S INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

Health and Safety Guide No. 43

DIMETHYLFORMAMIDE (DMF) HEALTH AND SAFETY GUIDE

UNITED NATIONS
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WORLD HEALTH ORGANIZATION, GENEVA 1990

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Health and Safety Guide No. 43

DIMETHYLFORMAMIDE (DMF) HEALTH AND SAFETY GUIDE

This is a companion volume to
Environmental Health Criteria 114: Dimethylformamide (DMF)

Published by the World Health Organization for the International Programme on Chemical Safety
(a collaborative programme of the United Nations Environment Programme, the International Labour Organisation, and the World Health Organization)

WORLD HEALTH ORGANIZATION, GENEVA 1990

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INTRODUCTION

The Environmental Health Criteria (EHC) documents produced by the International Programme on Chemical Safety include an assessment of the effects on the environment and on human health of exposure to a chemical or combination of chemicals, or physical or biological agents. They also provide guidelines for setting exposure limits.

The purpose of a Health and Safety Guide is to facilitate the application of these guidelines in national chemical safety programmes. The first three sections of a Health and Safety Guide highlight the relevant technical information in the corresponding EHC. Section 4 includes advice on preventive and protective measures and emergency action; health workers should be thoroughly familiar with the medical information to ensure that they can act efficiently in an emergency. Within the Guide is a Summary of Chemical Safety Information which should be readily available, and should be clearly explained, to all who could come into contact with the chemical. The section on regulatory information has been extracted from the legal file of the International Register of Potentially Toxic Chemicals (IRPTC) and from other United Nations sources.

The target readership includes occupational health services, those in ministries, governmental agencies, industry, and trade unions who are involved in the safe use of chemicals and the avoidance of environmental health hazards, and those wanting more information on this topic. An attempt has been made to use only terms that will be familiar to the intended user. However, sections 1 and 2 inevitably contain some technical terms. A bibliography has been included for readers who require further background information.

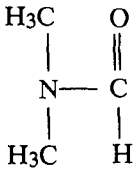
Revision of the information in this Guide will take place in due course, and the eventual aim is to use standardized terminology. Comments on any difficulties encountered in using the Guide would be very helpful and should be addressed to:

The Manager
International Programme on Chemical Safety
Division of Environmental Health
World Health Organization
1211 Geneva 27
Switzerland

THE INFORMATION IN THIS GUIDE SHOULD BE CONSIDERED AS A STARTING POINT TO A COMPREHENSIVE HEALTH AND SAFETY PROGRAMME

1. PRODUCT IDENTITY AND USES

1.1 Identity

Common name:	dimethylformamide
Chemical structure:	
Chemical formula:	C_3H_7NO
Common synonyms:	*N,N*-dimethylformamide, DMF, DMFA, formdimethylamide
CAS registry number:	68-12-2
RTECS registry number:	LQ2100000
Conversion factors: (at 20 °C)	1 ppm = 3 mg/m^3 1 mg/m^3 = 0.33 ppm
Relative molecular mass:	73.1

1.2 Physical and Chemical Properties

Dimethylformamide (DMF) is a colourless liquid with only a slight, unpleasant odour; smell is, therefore, not a useful warning signal. DMF is usually stable but, when it comes into contact with strong oxidizers, halogens, alkylaluminium, or halogenated hydrocarbons (especially in combination with metals), it may cause fires and explosions. DMF is completely miscible with water and most organic solvents. It has a relatively low vapour pressure.

1.3 Analytical Methods

Gas-chromatographic methods for determining DMF are available.

1.4 Production and Uses

DMF is a universal industrial solvent, because of its solubility in water, its organic nature, and its high dielectric constant. The main use (65–75%) of DMF is as a solvent for acrylic fibres and polyurethanes; 15–20% is used in the production of pharmaceutical products. It is also used as a laboratory solvent and, in the chemical industry, as an intermediate and an additive.

DMF is not normally available to the general population, either as the pure compound or as a component of consumer products.

2. SUMMARY AND EVALUATION

2.1 Human Exposure to Dimethylformamide

DMF does not occur naturally. There are few data concerning environmental levels and the exposure of the general population to DMF. Concentrations within the range of 0.02–0.12 mg/m^3 have been found in the air in residential areas near industrial sites. DMF has been detected only rarely in the water of heavily industrialized river basins, and then only at concentrations below 0.01 mg/litre.

