

# N,N-Dimethylformamide

sc-253141



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key:

EXTREME

HIGH

MODERATE

LOW

## Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

### PRODUCT NAME

N,N-Dimethylformamide

### STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

### NFPA



### SUPPLIER

Company: Santa Cruz Biotechnology, Inc.

Address:

2145 Delaware Ave

Santa Cruz, CA 95060

United States of America

Telephone: 800.457.3801 or 831.457.3800

Emergency Tel: ChemWatch

Emergency Tel: From within the US and Canada: 877-715-9305

From outside the US and Canada: 800-2436-2255 (1-800-CHEMCALL) Or call 613-9573-3112

### SYNONYMS

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

## Section 2 - HAZARDS IDENTIFICATION

### CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability:	2	
Toxicity:	2	
Body Contact:	2	
Reactivity:	1	
Chronic:	3	

Min/Nil=0  
Low=1  
Moderate=2  
High=3  
Extreme=4



### CANADIAN WHMIS SYMBOLS



## EMERGENCY OVERVIEW

### RISK

Irritating to eyes.  
May cause harm to the unborn child.  
HARMFUL - May cause lung damage if swallowed.  
Harmful by inhalation and in contact with skin.  
Flammable.

## POTENTIAL HEALTH EFFECTS

### ACUTE HEALTH EFFECTS

#### SWALLOWED

- Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733).
- Accidental ingestion of the material may be damaging to the health of the individual.
- Symptoms of exposure may be delayed.
- At sufficiently high doses the material may be hepatotoxic (i.e. poisonous to the liver).

#### EYE

- There is evidence that material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Severe inflammation may be expected with pain. There may be damage to the cornea. Unless treatment is prompt and adequate there may be permanent loss of vision. Conjunctivitis can occur following repeated exposure.

#### SKIN

- Skin contact with the material may be harmful; systemic effects may result following absorption.
  - There is some evidence to suggest that the material may cause mild but significant inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterized by redness, swelling and blistering.
  - Open cuts, abraded or irritated skin should not be exposed to this material.
  - 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.
  - DMF is extensively absorbed through the skin, its metabolism and kinetics are well known, and urinary metabolites exist that can be accurately measured. As a result, biological monitoring has been extensively used in the assessment of the absorbed amounts in occupationally exposed populations. The metabolite most often analysed is N-methylformamide (NMF)
- In one case of accidental exposure, to dimethylformamide, the patient showed itching, hyperaemia, abdominal pain, vomiting and increased blood pressure. There are inconclusive reports of human sensitisation.

#### INHALED

- Inhalation of vapors or aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful.
  - The material is not thought to produce respiratory irritation (as classified using animal models). Nevertheless inhalation of vapors, fumes or aerosols, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress.
  - Inhalation and/or ingestion, of dimethylformamide (DMF), can lead to headache, dizziness, nausea, vomiting, anorexia and abdominal spasm. The use of alcoholic beverages accentuates the toxic effects and intolerance to alcohol can occur up to 4 days after exposure. Case reports in workers acutely exposed to DMF confirm that the liver is the target organ, with hepatic effects and associated disorders of the digestive system being reported. Symptoms include abdominal pain, anorexia, incoordination, and jaundice, as well as nausea, vomiting, and diarrhoea; nasal and skin irritation have also been reported
- Single exposures of 6 hours duration to air saturated with DMF vapour (approximately 5000 ppm) at room temperature killed rats and produced injury to lungs, liver and kidneys. At 2500 ppm rats were killed after five 6-hour exposures. At 20 ppm dogs survived more than 100 exposure periods of 6 hours and showed no gross pathology but did show a functional drop in systolic blood pressure.
- Inhalation hazard is increased at higher temperatures.

## CHRONIC HEALTH EFFECTS

- Ample evidence exists, from results in experimentation, that developmental disorders are directly caused by human exposure to the material.
- There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment. Liver injury has been produced in cats after prolonged inhalation of 100 ppm dimethylformamide (DMF) (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.

## Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

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

## Section 4 - FIRST AID MEASURES

### SWALLOWED

- 
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Seek medical advice.
- If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

### 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.
- 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

- Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically. Mechanical means should be used if it is considered necessary to evacuate the stomach contents; these include gastric lavage after endotracheal intubation. If spontaneous vomiting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours. Treat symptomatically.

