

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 1 of 17

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

N,N-DIMETHYLFORMAMIDE

OTHER NAMES

C₃-H₇-N-O, C₃-H₇-N-O, H-CO-N-(CH₃)₂, H-CO-N-(CH₃)₂, "dimethyl formamide", "formyl dimethylamine", formyldimethylamine, formdimethylamide,

PROPER SHIPPING NAME

N,N-DIMETHYL-FORMAMIDE
N,N-DIMETHYLFORMAMIDE

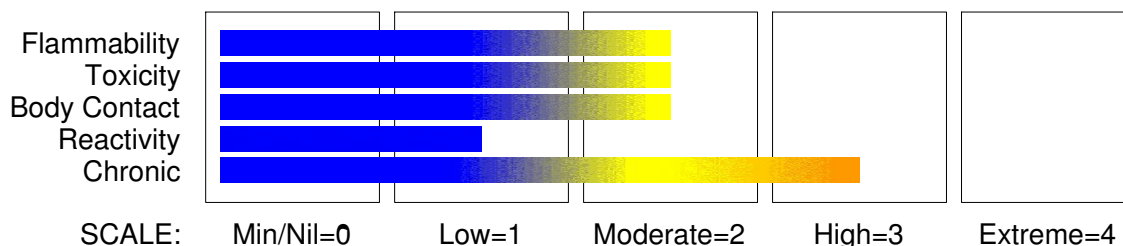
PRODUCT USE

Solvent for liquids and gases. In the synthesis of organic compounds;. wherever a solvent with a low rate of evaporation is required.
Employed as a booster or co-solvent in applications such as coatings, adhesives, films and printing inks. A component of many paint removers. A solvent for polyacrylic fibres.

SUPPLIER

Company: S D FINE- CHEM LIMITED
Address:
315- 317, T.V. INDUSTRIAL ESTATE,
248, WORLI,
MUMBAI- 400030.INDIA.
technical@sdfine.com
Telephone: 91- 22- 24959898
Telephone: 91- 22- 24959899
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HAZARD RATINGS



continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 2 of 17

Section 2 - HAZARDS IDENTIFICATION

GHS Classification

Acute Toxicity (Dermal) Category 4
Acute Toxicity (Inhalation) Category 4
Acute Toxicity (Oral) Category 5
Eye Irritation Category 2A
Flammable Liquid Category 3
Reproductive Toxicity Category 1B
Skin Corrosion/Irritation Category 3



EMERGENCY OVERVIEW

HAZARD

DANGER

Determined by using GHS criteria:

H226 H332 H312 H303 H316 H319 H360

Flammable liquid and vapour

Harmful if inhaled

Harmful in contact with skin

May be harmful if swallowed

Causes mild skin irritation

Causes serious eye irritation

May damage the unborn child

PRECAUTIONARY STATEMENTS

Prevention

Wash hands thoroughly after handling.

Ground/bond container and receiving equipment.

Do not handle until all safety precautions have been read and understood.

Obtain special instructions before use.

Avoid breathing dust/fume/gas/mist/vapours/spray.

Use only outdoors or in a well ventilated area.

Wear protective gloves/clothing

Use only non-sparking tools.

Keep container tightly closed.

Keep away from heat/sparks/open flame - No smoking.

Use personal protective equipment as required.

Take precautionary measures against static discharge

Use explosion-proof electrical/ventilating/lighting/equipment

Wear protective gloves and eye/face protection.

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 3 of 17

Section 2 - HAZARDS IDENTIFICATION

Response

Wash contaminated clothing before reuse.
If exposed or concerned: Get medical attention advice.
Wear eye/face protection.
If eye irritation persists, get medical advice/attention.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If skin irritation occurs, seek medical advice/attention.
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
Specific treatment: refer to Label or MSDS.
If on skin or hair: remove/take off immediately all contaminated clothing. Rinse with water/shower.
Call a POISON CENTER or doctor/physician if you feel unwell.
IF ON SKIN: Gently wash with plenty of soap and water.
IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.