Data are not available on the levels of DMF in soil, plants, wildlife, and food.

Occupational exposure occurs via skin contact with DMF liquid and vapour, and through the inhalation of vapour. Concentrations of 3–86 mg/m^3 air have been detected, with peaks of up to 600 mg/m^3 during the repair or maintenance of machines. In a few unusual situations, levels of up to 4500 mg/m^3 have been reported.

2.2 Environmental Transport, Distribution, and Transformation

DMF is stable in ambient air, but, in water, it may undergo microbial and algal degradation. Adapted microorganisms and activated sludge efficiently biodegrade DMF. As a result of its complete solubility in water, DMF moves readily through soils and would not be expected to accumulate in the food chain.

2.3 Kinetics and Metabolism

Toxic amounts of DMF may be absorbed by inhalation and through the skin. Absorbed DMF is distributed uniformly. The metabolic transformation of DMF takes place mainly in the liver with the aid of microsomal enzyme systems. In animals and human beings, the main product of DMF biotransformation is *N*-hydroxymethyl-*N*-methyl-formamide (DMF-OH). This metabolite is converted during gas-chromatographic analysis to *N*-methylformamide (NMF), which is itself (together with *N*-hydroxymethylformamide and formamide) a minor metabolite. In metabolic

studies and biological monitoring, urinary metabolite concentrations are measured and expressed as NMF, though DMF-OH is the major contributor to this concentration. The determination of NMF/DMF-OH in the urine may be a suitable biological indicator for total DMF exposure.

It has been demonstrated in experimental animals that DMF metabolism is saturated at high exposure levels and that, at very high levels, DMF inhibits its own metabolism.

Metabolic interaction occurs between DMF and ethanol.

2.4 Effects on Organisms in the Environment

The effects of DMF on the environment have not been well studied. Its toxicity for aquatic organisms appears to be low.

2.5 Effects on Experimental Animals and *In Vitro* Test Systems

The acute toxicity of DMF in a variety of animal species is low (in rats, the oral LD_{50} is approximately 3000 mg/kg, the dermal LD_{50} is approximately 5000 mg/kg, and the inhalation LC_{50} is approximately 10 000 mg/m^3). DMF may produce slight to moderate skin and eye irritation. One study on guinea-pigs indicated that it did not have sensitization potential. DMF can facilitate the absorption of other chemical substances through the skin.

All routes of exposure of experimental animals to DMF may cause dose-related liver injury, but regeneration after the cessation of exposure has been demonstrated. In some studies, signs of toxicity have also been described in the myocardium and kidneys.

DMF has been shown not to be toxic to the testes or ovaries, and no effects have been seen on fertility in rats. However, DMF is embryotoxic and is a weak teratogen in rats, mice, and rabbits. In inhalation exposure studies, the rabbit has been found to be the most sensitive species, teratogenic effects being observed at concentrations of 450 mg/m^3 or more, but not at 150 mg/m^3. After dermal exposure, a very low incidence of embryotoxic and teratogenic effects was observed, in some studies, at dose levels ranging between 100 and 400 mg/kg per day.

In an extensive set of short-term tests for genetic and related effects, DMF was generally inactive, both *in vitro* and *in vivo*.

Adequate long-term carcinogenicity studies on experimental animals have not been reported.

2.6 Effects on Human Beings

No adverse effects of DMF on the general population have been clearly demonstrated. However, skin irritation and conjunctivitis have been reported after direct contact with DMF.

After accidental exposure to high levels of DMF, abdominal pain, nausea, vomiting, dizziness, and fatigue occur within 48 h. Liver function may be disturbed, and blood pressure changes, tachycardia, and ECG abnormalities have been reported. Recovery is usually complete.

Following long-term, repeated exposure, symptoms include headache, loss of appetite, and fatigue. Biochemical signs of liver dysfunction may be observed. In the absence of skin contact, liver damage generally seems to occur only when the DMF exposure level is above 30 mg/m^3. This air level corresponds to approximately 40 mg NMF/DMF-OH per gram creatinine in a post-shift urine sample.