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

## Section 5 - FIRE FIGHTING MEASURES

Vapor Pressure (mmHg):	3.75 @ 25C
Upper Explosive Limit (%):	15.2
Specific Gravity (water=1):	0.94 @ 25C
Lower Explosive Limit (%):	2.2

### 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 Emergency Responders 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 vapor 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.

### **GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS**

- 
- Liquid and vapor are flammable.
- Moderate fire hazard when exposed to heat or flame.
- Vapor forms an explosive mixture with air.
- Moderate explosion hazard when exposed to heat or flame.
- Vapor 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 dioxide (CO<sub>2</sub>), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), other pyrolysis products typical of burning organic material.

### **FIRE INCOMPATIBILITY**

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

### **PERSONAL PROTECTION**

Glasses:

Chemical goggles.

Gloves:

1.BUTYL 2.BUTYL/NEOPRENE 3.CPE

Respirator:

Type A Filter of sufficient capacity

## **Section 6 - ACCIDENTAL RELEASE MEASURES**

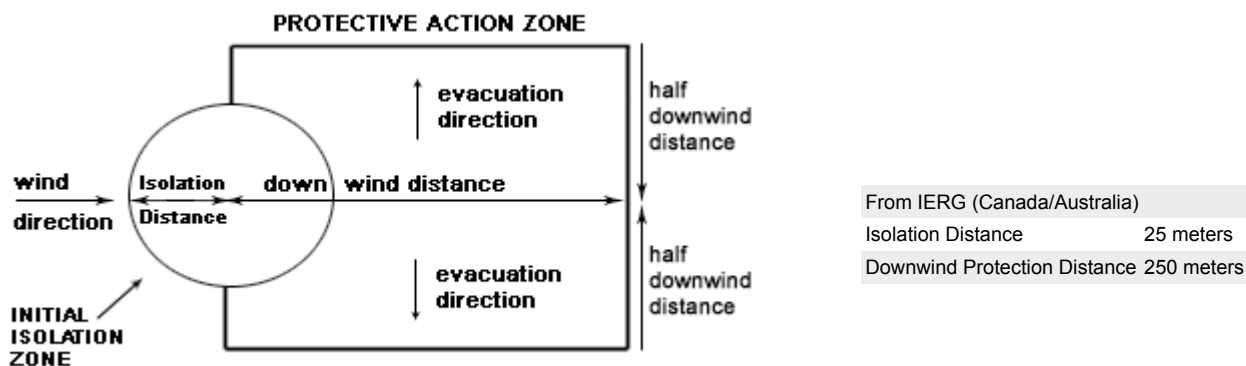
### **MINOR SPILLS**

- 
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapors 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 Emergency Responders 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 vapor.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labeled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services. \_

### **PROTECTIVE ACTIONS FOR SPILL**



From US Emergency Response Guide 2000 Guide 129

## FOOTNOTES

- 1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
- 2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.
- 3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.
- 4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.
- 5 Guide 129 is taken from the US DOT emergency response guide book.
- 6 IERG information is derived from CANUTEC - Transport Canada.

## ACUTE EXPOSURE GUIDELINE LEVELS (AEG) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

## 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	200ppm
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irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:

N,N-dimethylformamide	100ppm
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other than mild, transient adverse effects without perceiving a clearly defined odour is:

N,N-dimethylformamide	2ppm
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American Industrial Hygiene Association (AIHA)

Ingredients considered according exceed the following cutoffs

Very Toxic (T+)	>= 0.1%	Toxic (T)	>= 3.0%
R50	>= 0.25%	Corrosive (C)	>= 5.0%
R51	>= 2.5%		
else	>= 10%		

where percentage is percentage of ingredient found in the mixture

## Section 7 - HANDLING AND STORAGE

## PROCEDURE FOR HANDLING

- 
- Containers, even those that have been emptied, may contain explosive vapors.
- Do NOT cut, drill, grind, weld or perform similar operations on or near containers.
- 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.

## RECOMMENDED STORAGE METHODS

- Packing as supplied by manufacturer. Plastic containers may only be used if approved for flammable liquid. Check that containers are clearly labeled and free from leaks.
- For low viscosity materials (i): Drums and jerricans 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 (23 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 molded plastic box and the substances are not incompatible with the plastic.