Storage

Store locked up.

Disposal

Dispose of contents and container in accordance with relevant legislation.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
N, N- dimethylformamide	68-12-2	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

- Immediately give a glass of water.
- First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

EYE

- If this product comes in contact with the eyes:
- Wash out immediately with fresh running water.
 - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
 - If pain persists or recurs seek medical attention.
 - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin contact occurs:
- Immediately remove all contaminated clothing, including footwear.
 - Flush skin and hair with running water (and soap if available).
 - Seek medical attention in event of irritation.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 4 of 17

Section 4 - FIRST AID MEASURES

- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor.

NOTES TO PHYSICIAN

Treat symptomatically.

Depending on the degree of exposure, preplacement and periodic medical examination is desirable, especially evaluating the liver and kidney functions, and possible skin effects.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

DO NOT use halogenated fire extinguishing agents.

- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- If safe, switch off electrical equipment until vapour fire hazard removed.
- Use water delivered as a fine spray to control fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.

FIRE/EXPLOSION HAZARD

- Liquid and vapour are flammable.
 - Moderate fire hazard when exposed to heat or flame.
 - Vapour forms an explosive mixture with air.
 - Moderate explosion hazard when exposed to heat or flame.
 - Vapour may travel a considerable distance to source of ignition.
 - Heating may cause expansion or decomposition leading to violent rupture of containers.
 - On combustion, may emit toxic fumes of carbon monoxide (CO).
- Combustion products include: carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides (NO_x), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY

Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 5 of 17

Section 5 - FIRE FIGHTING MEASURES

Personal Protective Equipment

Breathing apparatus.
Chemical splash suit.

Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS

- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb small quantities with vermiculite or other absorbent material.
- Wipe up.
- Collect residues in a flammable waste container.

MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse / absorb vapour.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labelled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)

The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:

N,N-dimethylformamide 200 ppm

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:

N,N-dimethylformamide 100 ppm

other than mild, transient adverse effects without perceiving a clearly defined odour is:

N,N-dimethylformamide 2 ppm

The threshold concentration below which most people will experience no appreciable risk of health effects:

N,N-dimethylformamide 2 ppm

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 6 of 17

Section 6 - ACCIDENTAL RELEASE MEASURES

American Industrial Hygiene Association (AIHA)

Ingredients considered according to the following cutoffs

Very Toxic (T+)	$\geq 0.1\%$	Toxic (T)	$\geq 3.0\%$
R50	$\geq 0.25\%$	Corrosive (C)	$\geq 5.0\%$
R51	$\geq 2.5\%$		
else	$\geq 10\%$		

where percentage is percentage of ingredient found in the mixture

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



+: May be stored together

O: May be stored together with specific precautions

X: Must not be stored together

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

DO NOT allow clothing wet with material to stay in contact with skin.

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of overexposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- Avoid smoking, naked lights or ignition sources.
- Avoid generation of static electricity.
- DO NOT use plastic buckets.
- Earth all lines and equipment.
- Use spark-free tools when handling.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
- Containers, even those that have been emptied, may contain explosive vapours.
- Do NOT cut, drill, grind, weld or perform similar operations on or near containers.

SUITABLE CONTAINER

- Packing as supplied by manufacturer.
- Plastic containers may only be used if approved for flammable liquid.

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 7 of 17

Section 7 - HANDLING AND STORAGE

- Check that containers are clearly labelled and free from leaks.
 - For low viscosity materials (i) : Drums and jerry cans must be of the non-removable head type. (ii) : Where a can is to be used as an inner package, the can must have a screwed enclosure.
 - For materials with a viscosity of at least 2680 cSt. (23 deg. C)
 - For manufactured product having a viscosity of at least 250 cSt. (23 deg. C)
 - Manufactured product that requires stirring before use and having a viscosity of at least 20 cSt (25 deg. C)
 - (i) : Removable head packaging;
 - (ii) : Cans with friction closures and
 - (iii) : low pressure tubes and cartridges may be used.
 - Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages
 - In addition, where inner packagings are glass and contain liquids of packing group I there must be sufficient inert absorbent to absorb any spillage, unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.
- High purity DMF, required for acrylic fibres, is best stored in aluminium tanks.