Inhalation exposure to DMF, even at concentrations below 30 mg/m^3, may cause alcohol intolerance. Symptoms may include a sudden facial flush, tightness in the chest, and dizziness, sometimes accompanied by nausea and dyspnoea. The symptoms last from 2 to 4 h and disappear without treatment.

There is limited evidence that DMF is carcinogenic for human beings. An increased incidence of testicular tumours was reported in one study, whereas another study showed an increased incidence of tumours of the buccal cavity and pharynx, but not of the testes.

In two studies, about which few details were provided, an increased frequency of miscarriages was reported in women exposed to DMF, among other chemicals.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

1. In view of the present uses of DMF, exposure of the general population is probably very low.

2. DMF is readily absorbed through the skin, as well as by inhalation. Determination of urinary DMF-OH/NMF is a useful means of estimating the total amount of DMF absorbed.

3. The risk of liver damage is low, as long as the level of DMF in the ambient air is kept below 30 mg/m^3 and there is no skin contact. A tentative value for the corresponding urinary NMF/DMF-OH level in a post-shift sample is 40 mg/g creatinine.

4. DMF is embryotoxic and a weak teratogen in mice, rats, and rabbits.

5. There is limited evidence of the carcinogenicity of DMF for human beings.

6. Available data indicate low environmental toxicity. It is unlikely that bioaccumulation takes place.

3.2 Recommendations

3.2.1 *Safe handling*

1. Airborne concentrations should be maintained below 30 mg/m^3, and skin contact should be prevented.

2. Urinary NMF/DMF-OH, as an index of total exposure, should be monitored and maintained below 40 mg NMF/g creatinine in post-shift samples. If this level is exceeded, action should be taken to reduce exposure.

3.2.2 *Further research*

1. The possible carcinogenic effects of DMF in man should be investigated in experimental animals and human populations.

2. More information on the extrapolation of the embryotoxicity and teratogenicity of DMF in animal studies to human beings is needed. Comparison of the kinetics of DMF in human beings and animals would be valuable.

3. There is a need for more information on the mechanism of action and the relative potency of metabolites of DMF in both animals and human beings.

4. The relationships (*a*) between urinary metabolite concentrations and atmospheric exposure levels (in the absence of skin contact), and (*b*) between the total dose by all routes (as indicated by post-shift urinary NMF levels) and the absence of hepatotoxicity, should be refined.

4. HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION

4.1 Main Human Health Hazards, Prevention and Protection, First Aid

DMF is easily absorbed through the skin (in both liquid and vapour forms), and by inhalation and ingestion. It can penetrate all protective gloves; neoprene and natural rubber gloves provide the best protection.

Because the odour of DMF is not strong, it is a poor warning signal. DMF may produce moderate skin and eye irritation.

High exposure by any route may injure the liver and the unborn child. Conflicting data exist, but there is limited evidence for the carcinogenicity of DMF in human beings. Even at low exposure levels, DMF may cause a pronounced alcohol intolerance in some workers, reflected by facial flushing, dizziness, and tightness of the chest.

The human health hazards aasociated with certain types of exposure to DMF, together with preventive and protective measures and first-aid recommendations, are listed in the Summary of Chemical Safety Information on pages 20–22.

4.1.1 *Advice to physicians*

Medical treatment is symptomatic. Following high exposure, liver function should be monitored and DMF exposure should not be resumed until the patient has fully recovered.

Although specific information is not available on sensitive subpopulations, persons with pre-existing liver disease and pregnant women may be at higher risk when working with DMF.

Persons working with DMF may show alcohol intolerance and should be warned of this.

4.1.2 *Health surveillance and exposure monitoring*

Concentrations of DMF in the work-place should be monitored, preferably by personal monitoring in the breathing zone. Airborne

concentrations should be maintained below 30 mg/m^3 and skin contact should be prevented. Urinary NMF/DMF-OH, as an index of total exposure, should be monitored and maintained below 40 mg NMF/g creatinine in post-shift samples. If this level is exceeded, action should be taken to reduce exposure.

Workers regularly exposed to DMF should have a periodic health examination, which may include a medical history, a general medical examination, and biomedical laboratory testing. Special attention should be paid to the skin and to liver function.