## STORAGE REQUIREMENTS

- 
- Store in original containers in approved flammable liquid storage area.
- DO NOT store in pits, depressions, basements or areas where vapors 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.

## SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X: Must not be stored together

O: May be stored together with specific preventions

+: May be stored together

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m <sup>3</sup>	STEL ppm	STEL mg/m <sup>3</sup>	Notes
_____	_____	_____	_____	_____	_____	_____

Canada - Alberta Occupational Exposure Limits	N,N-dimethylformamide (Dimethylformamide)	10	30		
Canada - British Columbia Occupational Exposure Limits	N,N-dimethylformamide (Dimethylformamide)	10			Skin
Canada - Ontario Occupational Exposure Limits	N,N-dimethylformamide (N,N-Dimethylformamide)	10	30		Skin
US OSHA Permissible Exposure Levels (PELs) - Table Z1	N,N-dimethylformamide (Dimethylformamide)	10	30		
US ACGIH Threshold Limit Values (TLV)	N,N-dimethylformamide (Dimethylformamide)	10			TLV Basis: liver damage. BEI
US NIOSH Recommended Exposure Limits (RELs)	N,N-dimethylformamide (Dimethylformamide)	10	30		[skin]
US - Minnesota Permissible Exposure Limits (PELs)	N,N-dimethylformamide (Dimethylformamide)	10	30		
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	N,N-dimethylformamide (Dimethylformamide)	10	30		
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	N,N-dimethylformamide (Dimethylformamide)	10	30		
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	N,N-dimethylformamide (Dimethylformamide)	10	30		
US - California Permissible Exposure Limits for Chemical Contaminants	N,N-dimethylformamide (Dimethylformamide; DMF)	10	30		
US - Idaho - Limits for Air Contaminants	N,N-dimethylformamide (Dimethylformamide-Skin)	10	30		
US - Hawaii Air Contaminant Limits	N,N-dimethylformamide (Dimethylformamide)	10	30	20	60
US - Alaska Limits for Air Contaminants	N,N-dimethylformamide (Dimethylformamide)	10	30		
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	N,N-dimethylformamide (Dimethylformamide - Skin)	10	30	20	60
US - Washington Permissible exposure limits of air contaminants	N,N-dimethylformamide (Dimethylformamide)	10		20	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	N,N-dimethylformamide (Dimethylformamide)	10		15	Skin, T20
US - Michigan Exposure Limits for Air Contaminants	N,N-dimethylformamide (Dimethylformamide)	10	30		

Canada - Prince Edward Island Occupational Exposure Limits	N,N-dimethylformamide (Dimethylformamide)	10				TLV Basis: liver damage. BEI
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	N,N-dimethylformamide (Dimethylformamide)	10	30			
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	N,N-dimethylformamide (N,N-Dimethylformamide)	10	30			
US - Oregon Permissible Exposure Limits (Z-1)	N,N-dimethylformamide (Dimethylformamide)	10	30			
Canada - Northwest Territories Occupational Exposure Limits (English)	N,N-dimethylformamide (Dimethylformamide - Skin)	10	30	20	60	
Canada - Nova Scotia Occupational Exposure Limits	N,N-dimethylformamide (Dimethylformamide)	10				TLV Basis: liver damage. BEI

ENDOELTABLE

### ODOR 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.

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

The Odor Safety Factor (OSF) is defined as:

OSF= Exposure Standard (TWA) ppm/ Odor 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	Idem for 50-90% of persons being distracted
C	1-26	Idem for less than 50% of persons being distracted
D	0.18-1	0-50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	Idem for less than 10% of persons aware of being tested

Amoore and Hautala \* have determined that it is only at an OSF value of 26 that 50% of distracted persons can detect the substance at the Exposure Standard value. In the case of alerted persons, an OSF of 26 means that 99% of them can detect the odor at the Exposure Standard value. It is ONLY for substances belonging to Class A and B that there is a reasonable chance of being warned in time, that the Exposure Standard is being exceeded. \* Journal Applied Toxicology: Vol 3, 1983, p272

NOTE: The use of the OSF may be inappropriate for mixtures where substances mask the odor of others.