STORAGE INCOMPATIBILITY

- Avoid oxidising agents, acids, acid chlorides, acid anhydrides.
- Reacts violently with aluminium alkyls, 2,5-bis-endo-dichloro-7-bicyclo[2.2.1]heptane, carbon tetrachloride (above 65 C.), 2,5-dimethylpyrrole and phosphorous trichloride mixture, halogens, halogenated hydrocarbons and metal mixtures, highly halogenated compounds like carbon tetrachloride and hexachlorocyclohexane in the presence of iron, lithium azide, phosphorous trioxide, sodium and compounds.
- May polymerise violently with methylene diisocyanate.
- Reacts with borohydride and 2,4,6-trichloro-1,3,5-triazine.
- Avoid reaction with strong oxidisers, halogens (eg. CCl₄, Br₂), and nitrates (eg. Mg(NO₃)₂) and alkylaluminiums. Dimethylformamide will attack some forms of plastics, rubbers and coatings (polyethylene lined drums are safe to use).
- May attack brass, copper and its alloys, plastic, rubber and coatings.

STORAGE REQUIREMENTS

- Store in original containers in approved flammable liquid storage area.
- DO NOT store in pits, depressions, basements or areas where vapours may be trapped.
- No smoking, naked lights, heat or ignition sources.
- Keep containers securely sealed.
- Store away from incompatible materials in a cool, dry, well-ventilated area.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 8 of 17

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

ODOUR SAFETY FACTOR (OSF)

OSF=4.5 ("N,N-DIMETHYL FORMAMIDE")

Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.

Odour Safety Factor (OSF) is determined to fall into either Class C, D or E.

The Odour Safety Factor (OSF) is defined as:

OSF= Exposure Standard (TWA) ppm/ Odour Threshold Value (OTV) ppm

Classification into classes follows:

Class	OSF	Description
A	550	Over 90% of exposed individuals are aware by smell that the Exposure Standard (TLV- TWA for example) is being reached, even when distracted by working activities
B	26- 550	As " A" for 50- 90% of persons being distracted
C	1- 26	As " A" for less than 50% of persons being distracted
D	0.18- 1	10- 50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	As " D" for less than 10% of persons aware of being tested

MATERIAL DATA

Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no -observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five -category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.

OSHA (USA) concluded that exposure to sensory irritants can:

- cause inflammation
- cause increased susceptibility to other irritants and infectious agents
- lead to permanent injury or dysfunction
- permit greater absorption of hazardous substances and
- acclimate the worker to the irritant warning properties of these substances thus increasing the risk of overexposure.

Odour Threshold Value: 0.047 ppm, 100 ppm (recognition)

NOTE: Detector tubes for dimethylformamide, measuring in excess of 10 ppm,

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 9 of 17

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

are commercially available.

DMF is toxic to the liver. Numerous studies have attempted to establish whether DMF causes foetal malformation. The reports that have undergone examination for reproducibility, accuracy and clarity by the ACGIH and indicate that DMF does not cause malformations but does produce increased embryonic deaths when doses approach the lethal level for the female parent of the species. These doses are greatly in excess of the dose available by exposure at the TLV.

PERSONAL PROTECTION



EYE

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET

Suitability and durability of glove type is dependent on usage. Factors such as:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity,

are important in the selection of gloves.

Wear chemical protective gloves, eg. PVC.

Wear safety footwear or safety gumboots, eg. Rubber.

OTHER

- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:

"Forsberg Clothing Performance Index".

