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ETHYLENE GLYCOL
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MATERIAL SAFETY DATA SHEET

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SUBSTANCE IDENTIFICATION

SUBSTANCE: **ETHYLENE GLYCOL** CAS-NUMBER 107-21-1

TRADE NAMES/SYNONYMS:

1,2-DIHYDROXYETHANE; 1,2-ETHANEDIOL; ETHYLENE ALCOHOL; GLYCOL;
GLYCOL ALCOHOL; MONOETHYLENE GLYCOL; GLYCOL ETHER; ETHANE-1,2-DIOL;
LUTROL-9; MACROGOL 400 BPC; M.E.G.; TESCOLO; 2-HYDROXYETHANOL;
E-177; E-178; BP230; ACC09400

CHEMICAL FAMILY:
GLYCOL

MOLECULAR FORMULA: C₂H₆O₂

MOLECULAR WEIGHT: 62.08

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

COMPONENTS AND CONTAMINANTS

COMPONENT: ETHYLENE GLYCOL PERCENT: 99.9
CAS# 107-21-1

OTHER CONTAMINANTS: MAY CONTAIN 1,4-DIOXANE AT 0.0026%

EXPOSURE LIMITS:

ETHYLENE GLYCOL:
50 PPM (125 MG/M³) OSHA CEILING
50 PPM (125 MG/M³) ACGIH CEILING (VAPOR AND MIST)

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

1,4-DIOXANE:

25 PPM (90 MG/M³) OSHA TWA (SKIN)
25 PPM (90 MG/M³) ACGIH TWA (SKIN)
1 PPM (3.6 MG/M³) NIOSH RECOMMENDED 30 MINUTE CEILING
50 PPM (180 MG/M³) DFG MAK TWA (SKIN);
100 PPM (360 MG/M³) DFG MAK 30 MINUTE PEAK, AVERAGE VALUE, 4 TIMES/SHIFT

MEASUREMENT METHOD: CHARCOAL TUBE; CARBON DISULFIDE; GAS CHROMATOGRAPHY WITH FLAME IONIZATION DETECTION; (NIOSH VOL. III # 1602).

100 POUND 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 REQUIREMENTS- (JANUARY 1, 1988)

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: HYGROSCOPIC, CLEAR, COLORLESS, ODORLESS, SWEET-TASTING, SYRUPY

LIQUID. BOILING POINT: 387 F (197 C) MELTING POINT: 9 F (-13 C)

SPECIFIC GRAVITY: 1.1 @ 25 C VAPOR PRESSURE: 0.05 MMHG @ 20 C

SOLUBILITY IN WATER: SOLUBLE VAPOR DENSITY: 2.14

SOLVENT SOLUBILITY: ALCOHOL, ACETONE, GLYCEROL, ACETIC ACID, ALDEHYDES, KETONES, PYRIDINE; PRACTICALLY INSOLUBLE IN CHLORINATED HYDROCARBONS, BENZENE, PETROLEUM ETHER, AND OILS

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VISCOSITY: 26 CSP @ 15 C

FIRE AND EXPLOSION DATA

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

FLASH POINT: 232 F (111 C) (CC) UPPER EXPLOSIVE LIMIT: 15.3%

LOWER EXPLOSIVE LIMIT: 3.2% AUTOIGNITION TEMP.: 748 F (398 C)

FLAMMABILITY CLASS(OSHA): IIIB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM

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. DO NOT SCATTER SPILLED MATERIAL WITH HIGH-PRESSURE WATER STREAMS. DIKE FIRE CONTROL WATER FOR LATER DISPOSAL (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 31).

USE AGENTS SUITABLE FOR TYPE OF SURROUNDING FIRE. AVOID BREATHING HAZARDOUS VAPORS, KEEP UPWIND.

