inorganic acid mists have been evaluated as IARC Group 1 (Human Sufficient Evidence). Exposure to strong inorganic acid mists containing sulfuric acid has produced an excess risk of nasal sinus, laryngeal, and lung cancer.

LOCAL EFFECTS:

Corrosive: inhalation, skin, eye, ingestion

ACUTE TOXICITY LEVEL:

Highly Toxic: inhalation

Moderately Toxic: ingestion

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory disorders, skin disorders

MUTAGENIC DATA:

cytogenetic analysis - hamster ovary 4 mmol/L

REPRODUCTIVE EFFECTS DATA:

20 mg/m³ inhalation-rabbit TCLO/7 hour(s) 6-18 day(s) pregnant female continuous

HEALTH EFFECTS:

INHALATION:

ACUTE EXPOSURE:

SULFURIC ACID: Inhalation of mists may cause mucous membrane irritation principally affecting the respiratory tract epithelium. Low concentrations, 0.35-5 mg/m³, may cause increased pulmonary air flow resistance and subsequent shallower and more rapid breathing. Hot concentrated mists may cause rapid loss of consciousness with possible damage to lung tissue. Vapors may cause nasal secretions, sneezing, a burning or tickling sensation in the nose and throat and retrosternal region, followed by cough, respiratory distress, tracheobronchitis, chemical pneumonitis and possible spasm of the vocal cords. High concentrations may produce bloody nasal secretions and sputum, hematemesis gastritis, and pulmonary edema. A single overexposure may lead to laryngeal, tracheobronchial and pulmonary edema. One individual sprayed in the face with sulfuric acid liquid experienced delayed symptoms of pulmonary fibrosis, residual bronchitis, and pulmonary emphysema. Vapors from dilute solutions may irritate mucous membranes.

CHRONIC EXPOSURE:

SULFURIC ACID: Repeated exposure to the mist may cause inflammation of the upper respiratory tract, chronic bronchitis and etching of the dental enamel. The central and lateral incisors are primarily affected. Repeated excessive exposure over long periods of time have resulted in bronchitic symptoms, rhinorrhea, frequent respiratory tract infections, emphysema, stomatitis and digestive disturbances. Chronic inhalation may cause alkaline depletion of the body producing an acidosis which affects the nervous system and produces agitation, hesitant gait and generalized weakness. An epidemiological study of workers at a refinery and chemical plant suggests an increased risk of laryngeal cancer from exposure to high

concentrations of sulfuric acid. Reproductive effects have been reported in animals.

SKIN CONTACT:

ACUTE EXPOSURE:

SULFURIC ACID: Contact with concentrated sulfuric acid may cause severe second and third degree skin burns with necrosis due to its affinity for water and subsequent severe dehydrating action, and its exothermic reaction with moisture. Possible charring may occur leading to shock and collapse depending on the amount of tissue involved. The resulting wounds may be long in healing and may cause extensive scarring that may result in functional inhibition. Contact with dilute solutions may cause skin irritation.

CHRONIC EXPOSURE:

SULFURIC ACID: Repeated contact with low concentrations may cause skin desiccation and ulceration of the hands, and paronychia or chronic purulent inflammation around the nails. Repeated contact with dilute solutions may cause dermatitis.

EYE CONTACT:

ACUTE EXPOSURE:

SULFURIC ACID: Exposure to the vapors may cause a burning or stinging sensation in the eyes with lacrimation, blurred vision and conjunctival congestion. Splashes of acid in the eyes may produce deep corneal ulceration, kerato-conjunctivitis and palpebral lesions with severe sequelae. Irreparable corneal damage and blindness as well as scarring of the eyelids may occur. Severe sulfuric acid eye burns have included glaucoma and cataract as complications in the most severe cases. Contact with diluted acid may produce more transient effects from which recovery may be complete.

CHRONIC EXPOSURE:

SULFURIC ACID: Repeated exposure may result in lacrimation and chronic conjunctivitis.

INGESTION:

ACUTE EXPOSURE:

SULFURIC ACID: Ingestion may cause burning pain in the mouth, throat, esophagus and abdomen, a sour taste and nausea followed by vomiting and diarrhea of charred black stomach contents. Dehydration and carbonization of tissue may occur with eschars on the lips and mouth. Brownish or yellowish stains may be found around the mouth, intense thirst, difficult swallowing, acidemia, stomatitis, rapid and weak pulse, shallow breathing, shock and possible convulsions and death may occur. Albumin, blood and casts in urine, anuria, esophageal and delayed gastric stenosis has been reported. Possible perforation of the gastrointestinal tract may result in peritonitis.

CHRONIC EXPOSURE:

SULFURIC ACID: No data available.

12. ECOLOGICAL INFORMATION

Not available

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D002.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Sulfuric acid mixture
ID NUMBER: UN1830
HAZARD CLASS OR DIVISION: 8
PACKING GROUP: II
LABELING REQUIREMENTS: 8

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Sulfuric acid mixture
UN NUMBER: UN1830
CLASS: 8
PACKING GROUP/RISK GROUP: II

LAND TRANSPORT ADR:

PROPER SHIPPING NAME: Sulphuric acid mixture
UN NUMBER: UN1830
CLASS: 8
CLASSIFICATION CODE: C1
PACKING GROUP: II
LABELS: 8

LAND TRANSPORT RID:

PROPER SHIPPING NAME: Sulphuric acid mixture
UN NUMBER: UN1830
CLASS: 8
CLASSIFICATION CODE: C1
PACKING GROUP: II
LABELS: 8

AIR TRANSPORT IATA:

PROPER SHIPPING NAME: Sulphuric acid mixture
UN/ID NUMBER: UN1830
CLASS OR DIVISION: 8
HAZARD LABELS: 8
PACKING GROUP: II

AIR TRANSPORT ICAO:

PROPER SHIPPING NAME: Sulphuric acid mixture
UN NUMBER: UN1830
CLASS OR DIVISION: 8
LABELS: 8
UN PACKING GROUP: II

MARITIME TRANSPORT IMDG:

PROPER SHIPPING NAME: Sulphuric acid mixture
UN NUMBER: UN1830
CLASS OR DIVISION: 8
PACKING GROUP: II

15. REGULATORY INFORMATION

U.S. REGULATIONS:

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
SULFURIC ACID: 1000 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):
SULFURIC ACID: 1000 LBS TPQ

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40):
SULFURIC ACID: 1000 LBS RQ

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):
ACUTE: Yes
CHRONIC: No
FIRE: Yes
REACTIVE: Yes
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
SULFURIC ACID, AEROSOL FORMS ONLY

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

STATE REGULATIONS:

California Proposition 65: Not regulated.

CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: Not determined.

EUROPEAN REGULATIONS:

EC CLASSIFICATION (CALCULATED): Not determined.

NATIONAL INVENTORY STATUS:

U.S. INVENTORY (TSCA): All the components of this substance are listed on or are exempt from the inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

16. OTHER INFORMATION

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