Valid 02/1999 - 04/1999

Sigma Chemical Co.
P.O. Box 14508
St. Louis, MO 63178 USA
Tel: 314-771-5765

MATERIAL SAFETY DATA SHEET

SECTION 1. -- -- -- -- -- CHEMICAL IDENTIFICATION -- -- -- -- --
CATALOG #: D4254
NAME: N,N-DIMETHYLFORMAMIDE

SECTION 2. -- -- -- COMPOSITION/INFORMATION ON INGREDIENTS -- -- --
CAS #: 68-12-2
MF: C3H7NO
EC NO: 200-679-5
SYNONYMS
DIMETHYLMID KYSELINY MRAVENCI (CZECH) * DIMETHYLFORMAMID (GERMAN) *
DIMETHYL FORMAMIDE * N,N-DIMETHYL FORMAMIDE * DIMETHYLFORMAMIDE
(ACGIH:OSHA) * N,N-DIMETHYLMETHANAMIDE * DIMETILFORMAMIDE (ITALIAN) *
DIMETILFORMAMIDO (CZECH) * DMF * DMFA * DWUMETYLOFORMAMID (POLISH) *
N-FORMYLDEMYLAMINE * NCI-C60913 * NSC 5356 * U-4224 *

SECTION 3. -- -- -- -- -- HAZARDS IDENTIFICATION -- -- -- -- --
LABEL PRECAUTIONARY STATEMENTS
TOXIC
MAY CAUSE HARM TO THE UNBORN CHILD.
HARMFUL BY INHALATION AND IN CONTACT WITH SKIN.
IRRITATING TO EYES AND SKIN.
COMBUSTIBLE.
READILY ABSORBED THROUGH SKIN.
TARGET ORGAN(S):
LIVER
KIDNEYS
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE
IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE
PROTECTION.
DO NOT BREATHE VAPOR.

SECTION 4. -- -- -- -- FIRST-AID MEASURES -- -- -- -- -- --
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS
AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED
CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL
RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.
DISCARD CONTAMINATED SHOES.

SECTION 5. -- -- -- -- -- FIRE FIGHTING MEASURES -- -- -- -- -- --
EXTINGUISHING MEDIA
CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

SPECIAL FIREFIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO
PREVENT CONTACT WITH SKIN AND EYES.
COMBUSTIBLE.
UNUSUAL FIRE AND EXPLOSIONS HAZARDS
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

SECTION 6. -- -- -- -- ACCIDENTAL RELEASE MEASURES -- -- -- -- --
EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY
Rubber gloves. Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete. Refer to section 8.

Additional information: Dimethylformamide (DMF) mixed with triethylaluminum is explosive when heated. It reacts violently with carbon tetrachloride or 1,2,3,4,5,6-hexachlorocyclohexane (benzene hexachloride) above 65 C and with such oxidizing agents as chromic anhydride, magnesium nitrate, potassium permanganate, bromine and nitric acid. Runaway reactions with sodium hydride and borohydride have been reported. Can react vigorously in the presence of iron with halogenated hydrocarbons at moderate temperatures.

Section 8. -- -- -- -- Exposure controls/personal protection -- -- -- -- Wear appropriate NIOSH/MSHA-approved respirator, chemical-resistant gloves, safety goggles, other protective clothing. Safety shower and eye bath. Imperious protective clothing. Faceshield (8-inch minimum). Use only in a chemical fume hood. Do not breathe vapor. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure. Wash thoroughly after handling. Keep tightly closed. Keep away from heat and open flame. Store in a cool dry place.

Section 9. -- -- -- -- Physical and chemical properties -- -- -- -- Appearance and odor: Liquid.

Physical properties:
Boiling point: 153 C
Melting point: -61 C
Flashpoint: 136F
57.77C

Explosion limits in air:
Upper: 15.2%
Lower: 2.2%

Autoignition temperature: 833 F 444C

Vapor pressure: 2.7MM 20 C
Specific gravity: 0.944
Vapor density: 2.5

Section 10. -- -- -- -- -- Stability and reactivity -- -- -- -- Stability: Stable.

Incompatibilities:
Acid chlorides
Oxidizing agents
Chloroformates
Reducing agents
Halogens

Hazardous combustion or decomposition products: Thermal decomposition may produce carbon monoxide, carbon dioxide, and nitrogen oxides. Hazardous polymerization will not occur.