WATER OR FOAM MAY CAUSE FROTHING (NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1991)

TOXICITY

ETHYLENE GLYCOL:

IRRITATION DATA: 555 MG OPEN SKIN-RABBIT MILD; 12 MG/M³/3 DAYS EYE-RAT;
100 MG/1 HOUR EYE-RABBIT MILD; 500 MG/24 HOURS EYE-RABBIT MILD;

12 MG/M³/3 DAYS EYE-RABBIT; 1440 MG/6 HOURS EYE-RABBIT MODERATE.

TOXICITY DATA: 10000 MG/M³ INHALATION-HUMAN T_{CL}O; 198 MG/M³ INHALATION-RAT LC; 9530 MG/KG SKIN-RABBIT LD₅₀; 5500 MG/KG ORAL-CHILD TD_{LO}; 786 MG/KG ORAL-HUMAN LD_{LO}; 398 MG/KG ORAL-HUMAN LD_{LO}; 16 GM/KG ORAL-MAN TD_{LO}; 4700 MG/KG ORAL-RAT LD₅₀; 7500 MG/KG ORAL-MOUSE LD₅₀; 6610 MG/KG ORAL-GUINEA PIG LD₅₀; 5500 MG/KG ORAL-DOG LD₅₀; 1650 MG/KG ORAL-CAT LD₅₀; 2800 MG/KG SUBCUTANEOUS-RAT LD₅₀; 2700 MG/KG SUBCUTANEOUS-MOUSE LD₅₀; 5000 MG/KG SUBCUTANEOUS-GUINEA PIG LD₅₀; 2000 MG/KG SUBCUTANEOUS-CAT LD₅₀; 3260 MG/KG INTRAVENOUS-RAT LD₅₀; 3000 MG/KG INTRAVENOUS-MOUSE LD₅₀; 5 GM/KG INTRAVENOUS-RABBIT LD₅₀; 5010 MG/KG INTRAPERITONEAL-RAT LD₅₀; 5614 MG/KG INTRAPERITONEAL-MOUSE LD₅₀; 1000 MG/KG INTRAPERITONEAL-RABBIT LD₅₀; 3300 MG/KG INTRAMUSCULAR-RAT LD₅₀; 5500 MG/KG INTRAMUSCULAR-RABBIT LD₅₀; 1637 MG/KG UNREPORTED ROUTE-MAN LD₅₀; 13 GM/KG UNREPORTED ROUTE-RAT LD₅₀; 5017 MG/KG UNREPORTED ROUTE-RABBIT LD₅₀; 8050 MG/KG UNREPORTED ROUTE-MOUSE LD₅₀; 11150 MG/KG UNREPORTED ROUTE-GUINEA PIG LD₅₀; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS).

CARCINOGEN STATUS: NONE.

LOCAL EFFECTS: IRRITANT- INHALATION, SKIN, EYE.

ACUTE TOXICITY LEVEL: MODERATELY TOXIC BY INGESTION; SLIGHTLY TOXIC BY DERMAL ABSORPTION.

TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT; NEPHROTOXIN; NEUROTOXIN. POISONING MAY AFFECT THE LUNGS, HEART, BLOOD, BRAIN AND LIVER.

HEALTH EFFECTS AND FIRST AID

INHALATION:
ETHYLENE GLYCOL:
IRRITANT.

ACUTE EXPOSURE- INHALATION IS UNLIKELY AT ROOM TEMPERATURE, DUE TO THE LOW VAPOR PRESSURE. AEROSOLS AT 140 MG/M³ WERE IRRITATING, AND 200 MG/M³ WERE INTOLERABLE CAUSING A BURNING SENSATION OF THROAT AND COUGHING. EXPOSURE TO HIGH CONCENTRATIONS OF MISTS OR AEROSOLS MAY RESULT IN EFFECTS ON THE HEMATOPOIETIC SYSTEM AND CENTRAL NERVOUS SYSTEM WITH HEADACHE, DIZZINESS AND DROWSINESS.