### MATERIAL DATA

N,N-DIMETHYLFORMAMIDE:

■ 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 for dimethylformamide (DMF): 0.047 ppm, 100 ppm (recognition)

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

Odour Safety Factor(OSF)

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

## PERSONAL PROTECTION



Consult your EHS staff for recommendations

### EYE

- 
- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses.

### HANDS/FEET

- Wear chemical protective gloves, eg. PVC.

Wear safety footwear or safety gumboots, eg. Rubber.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

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

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

- Aprotic solvents may greatly promote the toxic properties of solutes because of their unique ability to penetrate synthetic rubber protective gloves and the skin (butyl rubber gloves are reported to be more satisfactory than others)

### OTHER

- 
- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.

### 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

- Protective Material CPI \*

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

■ \* CPI - Chemwatch Performance Index

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-1	-
1000	50	-	A-1
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.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

## 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-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:	Air Speed:
solvent, vapors, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
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)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favorable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	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

### PHYSICAL PROPERTIES

Liquid.

Mixes with water.

State	Liquid	Molecular Weight	73.11
Melting Range (°F)	-77.8	Viscosity	0.802 cSt@40°C
Boiling Range (°F)	307.4	Solubility in water (g/L)	Miscible
Flash Point (°F)	136.4	pH (1% solution)	<7 slightly acid
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	833	Vapor Pressure (mmHg)	3.75 @ 25C
Upper Explosive Limit (%)	15.2	Specific Gravity (water=1)	0.94 @ 25C
Lower Explosive Limit (%)	2.2	Relative Vapor Density (air=1)	2.5
Volatile Component (%vol)	100	Evaporation Rate	0.17 BuAc=1

#### N,N-DIMETHYLFORMAMIDE

■ log Kow (Sangster 1997): - 1.01

#### 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.

log Kow -1.01

Material	Value
■ log Kow (Sangster 1997)	- 1.01

## Section 10 - CHEMICAL STABILITY

#### CONDITIONS CONTRIBUTING TO INSTABILITY

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

#### STORAGE INCOMPATIBILITY

- Dimethylformamide:
  - Reacts violently with carbon tetrachloride (above 65 C.), hexachlorocyclohexane and other highly halogenated compounds, particularly in contact with iron or strong oxidisers (may cause fire and explosions)
  - Reacts violently with 2,5-bis-endo-dichloro-7-bicyclo[2.2.1]heptane, 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.
  - Reacts vigorously with strong oxidisers, halogens (eg. Cl<sub>2</sub>, Br<sub>2</sub>), and nitrates (eg. Mg(NO<sub>3</sub>)<sub>2</sub>) and alkylaluminiums.
  - Is incompatible with strong acids, allyl trifluoromethanesulfonates, ammonia, cresols, chromic anhydride, isocyanates, phenols, phosphorous trioxide.
  - Reaction with inorganic acid chlorides, such as phosphorous oxychloride and thionyl chloride, may form dimethylcarbamoylchloride, a suspect carcinogen.
  - 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.
  - Avoid oxidizing agents, acids, acid chlorides, acid anhydrides.
  - Many aprotic (non-hydroxylic) solvents are not inert towards other reagents and care must be taken when using untried combinations of solvents and reagents for the first time.
  - Some aprotic solvents have a dramatic effect on reaction rates

For incompatible materials - refer to Section 7 - Handling and Storage.

## Section 11 - TOXICOLOGICAL INFORMATION

#### N,N-DIMETHYLFORMAMIDE

#### TOXICITY AND IRRITATION

■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Oral (rat) LD50: 2800 mg/kg	Skin (human): 100%/24h - Mild
Inhalation (human) TCLo: 20 ppm	Skin (rabbit): 10 mg/24h (open)
Intraperitoneal (Rat) LD50: 1400 mg/kg	Eye (rabbit): 100mg(rinsed)-SEVERE

Subcutaneous (Rat) LD50: 3800 mg/kg	Eye (rabbit): 20 mg (open)
Oral (Mouse) LD50: 2900 mg/kg	
Intravenous (Dog) LD50: 470 mg/kg	
Intraperitoneal (Cat) LD50: 500 mg/kg	
Inhalation (Mouse) LC50: 9400 mg/m <sup>3</sup> /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	

■ **For dimethylformamide (DMF):**

In humans, DMF is absorbed by inhalation and through the skin. After high exposures (up to 60 ppm) headaches, abdominal pain, nausea, vomiting, dizziness, elevated liver enzymes, and alcohol intolerance (facial flushing and palpitations) were seen. Case reports of testicular cancer in aircraft repair and leather tannery facilities failed to be confirmed in further studies. Reports of DNA and chromosomal damage in peripheral lymphocytes of subjects exposed to DMF either failed to take into account smoking as a confounder or coexposure to other chemicals.

