TOLUENE
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MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
CHEMTREC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 108-88-3

SUBSTANCE: **TOLUENE**

TRADE NAMES/SYNONYMS:
BENZENE, METHYL-; METHYLBENZENE; TOLUOL; METHYLBENZOL; PHENYLMETHANE; METHACIDE; T290; T289; T330; T324; T324S; T324SK; T323; T313; T290SK; T291; T313SK; C7H8; RCRA U220; UN 1294; STCC 4909305; ACC23590

CHEMICAL FAMILY:
Hydrocarbon, aromatic

MOLECULAR FORMULA: C6-H5-C-H3

MOLECULAR WEIGHT: 92.14

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=1
NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: TOLUENE PERCENT: 100.0
CAS# 108-88-3

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
TOLUENE:
100 ppm (377 mg/m3) OSHA TWA; 150 ppm (565 mg/m3) OSHA STEL
50 ppm (188 mg/m3) ACGIH TWA (skin)
100 ppm (377 mg/m3) NIOSH recommended 10 hour TWA;
150 ppm (565 mg/m3) NIOSH recommended STEL
100 ppm (377 mg/m3) DFG MAK TWA;
500 ppm (1885 mg/m3) DFG MAK 30 minute peak, average value, 2 times/shift

Measurement method: Charcoal tube; carbon disulfide; gas chromatography with flame ionization detection; (NIOSH III # 1500, Hydrocarbons).

1000 pounds CERCLA Section 103 Reportable Quantity
Subject to SARA Section 313 Annual Toxic Chemical Release Reporting
Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirments- (January 1, 1991)

OSHA revoked the final rule limits of January 19, 1989 in response to the 11th Circuit Court of Appeals decision (AFL-CIO v. OSHA) effective June 30, 1993. See 29 CFR 1910.1000 (58 FR 35338)

PHYSICAL DATA

DESCRIPTION: Clear, colorless liquid with an aromatic odor.

BOILING POINT: 231 F (111 C) MELTING POINT: -139 F (-95 C)

SPECIFIC GRAVITY: 0.8669 VOLATILITY: 100% VAPOR PRESSURE: 22 mmHg @ 20 C

EVAPORATION RATE: (butyl acetate=1) 2.24 SOLUBILITY IN WATER: 0.05% @ 20 C

ODOR THRESHOLD: 10-15 ppm VAPOR DENSITY: 3.14

SOLVENT SOLUBILITY: Soluble in alcohol, ether, benzene, ligroin,acetone, chloroform, glacial acetic acid, carbon disulfide.

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
Dangerous fire hazard when exposed to heat or flame.

Vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back.

Vapor-air mixtures are explosive.

Due to low electroconductivity of the substance, flow or agitation may generate electrostatic charges resulting in sparks with possible ignition.

FLASH POINT: 40 F (4 C) (CC) UPPER EXPLOSIVE LIMIT: 7.1%

LOWER EXPLOSIVE LIMIT: 1.2% AUTOIGNITION TEMP.: 896 F (480 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
Dry chemical, carbon dioxide, water spray or regular foam
(1993 Emergency Response Guidebook, RSPA P 5800.6).

For larger fires, use water spray, fog or regular foam
(1993 Emergency Response Guidebook, RSPA P 5800.6).

FIREFIGHTING:
Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire. Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire (1993 Emergency Response Guidebook, RSPA P 5800.6, Guide Page 27).

Extinguish only if flow can be stopped; use water in flooding quantities as fog, solid streams may spread fire. Cool containers with flooding amounts of water, apply from as far a distance as possible. Avoid breathing toxic vapors, keep upwind.

Water may be ineffective (NFPA 325M, Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids, 1991)

TRANSPORTATION DATA

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Toluene-UN 1294

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
3 - Flammable liquid

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101 AND SUBPART E:
Flammable liquid

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.150
NON-BULK PACKAGING: 49 CFR 173.202
BULK PACKAGING: 49 CFR 173.242

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 5 L
CARGO AIRCRAFT ONLY: 60 L