The effect(s) of the following substance(s) are taken into account in the computer-generated selection: N, N- dimethylformamide

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 10 of 17

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Material

BUTYL	A
BUTYL/NEOPRENE	A
SARANEX- 23 2- PLY	A
VITON/CHLOROBUTYL	A
PE/EVAL/PE	A
TEFLON	B
CPE	B
SARANEX- 23	C
NATURAL+NEOPRENE	C
PVA	C
NEOPRENE	C
NATURAL RUBBER	C
NITRILE+PVC	C
PVC	C
NITRILE	C

A: Best Selection

B: Satisfactory; may degrade after 4 hours continuous immersion

C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

RESPIRATOR

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half- face Respirator	Full- Face Respirator
1000	10	A- AUS	-
1000	50	-	A- AUS
5000	50	Airline *	-
5000	100	-	A- 2
10000	100	-	A- 3
	100+		Airline**

* - Continuous Flow

** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

For further information consult
your

Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

For flammable liquids and flammable gases, local exhaust ventilation or a process enclosure ventilation system may be required. Ventilation equipment should be explosion

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 11 of 17

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

-resistant.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:

solvent, vapours, degreasing etc., evaporating from tank (in still air).

aerosols, fumes from pouring operations,

intermittent container filling, low speed

conveyer transfers, welding, spray drift,

plating acid fumes, pickling (released at low velocity into zone of active generation)

direct spray, spray painting in shallow booths,

drum filling, conveyer loading, crusher dusts,

gas discharge (active generation into zone of rapid air motion)

Air Speed:

0.25- 0.5 m/s (50- 100 f/min.)

0.5- 1 m/s (100- 200 f/min.)

1- 2.5 m/s (200- 500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range

1: Room air currents minimal or favourable to capture

2: Contaminants of low toxicity or of nuisance value only.

3: Intermittent, low production.

4: Large hood or large air mass in motion

Upper end of the range

1: Disturbing room air currents

2: Contaminants of high toxicity

3: High production, heavy use

4: Small hood- local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min.) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Clear, colourless to slightly yellow, mobile liquid with an amine-like (fishy) or ammonia-like odour. Viscosity : 0.802 mPa sec @ 25C.

Completely miscible in water and readily dissolves many resins and polymers.

PHYSICAL PROPERTIES

Liquid.

Mixes with water.

Molecular Weight: 73.11

Melting Range (°C): - 61

Solubility in water (g/L): Miscible

pH (1% solution): <7 slightly acid

Boiling Range (°C): 153

Specific Gravity (water=1): 0.94 @ 25C

pH (as supplied): Not applicable

Vapour Pressure (kPa): 0.5 @ 25C

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 12 of 17

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Volatile Component (%vol): 100
Relative Vapour Density (air=1): 2.5
Lower Explosive Limit (%): 2.2
Autoignition Temp (°C): 445
State: Liquid

Evaporation Rate: 0.17 BuAc=1
Flash Point (°C): 58
Upper Explosive Limit (%): 15.2
Decomposition Temp (°C): Not Available
Viscosity: 0.802 cSt@40°C

log Kow (Sangster 1997): - 1.01
log Kow: -1.01

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

Accidental ingestion of the material may be damaging to the health of the individual.

Symptoms of exposure may be delayed.

The material is not thought to produce adverse health effects following ingestion (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum.

EYE

Evidence exists, or practical experience predicts, that the material may cause severe eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals. Eye contact may cause significant inflammation with pain. Corneal injury may occur; permanent impairment of vision may result unless treatment is prompt and adequate. Repeated or prolonged exposure to irritants may cause inflammation characterised by a temporary redness (similar to windburn) of the conjunctiva (conjunctivitis); temporary impairment of vision and/or other transient eye damage/ulceration may occur.

SKIN

Skin contact with the material may be harmful; systemic effects may result following absorption.

Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

The material may produce mild skin irritation; limited evidence or practical experience suggests, that the material either:

- produces mild inflammation of the skin in a substantial number of individuals following

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 13 of 17

Section 11 - TOXICOLOGICAL INFORMATION

direct contact, and/or

- produces significant, but mild, inflammation when applied to the healthy intact skin of animals (for up to four hours), such inflammation being present twenty-four hours or more after the end of the exposure period.

Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (non allergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis.

INHALED

Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful.

Inhalation hazard is increased at higher temperatures.