Acute toxicity: N,N-dimethylformamide (DMF) is of low acute toxicity in mammals: LD50 rat (oral) 3040 mg/kg bw, LC50 rat (inhalative, 4 h) > 5900 mg/m<sup>3</sup>, LD50 rat (dermal) > 3160 mg/kg bw. Main symptoms following exposure were apathy and staggering (oral) and irregular or intermittent respiration (inhalation). It was irritating to the eyes of rabbits but not irritating to the skin of rabbits and rats.

DMF did not show a sensitizing potential when used as a vehicle in a local lymph node assay.

Repeat dose toxicity: In repeated-dose toxicity studies in rats and mice with chronic exposure over 2 years (rats) or 18 months (mice) and subchronic exposure over 13 weeks by inhalation, or in rats treated by oral administration of DMF (90 day feeding study or administration by gavage for 28 days), the predominant target organ was the liver (NOAEC: chronic inhalation rat: 25 ppm (about 80 mg/m<sup>3</sup>), LOAEC: chronic inhalation mouse: 25 ppm (about 80 mg/m<sup>3</sup>); NOAEC: subchronic inhalation rat: 100 ppm, mouse: 400 ppm (about 300 mg/m<sup>3</sup> and 1210 mg/m<sup>3</sup>, respectively); NOAEL: rat, 90 days 200 ppm (about 12 mg/kg bw/day), 28 days about 238 mg/kg bw/day). In a 13-week inhalation study with a limited number of Cynomolgus monkeys no treatment-related effects occurred (NOAEC: 500 ppm (about 1500 mg/m<sup>3</sup>)).

Genetic toxicity: DMF does not induce chromosome aberrations or gene mutations in various test systems in vivo and in vitro. In addition, no increased tumor incidence was found in carcinogenicity studies in rats and mice that were exposed to 25, 100 and 400 ppm DMF (about 80, 300, and 1210 mg/m<sup>3</sup>) by inhalation for 2 years or 18 months, respectively.

Reproductive and developmental toxicity: Reproductive toxicity was observed at the presence of some general toxicity in a continuous breeding study in mice, when DMF was administered orally in the drinking water at doses of 1000, 4000 and 7000 ppm (about 219, 820 and 1455 mg/kg bw/day). The maximal tolerated dose for generalised toxicity was 1000 ppm (about 219 mg/kg bw/day) for the F0 and the F1 generation, thus a systemic NOAEL could not be determined. Significant reproductive toxicity (e.g. reduced fertility and fecundity characterized by reduced pregnancy and mating index (the latter one only in the high dose group), reduced number of litters, reduced average litter size and for the F1 parental males by effects on prostate weight and epididymal spermatozoa concentration, the latter finding only in the high dose group) and developmental toxicity (e.g. reduced survival and growth of pups, increase in craniofacial and sternebral malformations) occurred at 4000 ppm and above. At 1000 ppm, reduced pup weights were found in F2 pups. Thus 1000 ppm (about 219 mg/kg bw/day) was the NOAEL for reproductive and developmental toxicity in F0 and F1, and the LOAEL for developmental toxicity in F2.

Developmental toxicity and teratogenicity occurred in rats and rabbits in various studies (inhalation, oral- or dermal administration) and in mice (oral administration). In rats embryo/ foetotoxicity and teratogenicity were mostly seen at maternally toxic doses, whereas in mice and in rabbits embryo-/foetotoxicity and teratogenicity occurred also at dose levels without maternal toxicity. However, the rabbit appeared to be the most sensitive species to the developmental toxic effects of DMF.

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 on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin.