TOXICITY

TOLUENE:
IRRITATION DATA: 300 ppm eye-human; 870 ug eye-rabbit mild; 2 mg/24 hours eye-rabbit severe; 100 mg/30 seconds rinsed eye-rabbit mild; 435 mg skin-rabbit mild; 500 mg skin-rabbit moderate; 20 mg/24 hours skin-rabbit moderate.
TOXICITY DATA: 200 ppm inhalation-human TCLo; 100 ppm inhalation-man TCLo; 49 gm/m3/4 hours inhalation-rat LC50; 1600 ppm/20 hours/7 days-intermittent inhalation-rat TCLo; 80 ppm/6 hours/4 weeks-intermittent inhalation-rat TCLo; 12000 ppm/10 minutes/8 weeks-intermittent inhalation-rat TCLo; 2500 ppm/6.5 hours/15 weeks-intermittent inhalation-rat TCLo; 1500 ppm/6 hours/26 weeks-intermittent inhalation-rat TCLo; 300 ppm/6 hours/2 years intermittent inhalation-rat TCLo; 400 ppm/24 hours inhalation-mouse LC50; 12000 ppm/10 minutes/8 weeks-intermittent inhalation-mouse TCLo; 1250 ppm/6 hours/14 weeks-intermittent inhalation-mouse TCLo; 55000 ppm/40 minutes inhalation-rabbit LCLo; 50 mg/m3/4 hours/26 weeks-intermittent inhalation-rabbit TCLo; 1600 ppm inhalation-guinea pig LCLo; 30 gm/m3 inhalation-mammal LC50; 12124 mg/kg skin-rabbit LD50; 636 mg/kg oral-rat LD50; 162 gm/kg/13 weeks-intermittent oral-rat TDLo; 227 gm/kg/13 weeks intermittent oral-mouse TDLo; 2940 mg/kg/4 weeks-continuous oral-mouse TDLo; 4 gm/kg oral-mammal LD50; 2250 mg/kg subcutaneous-mouse LD50; 1960 mg/kg intravenous-rat LD50; 130 mg/kg intravenous-rabbit LDLo; 500 mg/kg intraperitoneal-guinea pig LD50; 1332 mg/kg intraperitoneal-rat LD50;

59 mg/kg intraperitoneal-mouse LD50; 1750 mg/kg intraperitoneal-mammal LDLo; 6900 mg/kg unreported-rat LD50; 2 gm/kg unreported-mouse LD50; mutagenic data (RTECS); reproductive effects data (RTECS).
CARCINOGEN STATUS: Human Inadequate Evidence, Animal Inadequate Evidence (IARC Group-3).
LOCAL EFFECTS: Irritant- inhalation, skin, eye.
ACUTE TOXICITY LEVEL: Moderately toxic by ingestion; slightly toxic by inhalation and dermal absorption.
TARGET EFFECTS: Central nervous system depressant; neurotoxin. Poisoning may also affect the heart, liver, kidneys, and blood.
ADDITIONAL DATA: Stimulants such as epinephrine may induce ventricular fibrillation. Alcohol may enhance the toxic effects. The metabolism of other solvents may be inhibited resulting in a potentiation of toxic effects of those chemicals. Uptake is directly proportional to the amount of body fat. Blood levels may be cumulative when exposure is extended.

HEALTH EFFECTS AND FIRST AID

INHALATION:
TOLUENE:
IRRITANT/NARCOTIC/NEUROTOXIN.
500 ppm Immediately Dangerous to Life or Health.
ACUTE EXPOSURE- Odor detection may be insufficient for warning due to olfactory fatigue. Exposure to 100 ppm may cause irritation. 200-600 ppm for up to 8 hours caused fatigue, weakness, confusion, headache, nausea, impaired coordination and reaction time, paresthesias of the skin, euphoria, dizziness, and dilated pupils. 800 ppm caused rapid irritation, nasal mucous secretion, metallic taste, drowsiness, and impaired balance. After effects including nervousness, muscular fatigue, and insomnia lasted for several days. A worker found unconscious after exposure to high vapor concentrations for 18 hours developed hepatic and renal damage with myoglobinuria. Recovery was complete within 6 months. Hematologic effects occur rarely with exposure to high concentrations. Death may be due to respiratory failure or ventricular fibrillation.
CHRONIC EXPOSURE- Prolonged or repeated exposure may cause mucous membrane irritation, vomiting, insomnia, nosebleeds, chest pains, euphoria, headache, vertigo, nausea, anorexia, momentary loss of memory, loss of coordination and impairment of reaction time, tinnitus, impaired speech, vision, and/or hearing, alcohol intolerance, and petechiae and abnormal bleeding. Bone marrow hypoplasia and leukopenia have been reported occasionally, but may be due to benzene contamination. Examination of workers exposed to 100-1100 ppm revealed hepatomegaly, mild macrocytosis, moderate erythropenia, and absolute lymphocytosis but no leukopenia. Other workers exposed to toluene fumes developed leukopenia and especially neutropenia. Within 6 months, they showed decreased prothrombin level and increased coagulation time. Periodontal effects were also noted. Volunteers exposed to 200 ppm for 6 hours/day for 2 days showed a significant increase in heart rate. Cardiac sensitization may occur and may result in cardiac arrest due to ventricular fibrillation. Repeated inhalation to the point of euphoria has caused irreversible encephalopathy with cerebellar ataxia, rhythmic limb movements, disequilibrium, bizarre behavior, emotional lability, optic atrophy, and diffuse cerebral atrophy. Other neuropsychiatric effects may include dizziness, syncope, paresthesias, peripheral neuropathy, hallucinations, lethargy, and coma. Intentional sniffing can produce renal tubular defects with metabolic acidosis, electrolyte abnormalities and potassium loss. Severe muscle weakness leading to limb paralysis and cardiac arrhythmias may result from the hypokalemia; however, sensory function and tendon reflexes are not impaired. Gastrointestinal effects may include abdominal pain, nausea, vomiting, and hematemesis. Chromosome changes were observed in some workers up to two years after cessation of exposure to toluene. Women occupationally exposed to toluene and other varnish solvents have reported menstrual disorders, underweight offspring who did not nurse well, and fetal asphyxia. One case study indicated toluene apparently crossed the placenta and created cerebellar damage in an unborn infant. Dysmenorrhea has been reported in women occupationally exposed to toluene levels of 60-100 ppm. Reproductive effects have also been reported in animals.