Section 11. -- -- -- -- -- Toxicological information -- -- -- -- Acute effects:
Harmful if inhaled.
Harmful if absorbed through skin.
May be harmful if swallowed.
Causes eye and skin irritation.
MATERIAL MAY BE IRRITATING TO MUCOUS MEMBRANES AND UPPER
RESPIRATORY TRACT.
EXPOSURE CAN CAUSE:
STOMACH PAINS, VOMITING, DIARRHEA.
NAUSEA, DIZZINESS AND HEADACHE
READILY ABSORBED THROUGH SKIN.
CHRONIC EFFECTS
THIS PRODUCT IS OR CONTAINS A COMPONENT THAT HAS BEEN REPORTED TO BE
POSSIBLY CARCINOGENIC BASED ON ITS IAAR, ACGIH, NTP OR EPA
CLASSIFICATION.
MAY CAUSE CONGENITAL MALFORMATION IN THE FETUS.
TARGET ORGAN(S):
LIVER
KIDNEYS
CENTRAL NERVOUS SYSTEM
CARDIOVASCULAR SYSTEM
BLOOD
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND
TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
ADDITIONAL INFORMATION
WARNING: INTOLERANCE FOR ALCOHOL CAN OCCUR UP TO 4 DAYS AFTER
DIMETHYLFORMAMIDE EXPOSURE. N,N-DIMETHYLFORMAMIDE IS CONSIDERED TO BE
A POTENT LIVER TOXIN.
RTECS #: LQ2100000
FORMAMIDE, N,N-DIMETHYL-
IRRITATION DATA
SKN-HMN 100%/24H MLD     BJIMAG 13,51,1956
EYE-RBT 100 MG RINSE SEV   DCTODJ 9,147,1986
TOXICITY DATA
ORL-RAT LD50:2800 MG/KG    ZEKBAI 69,103,1967
IPR-RAT LD50:1400 MG/KG    BJIMAG 13,51,1956
SCU-RAT LD50:3800 MG/KG    ARZNAD 15,618,1965
IVN-RAT LD50:2 GM/KG       ZEKBAI 69,103,1967
UNR-RAT LD50:3 GM/KG       ARZNAD 18,645,1968
ORL-MUS LD50:3700 MG/KG    GISAAA 23(5),31,1958
IH-L-MUS LC50:9400 MG/M3/2H TPKVAL 1,54,1961
IPR-MUS LD50:650 MG/KG     CNCRA6 30,9,1963
SCU-MUS LD50:4500 MG/KG    ARZNAD 15,618,1965
IVN-MUS LD50:2500 MG/KG    ARZNAD 15,618,1965
IMS-MUS LD50:3900 MG/KG    ARZNAD 15,618,1965
IVN-DG LD50:470 MG/KG      ARZNAD 15,618,1965
IPR-CAT LD50:500 MG/KG     BJIMAG 13,51,1956
ORL-RBT LD50:5 GM/KG       NTIS** OTS0520699
SKN-RBT LD50:4720 MG/KG    AIHAAP 30,470,1969
IPR-RBT LD50:1 GM/KG       BJIMAG 13,51,1956
IVN-RBT LD50:1800 MG/KG    ARZNAD 15,618,1965
IVN-GPG LD50:1050 MG/KG    ARZNAD 15,618,1965
TARGET ORGAN DATA
BEHAVIORAL (SOMNOLENCE)
BEHAVIORAL (MUSCLE WEAKNESS)
LIVER (OTHER CHANGES)
KIDNEY, URETER, BLADDER (OTHER CHANGES IN URINE COMPOSITION)
ENDOCRINE (EFFECT ON MENSTRUAL CYCLE)
BLOOD (CHANGES IN CELL COUNT)
PATERNAL EFFECTS (SPERMATOGENESIS)
MATERNAL EFFECTS (OTHER EFFECTS ON FEMALE)
EFFECTS ON FERTILITY (POST-IMPLANTATION MORTALITY)
EFFECTS ON EMBRYO OR FETUS (EXTRA EMBRYONIC STRUCTURES)
EFFECTS ON EMBRYO OR FETUS (FETOXICITY)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (BODY WALL)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
NUTRITIONAL AND GROSS METABOLIC (WEIGHT LOSS OR DECREASED WEIGHT GAIN)
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES
(RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR
COMPLETE INFORMATION.
SECTION 12. - - - - - - - ECOLOGICAL INFORMATION - - - - - - -
DATA NOT YET AVAILABLE.

SECTION 13. - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - -
THIS COMBUSTIBLE MATERIAL MAY BE BURNED IN A CHEMICAL INCINERATOR
EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.
OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - - - TRANSPORT INFORMATION - - - - - - -
CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - - - REGULATORY INFORMATION - - - - - - -

EUROPEAN INFORMATION
EC INDEX NO: 616-001-00-X
TOXIC
R 20/21
HARMFUL BY INHALATION AND IN CONTACT WITH SKIN.
R 36
IRRITATING TO EYES.
R 61
MAY CAUSE HARM TO THE UNBORN CHILD.
S 45
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE
IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
S 53
AVOID EXPOSURE - OBTAIN SPECIAL INSTRUCTIONS BEFORE USE.

