**TETRAHYDROFURAN**
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# MATERIAL SAFETY DATA SHEET

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## SUBSTANCE IDENTIFICATION

CAS-NUMBER 109-99-9

SUBSTANCE: **TETRAHYDROFURAN**

TRADE NAMES/SYNONYMS:
FURAN, TETRAHYDRO-; BUTANE, ALPHA, DELTA-OXIDE; CYCLOTETRAMETHYLENE OXIDE; FURANIDINE; OXACYCLOPENTANE; OXOLANE; TETRAMETHYLENE OXIDE; THF; U213; STCC 4908290; UN 2056; T-397; T-397-S; T-400; T-424;

CHEMICAL FAMILY:
FURAN DERIVATIVE

MOLECULAR FORMULA: C4-H8-O

MOLECULAR WEIGHT: 72.10

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

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## COMPONENTS AND CONTAMINANTS

COMPONENT: TETRAHYDROFURAN PERCENT: >99

OTHER CONTAMINANTS: WATER; 0.025% BUTYLATED HYDROXYTOLUENE

EXPOSURE LIMITS:
TETRAHYDROFURAN:
200 PPM (590 MG/M3) OSHA TWA; 250 PPM (735 MG/M3) OSHA STEL
200 PPM (590 MG/M3) ACGIH TWA; 250 PPM (735 MG/M3) ACGIH STEL

1000 POUND CERCLA SECTION 103 REPORTABLE QUANTITY

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## PHYSICAL DATA

DESCRIPTION: COLORLESS, VOLATILE, MOBILE LIQUID WITH A FAINT, ETHER-LIKE, FRUITY ODOR. BOILING POINT: 151 F (66 C) MELTING POINT: -163 F (-108 C)

SPECIFIC GRAVITY: 0.8892 VAPOR PRESSURE: 145 MMHG @ 20 C

EVAPORATION RATE: (BUTYL ACETATE = 1) 5.8 SOLUBILITY IN WATER: VERY SOLUBLE

ODOR THRESHOLD: 20 PPM VAPOR DENSITY: 2.5

SOLVENT SOLUBILITY: SOLUBLE IN ETHANOL, ACETONE, DIMETHYL SULFOXIDE, DIETHYL ETHER, BENZENE, ALCOHOLS, KETONES, ESTERS, ETHERS, HYDROCARBONS

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## FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPOR-AIR MIXTURES ARE EXPLOSIVE.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

FLASH POINT: 6 F (-14 C) (CC) UPPER EXPLOSIVE LIMIT: 11.8%

LOWER EXPLOSIVE LIMIT: 2% AUTOIGNITION TEMP.: 610 F (321 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR ALCOHOL FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK

ENDS. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES, ELSE WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK DUE TO FIRE (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 26).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING AMOUNTS AS FOG, SOLID STREAMS MAY NOT BE EFFECTIVE. COOL CONTAINERS WITH FLOODING QUANTITIES OF WATER. APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING TOXIC VAPORS, KEEP UPWIND. EVACUATE TO A RADIUS OF 1500 FEET FOR UNCONTROLLABLE FIRES. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

WATER MAY BE INEFFECTIVE (NFPA FIRE PROTECTION GUIDE ON HAZARDOUS MATERIALS, EIGHTH EDITION).

ALCOHOL FOAM (NFPA FIRE PROTECTION GUIDE ON HAZARDOUS MATERIAL, EIGHTH EDITION).

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## TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.119
EXCEPTIONS: NONE

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## TOXICITY

TETRAHYDROFURAN:
25,000 PPM INHALATION-HUMAN TCLO; 21,000 PPM/3 HOURS INHALATION-RAT LC50; 24,000 MG/M3/2 HOURS INHALATION-MOUSE LCLO; 2816 MG/KG ORAL-RAT LD50; 2900 MG/KG INTRAPERITONEAL-RAT LD50; 1900 MG/KG INTRAPERITONEAL-MOUSE LD50; 500 MG/KG INTRAPERITONEAL-GUINEA PIG LDLO; MUTAGENIC DATA (RTECS).
CARCINOGEN STATUS: NONE.
TETRAHYDROFURAN IS AN EYE AND MUCOUS MEMBRANE IRRITANT AND CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY AFFECT THE LIVER, KIDNEYS AND RESPIRATORY SYSTEM. CONSUMPTION OF ALCOHOLIC BEVERAGES MAY ENHANCE THE TOXIC EFFECTS. PERSONS WITH A HISTORY OF CHRONIC RESPIRATORY OR SKIN DISEASE MAY BE AT AN INCREASED RISK FROM EXPOSURE.