FIRST AID- Remove from exposure area to fresh air immediately. Perform artificial respiration if necessary. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:
TOLUENE:
IRRITANT.
ACUTE EXPOSURE- Contact with the liquid may cause irritation. Vapors may cause drying. Skin absorption does occur, but it is generally too slow to produce signs of acute systemic toxicity.
CHRONIC EXPOSURE- Prolonged or repeated contact with the liquid may cause defatting of the skin with a dry fissured dermatitis. Repeated application to rabbit skin produced slight to moderate irritation and slight necrosis. Topical application of 10 gm/kg produced an increase in plasmic and lymphoid reticular cells in bone marrow of rats, while 1 gm/kg had no effect.

FIRST AID- Remove contaminated clothing and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately.

EYE CONTACT:
TOLUENE:
IRRITANT.
ACUTE EXPOSURE- Liquid may cause irritation and corneal burns if not promptly removed. Concentrations around 300-800 ppm may cause noticeable irritation and lacrimation. Corneal lesions and very fine vacuoles have been reported in workers exposed to a solvent containing toluene. The lesions subsided following several days of non-exposure. Similar lesions have been produced in cats following exposure to toluene.
CHRONIC EXPOSURE- Repeated or prolonged contact with irritants may cause conjunctivitis.

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately.

INGESTION:
TOLUENE:
NARCOTIC.
ACUTE EXPOSURE- May cause a burning sensation in the epigastrium and abdominal spasms. Systemic effects may occur as described in acute inhalation. Aspiration of the liquid into the lungs may cause coughing, gagging, distress, acute hemorrhagic pneumonitis, and rapidly developing pulmonary edema. The approximate lethal dose in humans is 15-30 ml.
CHRONIC EXPOSURE- No effects were reported in rats fed up to 590 mg/kg/day for 193 days. Administration to animals during gestation produced significant embryolethality and an increase in cleft palate in offspring.

FIRST AID- Extreme care must be used to prevent aspiration. Gastric lavage with a cuffed endotracheal tube in place to prevent further aspiration should be done within 15 minutes. In the absence of depression or convulsions or impaired gag reflex, emesis can also be induced using syrup of ipecac without increasing the hazard of aspiration (Dreisbach, Handbook of Poisoning, 12th Ed.). Treat symptomatically and supportively. Gastric lavage should be performed by qualified medical personnel. Get medical attention immediately.

ANTIDOTE:
No specific antidote. Treat symptomatically and supportively.

REACTIVITY

REACTIVITY:
Stable under normal temperatures and pressures.

INCOMPATIBILITIES:
TOLUENE:
ALLYL CHLORIDE + DICHLOROETHYL ALUMINUM OR ETHYLALUMINUM SESQUICHLORIDE: Possible explosion.
BROMINE TRIFLUORIDE (SOLID): Violent reaction.
1,3-DICHLORO-5,5-DIMETHYL-2,4-IMIDAZOLIDIDIONE: Explosive reaction.
DINITROGEN TETRAFLUORIDE: Forms explosive mixture.
MINERAL ACIDS (STRONG): Incompatible.
NITRIC ACID: Vigorous reaction.
NITRIC ACID + SULFURIC ACID: Violent decomposition possible.
NITROGEN TETROXIDE: Explosive reaction.
OXIDIZERS (STRONG): Fire and explosion hazard.
PLASTICS, RUBBER, AND COATINGS: May be attacked.
SILVER PERCHLORATE: Forms shock-sensitive mixture.
SULFUR DICHLORIDE: Violent reaction, greatly accelerated in the presence of iron or ferric chloride.
SULFURIC ACID: Exothermic reaction.
TETRANITROMETHANE: Forms explosive mixture.
URANIUM HEXAFLUORIDE: Violent reaction.

DECOMPOSITION:
Thermal decomposition products may include toxic oxides of carbon and various hydrocarbons.

POLYMERIZATION:
Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

STORAGE AND DISPOSAL

Observe all federal, state and local regulations when storing or disposing of this substance.

Storage

Store in accordance with 29 CFR 1910.106.

Protect against physical damage. Outside or detached storage is preferable.