The material is not thought to produce respiratory irritation (as classified by EC Directives using animal models). Nevertheless inhalation of vapours, fumes or aerosols, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress.

At sufficiently high doses the material may be hepatotoxic (i.e. poisonous to the liver).

CHRONIC HEALTH EFFECTS

On the basis, primarily, of animal experiments, concern has been expressed by at least one classification body that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment.

There is sufficient evidence to provide a strong presumption that human exposure to the material may result in developmental toxicity, generally on the basis of:

- clear results in appropriate animal studies where effects have been observed in the absence of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not secondary non-specific consequences of the other toxic effects.

Liver injury has been produced in cats after prolonged inhalation of 100 ppm (but not rats).

Leather tannery and airframe repair shop workers exposed to DMF and a number of other chemicals showed an increased number of testicular cancers above the number of expected cases. The available data however does not conclusively establish DMF as a carcinogen.

The literature contains citations indicating DMF increases the rate of embryonic mortalities in animals at high maternal doses.

TOXICITY AND IRRITATION

TOXICITY

Oral (rat) LD50: 2800 mg/kg
Inhalation (human) TCl₀: 20 ppm
Intraperitoneal (Rat) LD50: 1400 mg/kg
Subcutaneous (Rat) LD50: 3800 mg/kg
Oral (Mouse) LD50: 2900 mg/kg
Intravenous (Dog) LD50: 470 mg/kg
Intraperitoneal (Cat) LD50: 500 mg/kg
Inhalation (Mouse) LC50: 9400 mg/m³/2h
Intraperitoneal (Mouse) LD50: 650 mg/kg
Subcutaneous (Mouse) LD50: 4500 mg/kg
Intravenous (Mouse) LD50: 2500 mg/kg
Intravenous (Rabbit) LD50: 1800 mg/kg
Intravenous (Guinea) pig: LD50 1050 mg/kg

IRRITATION

Skin (human): 100%/24h - Mild
Skin (rabbit): 10 mg/24h (open)
Eye (rabbit): 100mg(rinsed)- SEVERE

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 14 of 17

Section 11 - TOXICOLOGICAL INFORMATION

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.

The substance is classified by IARC as Group 3:
NOT classifiable as to its carcinogenicity to humans.

Evidence of carcinogenicity may be inadequate or limited in animal testing.

Dermal (rabbit): 4720 mg/kg Eye (rabbit): 20 mg (open)

Section 12 - ECOLOGICAL INFORMATION

Hazardous Air Pollutant:	Yes
log Kow (Sangster 1997):	- 1.01
log Pow (Verschuere 1983):	1.47457627

DO NOT discharge into sewer or waterways.

log Kow: -1.01

Koc: 7

Half-life (hr) air: 2

Henry's atm m³ /mol: 7.39E-08

Log BCF: -1

Toxicity Fish: LC50(96)2695-3677mg/L

Bioaccumulation: not sig

Degradation Biological: little, slow

processes Abiotic: RxnOH*,hydrol&photol not sig

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible.
 - Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
 - Dispose of by: Burial in a licenced land-fill or Incineration in a licenced apparatus (after admixture with suitable combustible material).
 - Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.
 - Containers may still present a chemical hazard/ danger when empty.
 - Return to supplier for reuse/ recycling if possible.
- Otherwise:
- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
 - Where possible retain label warnings and MSDS and observe all notices pertaining to the product.

WASTE DISPOSAL PROCEDURES

- Collect and package recoverable quantities of dimethylformamide in nonhalogenated solvent disposal containers for recycling or incineration. Burn in a furnace equipped with an afterburner and scrubber. Wear eye protection,

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 15 of 17

Section 13 - DISPOSAL CONSIDERATIONS

butyl rubber gloves and protective clothing to control personal contact from small quantities of dimethylformamide. Work in a well ventilated area, and add 10mL of 10% sodium hydroxide solution for every 1mL of dimethylformamide. Heat the mixture under reflux for 30 minutes , or allow the mixture to stand at room temperature for 48 hours. Empty the liquid into the drain with water [Armour 1996].