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## HEALTH EFFECTS AND FIRST AID

INHALATION:
TETRAHYDROFURAN:
IRRITANT/NARCOTIC. 20,000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
- ACUTE EXPOSURE- INHALATION OF HIGH VAPOR CONCENTRATIONS MAY CAUSE SORE THROAT, COUGHING, HEADACHE, DIZZINESS, NAUSEA, WEAKNESS, CENTRAL NERVOUS SYSTEM DEPRESSION, UNCONSCIOUSNESS, AND POSSIBLE ASPHYXIATION. SYMPTOMS ARE READILY REVERSIBLE UPON REMOVAL FROM EXPOSURE. CONCENTRATIONS ABOVE 25,000 PPM PRODUCED ANESTHESIA WITH PROLONGED INDUCTION, PROFUSE SALIVATION, VOMITING, MARKED FALL IN BLOOD PRESSURE, POOR MUSCULAR RELAXATION, RESPIRATORY STIMULATION, AND NARCOSIS IN EXPERIMENTAL ANIMALS. THERE WAS A SMALL MARGIN OF SAFETY BETWEEN ANESTHESIA AND DEATH. TECHNICIANS PERFORMING THESE EXPERIMENTS COMPLAINED OF SEVERE OCCIPITAL HEADACHES AND DULLNESS.
- CHRONIC EXPOSURE- 3000 PPM FOR 8 HOURS/DAY FOR 20 DAYS PRODUCED IRRITATION OF THE UPPER RESPIRATORY TRACT. LIVER AND KIDNEY DAMAGE WERE REPORTED, BUT MAY HAVE BEEN DUE TO IMPURITIES.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
TETRAHYFROFURAN:
- ACUTE EXPOSURE- LIQUID APPLIED TO THE SKIN OF 196 PERSONS WAS ESSENTIALLY NONIRRITATING. AQUEOUS SOLUTIONS IN CONCENTRATIONS ABOVE 20% CAUSED IRRITATION WHEN APPLIED TO RABBIT SKIN.
- CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY DEHYDRATE AND DEFAT THE SKIN AND CAUSE DERMATITIS. IT IS BELIEVED THAT LIVER DAMAGE MAY RESULT FROM SKIN ABSORPTION.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
TETRAHYDROFURAN:
IRRITANT.
- ACUTE EXPOSURE- VAPORS MAY CAUSE IRRITATION AND LIQUID MAY CAUSE IRRITATION OR POSSIBLE BURNS.
- CHRONIC EXPOSURE- REPEATED OR PROLONGED VAPOR EXPOSURE MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE PH HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGES. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
TETRAHYDROFURAN:
NARCOTIC.
ACUTE EXPOSURE- INGESTION MAY CAUSE GASTROINTESTINAL IRRITATION, SORE THROAT, ABDOMINAL PAIN, NAUSEA, VOMITING, DIARRHEA, DIZZINESS, HEADACHE, AND DULLNESS. UNCONSCIOUSNESS MAY RESULT FROM VERY LARGE QUANTITIES. ASPIRATION INTO THE LUNGS DURING VOMITING MAY CAUSE SEVERE LUNG IRRITATION AND POSSIBLE DELAYED CHEMICAL PNEUMONITIS. LIVER AND KIDNEY DAMAGE ARE POSSIBLE.
CHRONIC EXPOSURE- THE FOOD, DRUG AND COSMETIC ACT PERMITS USE FOR FABRICATION OF ARTICLES FOR PACKAGING, TRANSPORT, OR STORING OF FOODS IF THE RESIDUAL AMOUNT DOES NOT EXCEED 1.5% OF THE FILM. NO ADVERSE EFFECTS HAVE BEEN REPORTED IN HUMANS.