CHRONIC EXPOSURE- HUMANS EXPOSED TO AEROSOLS FROM 3-67 MG/M³ CONTINUOUSLY FOR 1 MONTH REPORTED IRRITATION OF THE RESPIRATORY TRACT, OCCASIONALLY SLIGHT HEADACHE AND LOW BACKACHE, BUT NO OTHER SIGNIFICANT ADVERSE EFFECTS. CONTINUED EXPOSURE TO VAPORS FROM A PROCESS UTILIZING A MIXTURE OF ETHYLENE GLYCOL, BORIC ACID AND AMMONIA HEATED ABOVE 100 C RESULTED IN NYSTAGMUS, LYMPHOCYTOSIS AND SUDDEN LOSS OF CONSCIOUSNESS FOR 5-10 MINUTES. NYSTAGMUS OCCURRED 2-3 TIMES WEEKLY UNTIL EXPOSURE CEASED. REPEATED EXPOSURE TO SATURATED ETHYLENE GLYCOL VAPORS PRODUCED SLIGHT NARCOSIS IN RATS. EFFECTS ON THE FETUS HAVE BEEN REPORTED IN RATS AND MICE FOLLOWING EXPOSURE DURING GESTATION. THERE WAS A LIKELIHOOD THAT AT LEAST A PORTION OF THE EFFECTS RESULTED FROM INGESTION SINCE ANIMALS GROOMED CONSTANTLY BEFORE AND AFTER EXPOSURE.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING

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HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
ETHYLENE GLYCOL:

IRRITANT:
ACUTE EXPOSURE - LIQUID MAY DEFAET THE SKIN AND CAUSE MINOR IRRITATION. ANIMAL STUDIES INDICATE THAT LETHAL AMOUNTS MAY BE ABSORBED THROUGH INTACT SKIN. ONE CASE HAS BEEN REPORTED OF COMA ACCOMPANIED BY MYOSIS AND SLOWED PULSE 4 HOURS AFTER MASSIVE APPLICATION OF AN ECZEMA REMEDY CONTAINING ETHYLENE GLYCOL. SENSITIZATION REACTIONS MAY OCCUR IN PREVIOUSLY EXPOSED PERSONS. CHRONIC EXPOSURE - A SLIGHT MACERATING ACTION ON THE SKIN MAY RESULT FROM VERY SEVERE, PROLONGED EXPOSURE. REPEATED OR PROLONGED CONTACT MAY RESULT IN SENSITIZATION. REPEATED OR PROLONGED CONTACT MAY RESULT IN DERMATITIS.

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:
ETHYLENE GLYCOL:

IRRITANT:
ACUTE EXPOSURE - VAPORS MAY CAUSE REDNESS, AND CONTACT WITH THE LIQUID MAY CAUSE CONJUNCTIVITIS AND IRIDOCYCLITIS, BUT NO PERMANENT DAMAGE. CHRONIC EXPOSURE - VAPOR OR SPRAY AT 17 MG/M3/4 WEEKS PRODUCED NO ILL EFFECTS IN HUMANS. RATS EXPOSED CONTINUOUSLY TO 12 MG/M3 FOR SEVERAL DAYS SOMETIMES SHOWED SEVERE EYE IRRITATION, EDEMA OF THE EYELIDS, CORNEAL OPACITY AND APPARENT BLINDNESS, WITHOUT SIGNS OF SYSTEMIC INTOXICATION.

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:
ETHYLENE GLYCOL:

