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DIMETHYL SULFOXIDE
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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

SUBSTANCE: **DIMETHYL SULFOXIDE** CAS-NUMBER 67-68-5

TRADE NAMES/SYNONYMS:
SULFINYLBIS(METHANE); METHYL SULFOXIDE; DMSO; DEMESO; DEMASORB;
DIMETHYL SULPHOXIDE; DMS-70; DMS-90; DOLICUR; DOMOSO; DROMISOL; HYADUR;
INFILTRINA; RIMSO-50; RIMSO-100; D-128; D-136; BP231; C2H6OS; ACC07770

CHEMICAL FAMILY:
SULFOXIDE

MOLECULAR FORMULA: C2-H6-O-S

MOLECULAR WEIGHT: 78.13

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

COMPONENTS AND CONTAMINANTS

COMPONENT: DIMETHYL SULFOXIDE PERCENT: 100.0
CAS# 67-68-5

OTHER CONTAMINANTS: NONE.

EXPOSURE LIMITS:
NO OCCUPATIONAL EXPOSURE LIMITS ESTABLISHED BY OSHA, ACGIH, OR NIOSH.

PHYSICAL DATA

DESCRIPTION: CLEAR, WATER WHITE, HYGROSCOPIC LIQUID WITH A SLIGHTLY BITTER

TASTE AND A MILD GARLIC ODOR. BOILING POINT: 372 F (189 C) (DECOMPOSES)

MELTING POINT: 64 F (18 C) SPECIFIC GRAVITY: 1.1014

VISCOSITY: 1.1 CPS @ 27 C VAPOR PRESSURE: 0.37 MMHG @ 20 C

EVAPORATION RATE: 4.3 (CARBON TETRACHLORIDE=1)

SOLUBILITY IN WATER: MISCIBLE VAPOR DENSITY: 2.7

SOLVENT SOLUBILITY: SOLUBLE IN ALCOHOL, ETHER, ACETONE, BENZENE AND CHLOROFORM.

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
MODERATE 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 ABOVE FLASH POINT.

FLASH POINT: 192 F (89 C) UPPER EXPLOSIVE LIMIT: 42%

LOWER EXPLOSIVE LIMIT: 2.6% AUTOIGNITION TEMP.: 419 F (215 C)

FLAMMABILITY CLASS(OSHA): IIIA

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

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FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

ALCOHOL FOAM
(NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1991).

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 (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 27).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE FLOODING AMOUNTS OF WATER AS A FOG, SOLID STREAMS MAY BE INEFFECTIVE. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS, KEEP UPWIND.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49-CFR 172.101:
COMBUSTIBLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49-CFR 172.101 AND SUBPART E:
NONE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: NONE
EXCEPTIONS: 49-CFR 173.118A

TOXICITY

DIMETHYL SULFOXIDE:
IRRITATION DATA: 10 MG/24 HOURS OPEN SKIN-RABBIT MILD; 500 MG/24 HOURS SKIN-RABBIT MILD; 100 MG EYE-RABBIT; 500 MG/24 HOURS EYE-RABBIT MILD.
TOXICITY DATA: 1600 MG/M3/4 HOURS INHALATION-RAT LC50 (38MKAJ); 40 GM/KG SKIN-RAT LD50; 50 GM/KG SKIN-MOUSE LD50; 11 GM/KG SKIN-DOG LD50 (38MKAJ); 11 GM/KG SKIN-MONKEY LD50 (38MKAJ); 14500 MG/KG ORAL-RAT LD50; 7920 MG/KG ORAL-MOUSE LD50; 11 GM/KG ORAL-GUINEA PIG LDLO; 10 GM/KG ORAL-DOG LD50; 12 GM/KG SUBCUTANEOUS-RAT LD50; 14 GM/KG SUBCUTANEOUS-MOUSE LD50; 606 MG/KG INTRAVENOUS-MAN TDLO; 5360 MG/KG INTRAVENOUS-MOUSE LD50; 3100 MG/KG INTRAVENOUS-MOUSE LD50; 2500 MG/KG INTRAVENOUS-DOG LD50; 57600 MG/KG/4 WEEKS INTERMITTENT INTRAVENOUS-DOG TDLO; 200 MG/KG INTRAVENOUS-CAT LDLO; 8200 MG/KG INTRAPERITONEAL-RAT LD50; 192 GM/KG/4 WEEKS INTERMITTENT INTRAPERITONEAL-RAT TDLO; 2500 MG/KG INTRAPERITONEAL-MOUSE LD50; 55 MG/KG INTRAPERITONEAL-GUINEA PIG LDLO; 1300 MG/KG UNREPORTED-RAT LD50; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS).