FIRST AID- REMOVE BY GASTRIC LAVAGE OR EMESIS AND CONSIDER USING ACTIVATED CHARCOAL. DO NOT PERFORM GASTRIC LAVAGE OR EMESIS ON AN UNCONSCIOUS PERSON. MAINTAIN BLOOD PRESSURE AND RESPIRATION. GIVE OXYGEN IF RESPIRATION IS SHALLOW OR ANOXIA IS PRESENT. (DREISBACH, HANDBOOK OF POISONING, 12TH ED.) TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY. LAVAGE AND OXYGEN MUST BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

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## REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES IF PEROXIDATION IS INHIBITED. IF UNINHIBITED, MAY FORM EXPLOSIVE ORGANIC PEROXIDES WHEN EXPOSED TO AIR. IF DISTILLED OR EVAPORATED TO DRYNESS, AN EXPLOSION MAY OCCUR.

INCOMPATIBILITIES:
TETRAHYDROFURAN:
ACIDS: REACTION AND POSSIBLE POLYMERIZATION.
BORANE-TETRAHYDROFURAN COMPLEX: POSSIBLE EXPLOSION ON STORAGE.
BROMINE: VIGOROUS REACTION.
HAFNIUM TETRACHLORIDE: VIOLENT EXOTHERMIC REACTION.
LITHIUM ALUMINUM ALLOYS: EXPLOSION.
LITHIUM ALUMINUM HYDRIDE (LITHIUM TETRAHYDROALUMINATE): POSSIBLE IGNITION.
METALLIC HYDRIDES: POSSIBLE EXPLOSION WHEN HEATED.
OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
PLASTICS, RUBBER, COATINGS: SOME FORMS ATTACKED.
POTASSIUM DIOXIDE AND 2-AMINOPHENOL: POSSIBLE EXPLOSION.
POTASSIUM HYDROXIDE: POSSIBLE EXPLOSION IN PRESENCE OF PEROXIDE CONTAMINANTS.
SODIUM HYDROXIDE: POSSIBLE EXPLOSION IN PRESENCE OF PEROXIDE CONTAMINANTS.
SODIUM TETRAHYDROALUMINATE: POSSIBLE VIOLENT EXPLOSION.
TITANIUM TETRACHLORIDE: VIOLENT EXOTHERMIC REACTION.
ZIRCONIUM TETRACHLORIDE: VIOLENT EXOTHERMIC REACTION.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON.

POLYMERIZATION:
MAY POLYMERIZE EXOTHERMICALLY IN CONTACT WITH SOME ACIDS.

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## STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

### **STORAGE**

STORE IN ACCORDANCE WITH 29 CFR 1910.106.

BONDING AND GROUNDING: SUBSTANCES WITH LOW ELECTROCONDUCTIVITY, WHICH MAY BE IGNITED BY ELECTROSTATIC SPARKS, SHOULD BE STORED IN CONTAINERS WHICH MEET THE BONDING AND GROUNDING GUIDELINES SPECIFIED IN NFPA 77-1983, RECOMMENDED PRACTICE ON STATIC ELECTRICITY.

PROTECT AGAINST PHYSICAL DAMAGE. STORE IN A COOL, DARK, AND WELL VENTILATED AREA, AWAY FROM SOURCES OF HEAT. OUTSIDE OR DETACHED STORAGE IS PREFERABLE. INSIDE STORAGE SHOULD BE IN A STANDARD FLAMMABLE LIQUIDS STORAGE ROOM OR CABINET. PERIODICALLY CHECK FOR PEROXIDE CONTENT AND MAINTAIN BELOW 1% BY ADDING INHIBITOR. SEPARATE FROM OXIDIZING MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

### **DISPOSAL**

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40CFR 262. EPA HAZARDOUS WASTE NUMBER U213.

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## CONDITIONS TO AVOID

MAY BE IGNITED BY HEAT, SPARKS OR FLAMES. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION HAZARD INDOORS, OUTDOORS OR IN SEWERS. RUN-OFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

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## SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY.

REPORTABLE QUANTITY (RQ): 1000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

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## PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS OR NIOSH CRITERIA DOCUMENTS; OR DEPARTMENT OF LABOR, 29CFR1910 SUBPART Z.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION.

TETRAHYDROFURAN:

1000 PPM- ANY POWERED AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S).
ANY CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S).

5000 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

10,000 PPM- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.

20,000 PPM- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT BE WORN.

EMERGENCY WASH FACILITIES:
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

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## -ADDITIONAL INFORMATION-