**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.

**CARCINOGEN**

Dimethylformamide	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
Dimethylformamide ND		Carcinogen Category	A4

**REPROTOXIN**

N,N-dimethylformamide	ILO Chemicals in the electronics industry that have toxic effects on reproduction	Reduced fertility or sterility
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**SKIN**

N,N-dimethylformamide ND		Notes	Skin
N,N-dimethylformamide ND		Skin	Yes
N,N-dimethylformamide	US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants - Skin	Skin Designation	X
N,N-dimethylformamide	US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants - Skin	Skin Designation	X

N,N-dimethylformamide	US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants - Skin	Skin Designation	X
N,N-dimethylformamide	US - Washington Permissible exposure limits of air contaminants - Skin	Skin	X
N,N-dimethylformamide	ND	Skin Designation	Yes
N,N-dimethylformamide	ND	Notation	Skin
N,N-dimethylformamide	US - Minnesota Permissible Exposure Limits (PELs) - Skin	Skin Designation	X
N,N-dimethylformamide	US - Hawaii Air Contaminant Limits - Skin Designation	Skin Designation	X
N,N-dimethylformamide	ND	Skin Designation	X
N,N-dimethylformamide	US OSHA Permissible Exposure Levels (PELs) - Skin	Skin Designation	X
N,N-dimethylformamide	ND	Skin	X
N,N-dimethylformamide	US - California Permissible Exposure Limits for Chemical Contaminants - Skin	Skin	X
N,N-dimethylformamide	US - California Permissible Exposure Limits for Chemical Contaminants - Skin	Skin	S
N,N-dimethylformamide	Canada - Alberta Occupational Exposure Limits - Skin	Substance Interaction	1

## Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

N,N-DIMETHYLFORMAMIDE:

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

■ For dimethylformamide (DMF)

log Kow : -1.01

Koc : 7

Half-life (hr) air : 2

Henry's atm m<sup>3</sup> /mol: 7.39E-08

Log BCF : -1

Environmental fate:

The atmospheric pathway is particularly important in determining exposure to dimethylformamide (DMF). This is due to the fact that industrial releases of DMF into air appear to be considerably larger than releases to other environmental media.

Because of the complete miscibility of DMF in water, atmospheric DMF may be transported from air into surface water or soil pore water during rain events. Atmospheric DMF should be present in the vapour phase and therefore should be readily available for leaching out by rainfall. Although the efficiency and rate of washout are unknown, precipitation events (i.e., rain, snow, fog) likely shorten the residence time of DMF in the atmosphere. As water has an atmospheric half-life of, typically, 4 days in higher latitudes, this can be considered the minimum atmospheric half-life of DMF in relation to precipitation.

Chemical degradation of DMF in air is likely due to reaction with hydroxyl radicals. The possibility of photochemical decomposition (i.e., direct photolysis) of DMF is extremely small. Other chemical degradation processes - for example, reaction with nitrate radicals — are not known to significantly affect the fate of DMF in air. Although the degradation half-life of DMF in air cannot be estimated with certainty, the available evidence therefore suggests that the half-life is at least 8 days (192 h). The mean half-life used for fugacity based fate modelling was 170 h, as it is frequently used to represent a half-life range of 100–300 h.

Once released into surface water, DMF is unlikely to transfer to sediments, biota, or the atmosphere. With a Kow of approximately 1.01, DMF remains in the dissolved form and is not expected to adsorb to the organic fraction of sediments or suspended organic matter. This Kow also suggests that DMF does not concentrate in aquatic organisms; indeed, no bioaccumulation was observed in carp during an 8-week bioaccumulation test. With a Henry's law constant of 0.0345 Pa@m<sup>3</sup>/mol, volatilisation from water is expected to be slight. The overall rate of chemical degradation is expected to be very slow in surface water. Photochemical decomposition is unlikely in water. The photooxidation half-life of DMF in water was estimated experimentally at 50 days and would be even longer in the natural environment where other compounds compete for reaction with hydroxyl radicals. The rate of hydrolysis of amides like DMF at normal temperatures in laboratory studies is extremely slow, even under strong acid or base conditions. The low temperature (generally less than 20 °C) and near-neutral pH of natural surface water therefore limit and almost preclude the hydrolysis of DMF under normal environmental conditions.