4.2 Explosion and Fire Hazards

DMF is flammable and its explosive limits are 2.2–16% v/v. At temperatures above 350 °C, thermal decomposition of DMF to form dimethylamine and carbon monoxide occurs. Open flames and smoking should not be allowed in the vicinity.

Powder, alcohol-resistant foam, water spray, and carbon dioxide can be used as fire-extinguishing agents. Do not use halogenated extinguishing media.

Fire-fighters should be aware that the burning and thermal decomposition of DMF may give rise to toxic gases and vapours, such as dimethylamine and carbon monoxide.

4.3 Storage

As DMF can attack certain metals and compounds, such as copper and aluminium, plastics, rubbers, and coatings, it should be stored in mild-steel containers. It should be stored under fire-proof conditions and away from oxidizing agents, halogens, alkylaluminium, and halogenated hydrocarbons.

4.4 Transport

The conditions described in section 4.3 also apply during transport. In case of an accident, stop the engine and remove all sources of ignition. Do not smoke. Keep bystanders at a distance and upwind. In case of spillage

or a fire, use the methods advised in sections 4.5 and 4.2, respectively. Notify the police and fire brigade immediately.

4.5 Spillage

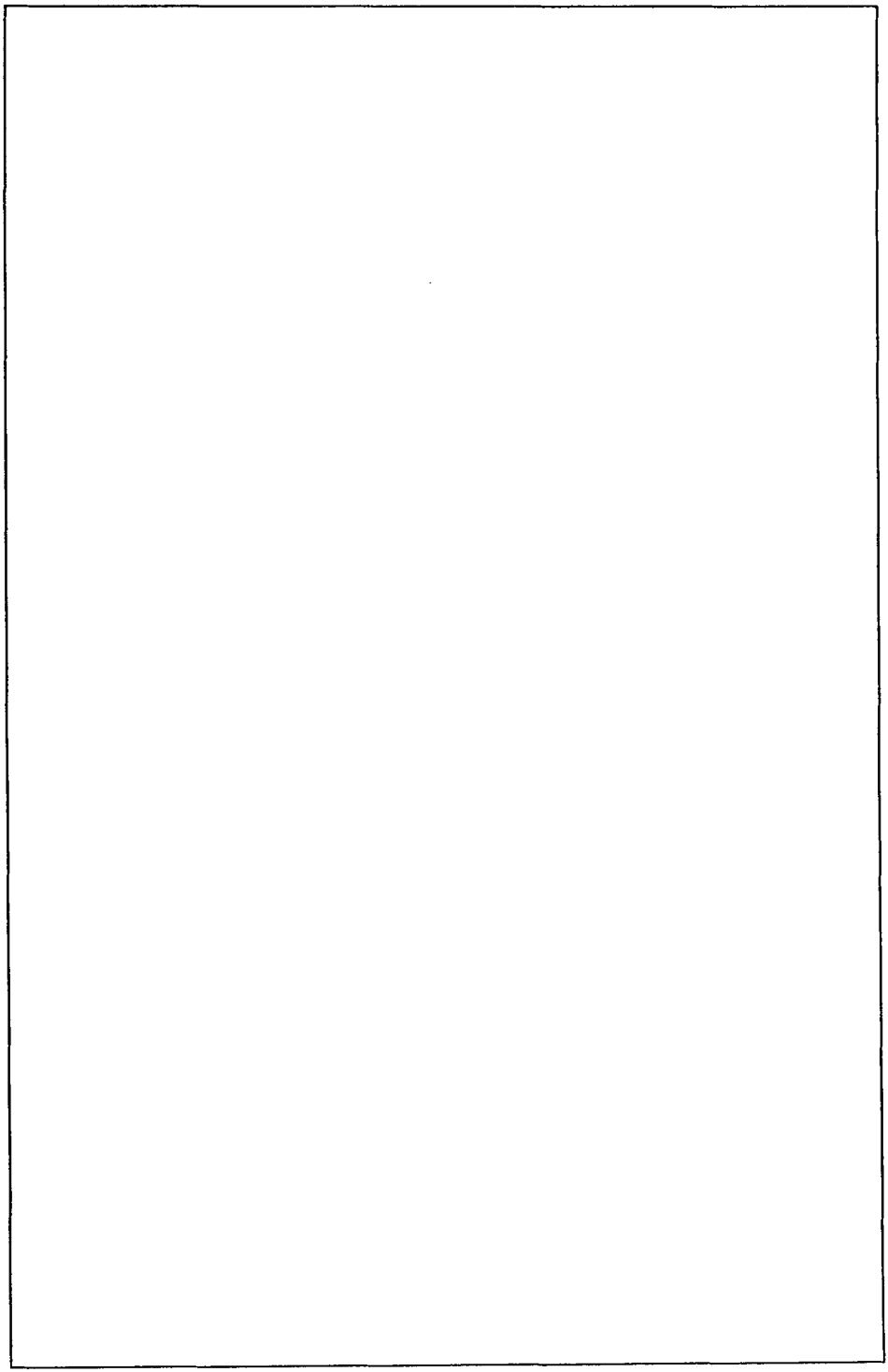
Remove all ignition sources and evacuate all persons not wearing adequate protective equipment. Collect leaking liquid in sealable mild-steel containers, soak up spilled liquid with sand or another inert absorbent, and put in a sealable container for safe disposal. Do not allow run-off into sewers or ditches, as this may cause an explosion hazard. Ensure skin and respiratory protection.