CARCINOGEN STATUS: NONE.
LOCAL EFFECTS: IRRITANT- INHALATION, SKIN, EYE
ACUTE TOXICITY LEVEL: TOXIC BY INHALATION; SLIGHTLY TOXIC BY INGESTION; RELATIVELY NON-TOXIC BY DERMAL ABSORPTION.
TARGET EFFECTS: POISONING MAY AFFECT THE LIVER AND KIDNEYS.
ADDITIONAL DATA: INTERACTIONS WITH MEDICATIONS HAVE BEEN REPORTED.

HEALTH EFFECTS AND FIRST AID

INHALATION:
DIMETHYL SULFOXIDE:
IRRITANT/TOXIC.
ACUTE EXPOSURE- VAPORS MAY CAUSE MODERATE IRRITATION OF THE RESPIRATORY TRACT WITH COUGHING. HIGH CONCENTRATIONS MAY CAUSE SYSTEMIC EFFECTS SUCH AS NAUSEA, VOMITING, CHILLS, CRAMPS, HEADACHE, DIZZINESS, AND LETHARGY. ALLERGIC RESPIRATORY REACTIONS MAY ALSO OCCUR. THE LETHAL DOSE REPORTED IN RATS WAS 1600 MG/M3 FOR 4 HOURS.
CHRONIC EXPOSURE- ANIMALS SHOWED LIVER DAMAGE AND BRONCHOPNEUMONIA ON BEING SUBJECTED TO SPRAY FOR 5 MINUTES, 10 TIMES OVER 15 DAYS, BUT NO EVIDENCE OF TOXICITY ON EXPOSURE TO HEATED VAPOR FOR 30 MINUTES UNDER SIMILAR CONDITIONS. RABBITS EXPOSED TO 25-50 ML/HOUR OF MIST FOR 5 MONTHS DEVELOPED CHEMICAL PNEUMONIA, CLOUDY SWELLING OF THE LIVER, AND SIGNS OF RENAL TOXICITY.

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:
DIMETHYL SULFOXIDE:
IRRITANT
ACUTE EXPOSURE- MAY CAUSE IRRITATION WITH ERYTHEMA, ITCHING, SCALING, A TRANSIENT BURNING SENSATION, AND POSSIBLY BLISTERING. IT CAN INITIATE THE IMMEDIATE RELEASE OF HISTAMINE WITH URTICARIAL WHEEL AND FLARE FORMATION. ABSORPTION IS RAPID AND MAY CAUSE A GARLIC-LIKE TASTE AND

ODOR TO THE BREATH AND SKIN. LARGE AMOUNTS MAY CAUSE NAUSEA, VOMITING, CRAMPS, DIARRHEA, ANESTHESIA, LETHARGY, DROWSINESS, HEADACHE, CHILLS, CHEST PAINS, BURNING OR ACHING EYES, AND TRANSIENT DISTURBANCES OF COLOR VISION AND PHOTOPHOBIA. TRANSIENT HEMOLYSIS WITH HEMOGLOBINURIA HAS ALSO BEEN REPORTED. ENHANCED IRRITATION, EPIDERMAL VESICULATION, HISTOLOGICAL EVIDENCE OF DERMAL DEATH, AND PERIVASCULAR DERMAL INFILTRATES WERE NOTED AFTER OCCLUDED PATCH TESTING. OCCASIONAL HYPERSENSITIVITY REACTIONS INCLUDING ANAPHYLAXIS HAVE BEEN REPORTED DUE TO ITS SOLVENT PROPERTIES. DMSO FACILITATES THE ABSORPTION OF SUBSTANCES PRESENT ON THE SKIN WHICH MAY RESULT IN TOXIC EFFECTS

CHRONIC EXPOSURE- 9 MILLILITERS OF 90% DMSO WAS APPLIED TO THE ENTIRE TRUNK OF 20 MEN ONCE DAILY FOR 26 WEEKS. THE EFFECTS NOTED WERE BAD BREATH, TRANSIENT ERYTHEMA, BURNING, AND STINGING. THE DERMATITIS, ACCOMPANIED BY ONLY MODERATE INFLAMMATION REGRESSED AS TREATMENT CONTINUED. DAILY CONTINUOUS APPLICATION WITH OCCLUSION PRODUCED HARDENING OF THE SKIN IN MOST SUBJECTS WITHIN 1 MONTH. CRYSTALLINE LENS ALTERATIONS, RESEMBLING JUVENILE NUCLEAR SCLEROSIS, HAVE BEEN PRODUCED IN SOME ANIMAL SPECIES, BUT NOT IN HUMANS. NO LENS ABNORMALITIES WERE FOUND IN 25 PATIENTS TREATED DAILY WITH UP TO 30 ML APPLIED TOPICALLY FOR 19 MONTHS.