SPILLAGE DISPOSAL

- Wear eye protection, protective clothing and butyl rubber gloves to control personal contact from dimethylformamide. Cover the spill with a 1:1:1 mixture by weight of soda ash, bentonite and sand. Collect the absorbed material and transport to a well ventilated area. Add the mixture to a 10% sodium hydroxide solution, allowing 10mL of sodium hydroxide for each 1mL of dimethylformamide. Allow the solution to stand for 48 hours. Decant the liquid into the drain with water. Collect the recoverable solid and discard as normal refuse [Armour 1996].

Section 14 - TRANSPORTATION INFORMATION



Labels Required: FLAMMABLE LIQUID
HAZCHEM: 2W

UNDG:

Dangerous Goods Class:	3	Subrisk:	None
UN Number:	2265	Packing Group:	III
Shipping Name: N,N-DIMETHYL-FORMAMIDE			
N,N-DIMETHYLFORMAMIDE			

Air Transport IATA:

ICAO/IATA Class:	3	ICAO/IATA Subrisk:	None
UN/ID Number:	2265	Packing Group:	III
ERG Code:	3L		
Shipping name: N,N-DIMETHYL-FORMAMIDE			
N,N-DIMETHYLFORMAMIDE			

Maritime Transport IMDG:

IMDG Class:	3	IMDG Subrisk:	None
UN Number:	2265	Packing Group:	III
EMS Number:	F- E, S- D		
Shipping name: N,N-DIMETHYL-FORMAMIDE			
N,N-DIMETHYLFORMAMIDE			

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 16 of 17

Section 15 - REGULATORY INFORMATION

REGULATIONS

N,N-dimethylformamide (CAS: 68-12-2) is found on the following regulatory lists;
IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk
International Agency for Research on Cancer (IARC) Carcinogens
International Council of Chemical Associations (ICCA) - High Production Volume List
OECD Representative List of High Production Volume (HPV) Chemicals

No data available for N,N-dimethylformamide as CAS: 15175-63-0, CAS: 114057-15-7, CAS: 33513-42-7, CAS: 15175-77-6.

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
N, N- dimethylformamide	68- 12- 2, 15175- 63- 0, 114057- 15- 7, 33513- 42- 7, 15175- 77- 6

REPRODUCTIVE HEALTH GUIDELINES

Established occupational exposure limits frequently do not take into consideration reproductive end points that are clearly below the thresholds for other toxic effects. Occupational reproductive guidelines (ORGs) have been suggested as an additional standard. These have been established after a literature search for reproductive no-observed-adverse effect-level (NOAEL) and the lowest-observed-adverse-effect-level (LOAEL). In addition the US EPA's procedures for risk assessment for hazard identification and dose-response assessment as applied by NIOSH were used in the creation of such limits. Uncertainty factors (UFs) have also been incorporated.

Ingredient	ORG	UF	Endpoi nt	CR	Adeq TLV
N, N- dimethylformamide	1.35 mg/m3	100	D	NA	-

These exposure guidelines have been derived from a screening level of risk assessment and should not be construed as unequivocally safe limits. ORGS represent an 8-hour time-weighted average unless specified otherwise.

CR = Cancer Risk/10000; UF = Uncertainty factor:

TLV believed to be adequate to protect reproductive health:

LOD: Limit of detection

Toxic endpoints have also been identified as:

D = Developmental; R = Reproductive; TC = Transplacental carcinogen

Jankovic J., Drake F.: A Screening Method for Occupational Reproductive

American Industrial Hygiene Association Journal 57: 641-649 (1996).

The above information is believed to be accurate and represent the best information currently available to us, but does not represent any warranty expressed or implied of the properties of the product. User should make their own investigation to

continued...

N,N-DIMETHYLFORMAMIDE

GHS Safety Data Sheet

Version No:4

Page 17 of 17

Section 16 - OTHER INFORMATION

determine the suitability of the information for their particular purpose.

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