4.6 Disposal

Burn in an appropriate incinerator with appropriate effluent gas scrubbing.

5. HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION

All operations should be conducted in such a way that DMF contamination of the air, water, and soil does not occur.



6. SUMMARY OF CHEMICAL SAFETY INFORMATION

This summary should be easily available to all health workers concerned with, and users of, dimethylformamide. It should be displayed at, or near, entrances to areas where there is potential exposure to dimethylformamide, and on processing equipment and containers. The summary should be translated into the appropriate language(s). All persons potentially exposed to the chemical should also have the instructions in the summary clearly explained.

Space is available for insertion of the National Occupational Exposure Limit, the address and telephone number of the National Poison Control Centre, and for local trade names.

SUMMARY OF CHEMICAL SAFETY INFORMATION

N,N-DIMETHYLFORMAMIDE

(DMF) (C_3H_7NO)

CAS Registry No. 68-12-2

RTECS Registry No. LQ2100000

PHYSICAL PROPERTIES

Relative molecular mass	73.1
Boiling point (°C)	153
Melting point (°C)	- 61
Flash point (°C) (open cup)	57
Autoignition temperature (°C)	445
Relative density (water = 1)	0.95
Relative vapour density (air = 1)	2.5
Vapour pressure (mbar at 25 °C)	5
Water solubility	unlimited
Explosive limits (vol. % in air)	2.2-16
Dielectric constant (at 20 °C)	36.7

OTHER CHARACTERISTICS

Colourless liquid with characteristic odour; DMF decomposes in a flame or on a hot surface, to form toxic gases (dimethylamine, carbon monoxide); it reacts violently with strong oxidizing agents, alkylaluminium, halogens, and halogenated hydrocarbons. DMF is easily absorbed through the skin, by inhalation, and also by ingestion.

HAZARDS/SYMPTOMS	PREVENTION AND PROTECTION	FIRST AID
SKIN: redness, pain; on absorption: headache, dizziness, vomiting, abdominal spasms	Avoid skin exposure; wear protective gloves (neoprene or natural rubber) and clothing; DMF readily penetrates all gloves	Remove contaminated clothing; wash with plenty of water; seek medical attention
EYES: Irritant; redness, pain, blurred vision	Wear safety goggles, face shield	Rinse with plenty of water; transport to a doctor
INHALATION: Coughing; headache, sore throat, dizziness, vomiting, abdominal spasms	Ventilation, local exhaust, and breathing protection[a]	Remove patient from contaminated area to fresh air; seek medical attention
INGESTION: Headache, dizziness, vomiting, abdominal spasms	Unlikely occupational hazard	Rinse mouth; give plenty of water to drink and induce vomiting; seek medical attention/transport to hospital
Other adverse effects: Liver damage, damage to the unborn child, potential carcinogen	Limit exposure	

SUMMARY OF CHEMICAL SAFETY INFORMATION (*continued*)