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:
DIMETHYL SULFOXIDE:
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT MAY CAUSE IRRITATION WITH REDNESS, PAIN, AND BLURRED VISION. AQUEOUS SOLUTIONS CONTAINING 75-90% DMSO MAY CAUSE IRRITATION WITH TEMPORARY STINGING AND BURNING. FIFTY PER CENT SOLUTIONS HAVE CAUSED A TRANSIENT BURNING SENSATION. LOWER CONCENTRATIONS HAVE BEEN TOLERATED WELL WITHOUT INJURY TO THE EYE. APPLICATION FULL STRENGTH INTO RABBIT EYES CAUSED PAIN, MODERATE DISCHARGE, CORNEAL EPITHELIUM INJURY, AND DILATION OF CONJUNCTIVAL BLOOD VESSELS BUT NO HEMORRHAGING. THE EYES RETURNED TO NORMAL IN 2 DAYS.

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 (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

DIMETHYL SULFOXIDE:
ACUTE EXPOSURE- INGESTION OF LARGE AMOUNTS MAY CAUSE NAUSEA, VOMITING, DIARRHEA, ABDOMINAL PAIN, LETHARGY, AND DROWSINESS.

CHRONIC EXPOSURE- REPEATED LARGE DOSES PRODUCED CRYSTALLINE LENS CHANGES, RESEMBLING JUVENILE NUCLEAR SCLEROSIS, IN SOME ANIMAL SPECIES, BUT NOT IN HUMANS. IN ANIMAL STUDIES, REPEATED DOSES OF 1-5 GM/KG RESULTED IN LIVER NECROSIS AND RENAL LESIONS. REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS.

FIRST AID- REMOVE CHEMICAL BY INDUCING EMESIS. GASTRIC LAVAGE, ACTIVATED CHARCOAL, AND FORCED DIURESIS MAY ALSO BE CONSIDERED. (PHYSICIANS' DESK REFERENCE, 40TH ED.) MAINTAIN BLOOD PRESSURE AND RESPIRATION. GIVE OXYGEN IF RESPIRATION IS DEPRESSED. GET MEDICAL ATTENTION IMMEDIATELY. ADMINISTRATION OF LAVAGE OR OXYGEN SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
DIMETHYL SULFOXIDE:

ACID ANHYDRIDES: POSSIBLE EXPLOSIVE REACTION.
ACID HALIDES: POSSIBLE EXPLOSIVE REACTION.
ACYL HALIDES: VIOLENT OR EXPLOSIVE REACTION.
ARYL HALIDES: VIOLENT DECOMPOSITION REACTION.
BORON HYDRIDES: MAY FORM EXPLOSIVE MIXTURE.
BORON HYDROBORATES: MAY FORM EXPLOSIVE MIXTURE.
4(4'-BROMOBENZYL)ACETANILIDE: MAY EXPLODE AT ELEVATED TEMPERATURES.
CARBONYL DIISOTHIOCYANATE: EXPLOSIVE REACTION.
DINITROGEN TETRAOXIDE: VIOLENT OR EXPLOSIVE REACTION.
IODINE PENTAFLUORIDE: POSSIBLE EXPLOSIVE REACTION.
METAL NITRATES: FORMS AN EXTREMELY EXPLOSIVE MIXTURE.
METAL PERCHLORATES: FORMS AN EXTREMELY EXPLOSIVE MIXTURE.
NITRIC ACID: POSSIBLE EXPLOSION HAZARD.
OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
PERCHLORIC ACID: EXPLODES ON CONTACT.
PERIODIC ACID: POSSIBLE EXPLOSIVE REACTION.
PHOSPHOROUS(III) OXIDE: VIOLENT REACTION.
POTASSIUM: VIOLENT REACTION.
POTASSIUM PERMANGANATE: IGNITION ON CONTACT.

SILVER DIFLUORIDE: VIOLENT REACTION.
SODIUM HYDRIDE: POSSIBLE FIRE AND EXPLOSION AT ELEVATED TEMPERATURES.
SULFUR TRIOXIDE: EXOTHERMIC REACTION.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE FORMALDEHYDE, METHYL MERCAPTAN, AND SULFUR DIOXIDE VAPORS.

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

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.

STORE IN ACCORDANCE WITH 29 CFR 1910.106.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES, OR OTHER SOURCES OF IGNITION. VAPORS MAY BE EXPLOSIVE. AVOID OVERHEATING OF CONTAINERS; CONTAINERS MAY VIOLENTLY RUPTURE IN HEAT OF FIRE. AVOID CONTAMINATION OF WATER SOURCES.

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 RESTRICT ENTRY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROCESS ENCLOSURE RECOMMENDED. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:

THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST BE BASED ON THE SPECIFIC OPERATION, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND MUST BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

ANY TYPE 'C' SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE, HELMET OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

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

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

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A 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:

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EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

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

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