Biodegradation appears to be the primary degradation process in surface water. Under experimental conditions, DMF was degraded, either aerobically or anaerobically, by various microorganisms and algae in activated sludges, over a wide range of concentrations. Intermediate biodegradation products include formic acid and dimethylamine, which further degrade to ammonia, carbon dioxide, and water. In some studies, acclimation periods of up to 16 days preceded quantitative degradation. Biodegradation of DMF in receiving surface waters is unlikely to be affected by the inherent toxicity of DMF and its biodegradation products.

Once in soils, DMF will be degraded by chemical and biological processes or leached into groundwater.

As rain fills the available pore space in soils, DMF is incorporated into the pore water. The low octanol/ water partition coefficient indicates that DMF will not tend to adsorb to humic material. Weak bonds with the mineral phase are possible but likely insignificant because of the high solubility of DMF. Biological degradation and, to a lesser extent, chemical processes operating in surface water would also likely affect DMF contained in soil pore water. As with surface water, biodegradation should therefore be the primary breakdown mechanism in soils.

The miscibility of DMF and its low Henry's law constant indicate limited volatilisation from moist soils. However, DMF will be efficiently removed from soils by leaching into groundwater, likely at the same speed as water percolates through the soil. This is supported by a calculated organic carbon/water partition coefficient (Koc) of 7 and a soil sorption coefficient (K<sub>om</sub>) of about 50, estimated from quantitative structure-activity relationships (QSAR), which both indicate that DMF is mobile in soils. If it reaches groundwater, DMF will be slowly degraded anaerobically.

**Ecotoxicity:**

DMF is not regarded as harmful to aquatic organisms

Fish LC50 (96 h ):Lepomis macrochirus 7100 mg/l

Daphnia magna EC50 948 h): 15700 mg/l

Algae EC50 996 h): Scenedesmus subspicatus 1000 mg/l (biomass and growth rate).

■ DO NOT discharge into sewer or waterways.

**Ecotoxicity**

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
N,N-dimethylformamide	LOW		LOW	HIGH

**GESAMP/EHS COMPOSITE LIST - GESAMP Hazard Profiles**

Name / Cas No / RTECS No	EHS	TRN	A1a	A1b	A1	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3
E2~ / CAS:68- 12- 2 / LQ2100000			676	274		0	0	0	R	1	0	0	1	2	1	2	R D 3

Legend: EHS=EHS Number (EHS=GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships)  
 NRT=Net Register Tonnage, A1a=Bioaccumulation log Pow, A1b=Bioaccumulation BCF, A1=Bioaccumulation, A2=Biodegradation,  
 B1=Acuteaquatic toxicity LC/ECIC50 (mg/l), B2=Chronic aquatic toxicity NOEC (mg/l), C1=Acute mammalian oral toxicity LD50 (mg/kg),  
 C2=Acutemammalian dermal toxicity LD50 (mg/kg), C3=Acute mammalian inhalation toxicity LC50 (mg/kg), D1=Skin irritation & corrosion,  
 D2=Eye irritation& corrosion, D3=Long-term health effects, E1=Tainting, E2=Physical effects on wildlife & benthic habitats, E3=Interference  
 with coastal amenities, For column A2: R=Readily biodegradable, NR=Not readily biodegradable. For column D3: C=Carcinogen,  
 M=Mutagenic, R=Reprotoxic, S=Sensitising, A=Aspiration hazard, T=Target organ systemic toxicity, L=Lunginjury, N=Neurotoxic,  
 I=Immunotoxic. For column E1: NT=Not tainting (tested), T=Tainting test positive. For column E2: Fp=Persistent floater, F=Floater, S=Sinking  
 substances. The numerical scales start from 0 (no hazard), while higher numbers reflect increasing hazard. (GESAMP/EHS Composite List  
 of Hazard Profiles - Hazard evaluation of substances transported by ships)

**Section 13 - DISPOSAL CONSIDERATIONS**

**US EPA Waste Number & Descriptions**

A. General Product Information

Ignitability characteristic: use EPA hazardous waste number D001 (waste code I)

**Disposal Instructions**

All waste must be handled in accordance with local, state and federal regulations.