SPILLAGE	STORAGE	FIRE AND EXPLOSION
Collect leaking liquid in sealable containers; absorb spilled liquid in sand or inert absorbent and remove to safe place; ensure personal protection by use of a self-contained breathing apparatus; do not allow run-off into sewers or ditches	Fire-proof, away from oxidizing agents, alkylaluminium, halogens, and halogenated hydrocarbons	DMF is flammable and its explosive limits are 2.2-16 vol. %; in case of fire, use powder, alcohol-resistant foam, water spray, or carbon dioxide

WASTE DISPOSAL		
Burn in an appropriate incinerator	National Occupational Exposure Limit:	United Nations No.: 2265
	Local trade names:	
	National Poison Control Centre:	

[a] Appropriate respirators should be worn only when work practice controls are not technically feasible, when they fail, or when they need to be supplemented. Self-contained breathing equipment should be used instead of masks in cases where oxygen may be lacking (tanks and other confined places).

7. CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

The information given in this section has been extracted from the International Register of Potentially Toxic Chemicals (IRPTC) legal file and other United Nations sources. Its intention is to give the reader a representative, but not an exhaustive, overview of current regulations, guidelines, and standards.

The reader should be aware that regulatory decisions about chemicals, taken in a certain country, can only be fully understood in the framework of the legislation of that country. Furthermore, the regulations and guidelines of all countries are subject to change and should always be verified with the appropriate regulatory authorities before application.

7.1 Previous Evaluations by International Bodies

The International Agency for Research on Cancer evaluated dimethylformamide in 1988 and concluded that "although there is inadequate evidence for the carcinogenicity of DMF in experimental animals, there is limited evidence for the carcinogenicity of DMF in humans. DMF is possibly carcinogenic to humans (Group 2B)."

7.2 Exposure Limit Values

Some exposure limit values are shown in the table on pages 24–27. When no effective date appears in the IRPTC legal file, the year of the reference from which the data are taken is indicated by (r).

7.3 Specific Restrictions

In the Federal Republic of Germany, it is noted that no risk of adverse effects in offspring occurs as long as exposure of pregnant women is kept below the maximum worksite concentration (MAK). Its handling is prohibited, or restricted, for adolescents and pregnant or nursing women.

In the Federal Republic of Germany, DMF is classified as slightly harmful in water, and appropriate security measures should be taken during storage, loading, and transport, in order to avoid contamination of water.

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

EXPOSURE LIMIT VALUES

Medium	Specification	Country/ organization	Exposure limit description [b]	Value	Effective date
AIR	Work-place	Australia[a]	Threshold limit value (TLV) - Time-weighted average (TWA)	 30 mg/m^3	1985 (r)
		Belgium[a]	Threshold limit value (TLV)	30 mg/m^3	1985 (r)
		Bulgaria[a]	Maximum permissible concentration (MPC)	10 mg/m^3	1985 (r)
		Czechoslovakia	Maximum allowable concentration (MAC) - Time-weighted average (TWA) - Ceiling value (CLV)	 30 mg/m^3 60 mg/m^3	1985
		German Democratic Republic	Maximum allowable concentration (MAK) - Time-weighted average (TWA) - Short-term exposure level (STEL)	 30 mg/m^3 60 mg/m^3	1985 (r)
		Germany, Federal Republic of	Maximum worksite concentration (MAK) - Time-weighted average (TWA) - Short-term exposure level (STEL) (30-min) (4× per shift)	 60 mg/m^3 120 mg/m^3	1986 (r)

AIR	Work-place (*continued*)	Hungary	Maximum allowable concentration (MAC) - Time-weighted average (TWA) - Short-term exposure level (STEL) (30 min)	 10 mg/m^3 20 mg/m^3	1985 (r)
		Italy[a]	Threshold limit value (TLV)	30 mg/m^3	1985 (r)
		Japan[a]	Maximum allowable concentration (MAC) - Time-weighted average (TWA)	 30 mg/m^3	1986 (r)
		Poland[a]	Maximum permissible concentration (MAC) - Ceiling value (CLV)	 10 mg/m^3	1982
		Netherlands[a]	Maximum limit (MXL) - Time-weighted average (TWA)	 30 mg/m^3	1985 (r)
		Romania[a]	Maximum permissible concentration (MAC) - Time-weighted average (TWA) - Ceiling value (CLV)	 20 mg/m^3 50 mg/m^3	1985 (r)
		Sweden[a]	Hygienic limit value (HLV) - Time-weighted average (TWA) - Short-term exposure level (STEL) (15-min TWA)	 30 mg/m^3 45 mg/m^3	1985
		Switzerland[a]	Maximum worksite concentration (MAK) - Time-weighted average (TWA)	 30 mg/m^3	1985 (r)