REVIEWS, STANDARDS, AND REGULATIONS
OEL=NAK
AGCHI TLV-NOT CLASSIFIABLE AS A HUMAN CARCINOGEN DTLVS* TLV/BEI,1997
AGCHI TLV-TWA 30 MG/M³ (10 PPM) (SKIN) DTLVS* TLV/BEI,1997
IARC CANCER REVIEW: HUMAN LIMITED EVIDENCE IMEMDT 47,171,1989
IARC CANCER REVIEW: ANIMAL INADEQUATE EVIDENCE IMEMDT 47,171,1989
IARC CANCER REVIEW: GROUP 2B IMEMDT 47,171,1989
MSHA STANDARD-AIR: TWA 10 PPM (30 MG/M³) (SKIN)
DTLV* 3,90,1971
OSHA PEL (GEN INDU): 8H TWA 10 PPM (30 MG/M³) (SKIN)
CFRGR 29,1910.1000,1994
OSHA PEL (CONSTRUC): 8H TWA 10 PPM (30 MG/M³) (SKIN)
CFRGR 29,1926.55,1994
OSHA PEL (SHIPYARD): 8H TWA 10 PPM (30 MG/M³) (SKIN)
CFRGR 29,1915.1000,1993
OSHA PEL (FED CONT): 8H TWA 10 PPM (30 MG/M³) (SKIN)
CFRGR 41,50-204.50,1994
OEL-AUSTRALIA: TWA 10 PPM (30 MG/M³); SKIN JAN 1993
OEL-BELGIUM: TWA 10 PPM (30 MG/M³); SKIN JAN 1993
OEL-DENMARK: TWA 10 PPM (30 MG/M³); SKIN JAN 1993
OEL-FINLAND: TWA 10 PPM (30 MG/M³); STEL 20 PPM (60 MG/M³); SKIN JAN 1993
OEL-FRANCE: TWA 10 PPM (30 MG/M³); SKIN JAN 1993
OEL-GERMANY: TWA 20 PPM (60 MG/M³); SKIN JAN 1993
OEL-HUNGARY: TWA 10 MG/M³; STEL 20 MG/M³; SKIN JAN 1993
OEL-JAPAN: TWA 10 PPM (30 MG/M³); SKIN JAN 1993
OEL-THE NETHERLANDS: TWA 10 PPM (30 MG/M³); SKIN JAN 1993
OEL-THE PHILIPPINES: TWA 10 PPM (30 MG/M³); SKIN JAN 1993
OEL-POLAND: TWA 10 MG/M³ JAN 1993
OEL-RUSSIA: TWA 10 PPM; STEL 10 MG/M³; SKIN JAN 1993
OEL-SWEDEN: TWA 10 PPM (30 MG/M³); STEL 15 PPM (45 MG/M³); SKIN JAN 1993
OEL-SWITZERLAND: TWA 10 PPM (30 MG/M³); STEL 20 PPM; SKIN JAN 1993
OEL-TURKEY: TWA 10 PPM (30 MG/M³); SKIN JAN 1993
OEL-UNITED KINGDOM: TWA 10 PPM (30 MG/M³); STEL 20 PPM; SKIN JAN 1993
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV
NIOSH REL TO DIMETHYLFORMAMIDE-AIR: TWA 10 PPM (SK)
NIOSH* OHHS #92-100,1992
NOHS 1974: HZD 26560; NIS 64; TNF 3115; NOS 71; TNE 69191
NOES 1983: HZD 26560; NIS 85; TNF 6209; NOS 93; TNE 124683; TFE 16011
EPA GENETOX PROGRAM 1988, NEGATIVE: SHE-CLONAL ASSAY; SPERM
MORPHOLOGY-MOUSE
EPA GENETOX PROGRAM 1988, NEGATIVE: IN VITRO UDS IN RAT LIVER
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: MAMMALIAN MICRONUCLEUS
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JUNE 1998
NIOSH ANALYTICAL METHOD, 1994: DIMETHYLFORMAMIDE, 2004
NTP TOXICITY STUDIES, RPT# TOX-22, OCTOBER 1997
OSHA ANALYTICAL METHOD #ID-66

U.S. INFORMATION
THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

SECTION 16. -- - - - - - - - - OTHER INFORMATION-- -- -- -- -- -- --
THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO
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