NARCOTIC/NEPHROTOXIN/NEUROTOXIN:
ACUTE EXPOSURE - THE ESTIMATED LETHAL DOSE FOR ADULTS IS 100 MILLILITERS. THERE ARE THREE STAGES OF INTOXICATION FOLLOWING INGESTION OF ETHYLENE GLYCOL: CENTRAL NERVOUS SYSTEM STIMULATION FOLLOWED BY DEPRESSION; CARDIORESPIRATORY FAILURE; AND RENAL FAILURE. AN ACUTE CENTRAL NERVOUS SYSTEM STAGE MAY FOLLOW SHORTLY AFTER INGESTION AND LAST SEVERAL HOURS WITH SYMPTOMS OF NAUSEA, VOMITING, ABDOMINAL PAIN, DEHYDRATION, VISUAL DIFFICULTY, CONFUSION, PERSONALITY CHANGES, HALLUCINATIONS, CONVULSIONS, COMA, MENINGISM, MYOCLONUS, FIXED PUPILS, DECREASED OR LOSS OF VISION, LOSS OF ACCOMMODATION, PAPILEDEMA, DIPLOPIA, NYSTAGMUS, STRABISMUS, ABNORMAL EYE MOVEMENTS, OPTIC NERVE ATROPHY, CRANIAL NERVE PALSIES, ATAXIA, TREMORS, MYOSITIS, MUSCLE TWITCHING, TETANY, HYPERREFLEXIA, AND AREFLEXIA. LIFE-THREATENING COMPLICATIONS WHICH MAY OCCUR IN THIS PERIOD INCLUDE RESPIRATORY FAILURE, SECONDARY TO CENTRAL NERVOUS SYSTEM DEPRESSION, CARDIOVASCULAR COLLAPSE, PULMONARY EDEMA AND SEVERE METABOLIC ACIDOSIS. WITHOUT TREATMENT, DEATH MAY OCCUR IN 8-24 HOURS. IF DEATH DOES NOT OCCUR EARLY, LUMBAR PAIN, ALBUMINURIA, HEMATURIA AND OLIGURIA PROGRESSING TO ANURIA ARE PROBABLE. ACUTE RENAL FAILURE WITH UREMIA, PERIPHERAL EDEMA, ASCITES, PULMONARY EDEMA, DROWSINESS, CYANOSIS, COMA AND DEATH IN 7-10 DAYS IS POSSIBLE. METABOLISM TO OXALIC ACID RESULTS IN PRECIPITATION OF CALCIUM OXALATE CRYSTALS IN SOFT TISSUES. CAPILLARY DAMAGE MAY RESULT IN EXUDATIVE, CONGESTIVE OR HEMORRHAGIC DAMAGE TO THE BRAIN, PERICARDIUM AND LIVER. MILDER INTOXICATION MAY RESULT IN INEBRIATION FOLLOWED BY AN ASYMPTOMATIC PERIOD OF SEVERAL DAYS BEFORE THE ONSET OF RENAL FAILURE. OLIGURIA MAY BE PERSISTENT, BUT EVENTUAL IMPROVEMENT IN RENAL FUNCTION IS ANTICIPATED IN SURVIVORS. PERMANENT CEREBRAL DAMAGE MAY OCCUR IN SURVIVORS OF PROLONGED COMA OR CONVULSIONS. CHRONIC EXPOSURE - REPEATED DAILY INGESTION OF 15-30 ML MAY CAUSE OLIGURIA WITHIN 24-72 HOURS, WHICH MAY PROGRESS RAPIDLY TO ANURIA AND UREMIA. REPEATED ADMINISTRATION TO ANIMALS RESULTED IN SHORTENED LIFE SPAN. CALCIUM OXALATE BLADDER STONES, SEVERE RENAL INJURY, PARTICULARLY OF THE TUBULES, AND CENTRIOBLULAR DEGENERATION OF THE LIVER. IN A TWO YEAR FEED STUDY, ADMINISTRATION RESULTED IN HEPATOCELLULAR HYALINE DEGENERATION AND INCREASED INCIDENCE OF MEDIAL HYPERPLASIA OF SMALL PULMONARY ARTERIES AND ARTERIOLES. MATERNAL EFFECTS, EFFECTS ON FERTILITY, FETAL DEVELOPMENTAL ABNORMALITIES AND EFFECTS ON THE EMBRYO AND FETUS HAVE BEEN REPORTED FROM REPEATED ADMINISTRATION TO RATS AND MICE DURING GESTATION; ADMINISTRATION TO LACTATING MICE PRODUCED DELAYED EFFECTS ON THE NEWBORN.