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

EXPOSURE LIMIT VALUES (*continued*)

Medium	Specification	Country/ organization	Exposure limit description	Value	Effective date
AIR	Work-place (*continued*)	United Kingdom[a]	Occupational exposure standard - Time-weighted average (TWA) (8 h) - Short-term exposure level (STEL) (10-min time-weighted average)	 30 mg/m^3 60 mg/m^3	1989 (r)
		USA (OSHA)[a]	Permissible exposure limit (PEL) - Time-weighted average (TWA)	 30 mg/m^3	1986 (r)
		USSR[a]	Maximum allowable concentration (MAC) - Ceiling value (CLV) (vapour)	 10 mg/m^3	1977
		Yugoslavia[a]	Maximum allowable concentration (MAC) - Time-weighted average (TWA)	 10 mg/m^3	1985 (r)
AIR	Ambient	USSR	Maximum allowable concentration (MAC) - (1 ×/day) - (av/day)	 0.03 mg/m^3 0.03 mg/m^3	1984

AIR	Emissions	Germany, Federal Republic of	Maximum limit (MXL) - at a mass flow of ≥ 2 kg/h DMF belongs to Class II. The air emissions of organic compounds must not exceed (as the sum of all compounds in that class) the given mass concentration	100 mg/m^3	1986
WATER	Surface	USSR	Maximum allowable concentration (MAC)	10 mg/litre	1983
		USSR	Maximum allowable concentration (MAC) (surface water for fishing)	0.28 mg/litre	1985 (r)
FOOD		USA	Maximum permissible concentration (PMC) (applies to certain specified colour additives that may be used in food, drugs, or cosmetics)	10 g/kg (1%)	1986 (r)
URINE	Collected at the end of the work shift	USA (ACGIH)	Biological exposure limit (BEL) as *N*-methylformamide/g creatinine	40 mg/g	1986-1987

[a] Risk of intake by skin absorption noted.
[b] 8-h TWA, unless stated otherwise.

In the USA, exemption from residue tolerance requirements is made for dimethylformamide in food and animal feed, in certain cases. This exemption applies to DMF residues in, or on, certain specified plant products, when used in formulations with the fungicide triforine at concentrations not exceeding 30%. It also applies when DMF is (*a*) used in plant products according to good agricultural practice, as an inert (or occasionally active) ingredient of pesticides, or (*b*) applied to growing crops for some specified purposes.

In the USA, dimethylformamide may be used as a component of adhesives in articles intended for use in the packaging, transportation, or holding of food.

European Economic Community (EEC) legislation prohibits the marketing of cosmetic products containing dimethylformamide.

7.4 Labelling, Packaging, and Transport

The United Nations Committee of Experts on the Transportation of Dangerous Goods classifies dimethylformamide in:

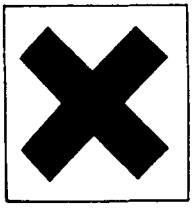
Hazard Class 3 : flammable liquids

The label should be as follows:

Background: red

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

European Economic Community legislation requires the labelling of DMF as a dangerous substance, using the symbol:



Sundhedsskadelig
Mindergiftig
(Gesundheitsschädlich)
Επιβλαβές
Harmful
Nocif
Nocivo
Schadelijk

The label must read:

Harmful by inhalation, in contact with skin; irritating to eyes; in case of contact with eyes, rinse immediately with plenty of water and seek medical advice; after contact with skin, wash immediately with plenty of ..... (to be specified by the manufacturer); wear suitable protective clothing.

In the EEC, the labelling of solvent preparations containing dimethylformamide is governed by legislation that classifies DMF in Class II/b.

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