! Puncture containers to prevent re-use and bury at an authorized landfill.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

**Section 14 - TRANSPORTATION INFORMATION**



DOT:

Symbols:	None	Hazard class or Division:	3
----------	------	---------------------------	---

Identification Numbers:	UN2265	PG:	III
Label Codes:	3	Special provisions:	B1, IB3, T2, TP2
Packaging: Exceptions:	150	Packaging: Non-bulk:	203
Packaging: Exceptions:	150	Quantity limitations: Passenger aircraft/rail:	60 L
Quantity Limitations: Cargo aircraft only:	220 L	Vessel stowage: Location:	A
Vessel stowage: Other:	None		

#### COMBUSTIBLE LIQUID

A flammable liquid with a flash point at or above 38 deg.C (100 deg.F) that does not meet the definition of any other hazard class may be reclassified as a combustible liquid. This provision does not apply to transportation by vessel or aircraft, except where other means of transportation is impracticable. An elevated temperature material that meets the definition of a Class 3 material because it is intentionally heated and offered for transportation or transported at or above its flash point may not be reclassified as a combustible liquid. Refer to 49 CFR 173.120(b)(2)

#### Air Transport IATA:

ICAO/IATA Class:	3	ICAO/IATA Subrisk:	None
UN/ID Number:	2265	Packing Group:	III
Special provisions:	None		

Shipping Name: N,N-DIMETHYLFORMAMIDE

#### Maritime Transport IMDG:

IMDG Class:	3	IMDG Subrisk:	None
UN Number:	2265	Packing Group:	III
EMS Number:	F-E , S-D	Special provisions:	None
Limited Quantities:	5 L		

Shipping Name: N,N-DIMETHYLFORMAMIDE

## Section 15 - REGULATORY INFORMATION



### REGULATIONS

**N,N-dimethylformamide (CAS: 68-12-2,15175-63-0,15175-77-6,33513-42-7,114057-15-7) is found on the following regulatory lists;**

"Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits - Carcinogens", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Saskatchewan Occupational Health and Safety Regulations - Designated Chemical Substances", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Domestic Substances List (DSL)", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Priority Substances List (PSL1, PSL 2)", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Chemical Secretariat (ChemSec) REACH SIN\* List (\*Substitute It Now!) 1.0", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - Alaska Limits for Air Contaminants", "US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)", "US - California Permissible Exposure Limits for Chemical Contaminants", "US - California Toxic Air Contaminant List Category II", "US - Connecticut Hazardous Air Pollutants", "US - Hawaii Air Contaminant Limits", "US - Idaho - Limits for Air Contaminants", "US - Massachusetts Oil & Hazardous Material List", "US - Michigan Exposure Limits for Air Contaminants", "US - Minnesota Hazardous Substance List", "US - Minnesota Permissible Exposure Limits (PELs)", "US - New Jersey Right to Know Hazardous Substances", "US - Oregon Permissible Exposure Limits (Z-1)", "US - Pennsylvania - Hazardous Substance List", "US - Rhode Island Hazardous Substance List", "US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants", "US - Washington Permissible exposure limits of air contaminants", "US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants", "US ACGIH Threshold Limit Values (TLV)", "US ACGIH Threshold Limit Values (TLV) - Carcinogens", "US CAA (Clean Air Act) - HON Rule - Organic HAPs (Hazardous Air Pollutants)", "US CERCLA Priority List of Hazardous Substances", "US Clean Air Act - Hazardous Air Pollutants", "US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US EPA Acute Exposure Guideline Levels (AEGs) -

Interim", "US EPA High Production Volume Program Chemical List", "US EPA Master Testing List - Index I Chemicals Listed", "US EPCRA Section 313 Chemical List", "US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives", "US List of Lists - Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US Toxic Substances Control Act (TSCA) - Inventory", "US TSCA Section 8 (d) - Health and Safety Data Reporting"

## Section 16 - OTHER INFORMATION

### LIMITED EVIDENCE

- Ingestion may produce health damage\*.
- May produce skin discomfort\*.
- Limited evidence of a carcinogenic effect\*.

\* (limited evidence).

### Ingredients with multiple CAS Nos

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

### 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	Endpoint	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 Health Risk: American Industrial Hygiene Association Journal 57: 641-649 (1996).

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■ Classification of the mixture and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:  
[www.chemwatch.net/references](http://www.chemwatch.net/references).

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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