FIRST AID- REMOVE INGESTED MATERIAL BY GASTRIC LAVAGE OR EMESIS. GIVE ARTIFICIAL RESPIRATION WITH OXYGEN IF RESPIRATION IS DEPRESSED (DREIBACH HANDBOOK OF POISONING, 11TH ED.). GET MEDICAL ATTENTION IMMEDIATELY. ADMINISTRATION OF GASTRIC LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:

THE FOLLOWING ANTIDOTE(S) HAVE BEEN RECOMMENDED. HOWEVER, THE DECISION AS TO WHETHER THE SEVERITY OF POISONING REQUIRES ADMINISTRATION OF ANY ANTIDOTE AND ACTUAL DOSE REQUIRED SHOULD BE MADE BY QUALIFIED MEDICAL PERSONNEL.

ETHYLENE GLYCOL POISONING:

GIVE ETHANOL, 50% (100 PROOF), 1.5 ML/KG ORALLY INITIALLY, DILUTED TO NOT MORE THAN 5% SOLUTION, FOLLOWED BY 0.5-1.0 ML/KG EVERY 2 HOURS ORALLY OR INTRAVENOUSLY FOR 4 DAYS TO PREVENT METABOLISM OF INGESTED ETHYLENE GLYCOL

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TO OXALATE. BLOOD ETHANOL LEVEL SHOULD BE IN THE RANGE 1-1.5 MG/ML. GIVE CALCIUM GLUCONATE, 10 ML OF 10% SOLUTION DILUTED IN 1 LITER OF 5% GLUCOSE, INTRAVENOUSLY AS NECESSARY TO MAINTAIN NORMAL SERUM CALCIUM LEVELS. CALCIUM ADMINISTRATION MAY CAUSE ANURIA DUE TO PRECIPITATION OF CALCIUM OXALATE IN THE KIDNEYS (DREIBACH, HANDBOOK OF POISONING, 11TH ED.). IN THE ABSENCE OF RENAL IMPAIRMENT, FORCE FLUIDS TO 4 LITERS DAILY TO INCREASE EXCRETION OR PERFORM HEMODIALYSIS. ANTIDOTE SHOULD BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL.

ORAL OR INTRAVENOUS ADMINISTRATION OF 4-METHYLPYRAZOLE INHIBITS ALCOHOL DEHYDROGENASE AND HAS BEEN USED EFFECTIVELY AS AN ANTIDOTE FOR METHANOL OR ETHYLENE GLYCOL POISONING (ELLENHORN AND BARCELOUX, MEDICAL TOXICOLOGY).

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:

ETHYLENE GLYCOL:
AMMONIUM DICROMATE: IGNITES @ 100 C.
CHLOROSULFONIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
CHROMIUM TRIOXIDE: IGNITES ON CONTACT.
DIMETHYL TEREPHTHALATE + TITANIUM BUTOXIDE: POSSIBLE IGNITION.
OLEUM: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
PERCHLORIC ACID: VIOLENT DECOMPOSITION.
PHOSPHORUS(V) SULFIDE: EXPLOSIVE REACTION ON HEATING.
POTASSIUM DICROMATE: VIGOROUS EXOTHERMIC REACTION @ 100 C.
POTASSIUM PERMANGANATE: IGNITES ON CONTACT.
SILVER CHLORATE: IGNITES @ 100 C.
SILVERED COPPER WIRE: IGNITES.
SODIUM CHLORITE: IGNITES @ 100 C.
SODIUM HYDROXIDE: EXPLOSION HAZARD.
SODIUM PEROXIDE: IGNITES ON CONTACT.
SULFURIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
URANYL NITRATE: IGNITES @ 100 C.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

CONDITIONS TO AVOID

NONE REPORTED.

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
NO SPECIAL PRECAUTIONS INDICATED.

PROTECTIVE EQUIPMENT

VENTILATION:

PROVIDE LOCAL EXHAUST VENTILATION SYSTEM TO MEET PUBLISHED EXPOSURE LIMITS.

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 CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S) AND A FULL FACEPIECE.

ANY GAS MASK WITH ORGANIC VAPOR CANISTER (CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER), WITH A FULL FACEPIECE.

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 A 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

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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:

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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