'S INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

Health and Safety Guide No. 58

METHYL ISOBUTYL KETONE HEALTH AND SAFETY GUIDE

UNITED NATIONS
ENVIRONMENT PROGRAMME

INTERNATIONAL
LABOUR ORGANISATION

WORLD HEALTH
ORGANIZATION

WORLD HEALTH ORGANIZATION, GENEVA 1991

Other HEALTH AND SAFETY GUIDES available:

1. Acrylonitrile
2. Kelevan
3. 1-Butanol
4. 2-Butanol
5. 2,4-Dichlorphenoxy-acetic Acid (2,4-D)
6. Methylene Chloride
7. *tert*-Butanol
8. Epichlorohydrin
9. Isobutanol
10. Tetrachloroethylene
11. Tetradifon
12. Tecnazene
13. Chlordane
14. Heptachlor
15. Propylene Oxide
16. Ethylene Oxide
17. Endosulfan
18. Dichlorvos
19. Pentachlorophenol
20. Dimethoate
21. Aldrin and Dieldrin
22. Cypermethrin
23. Quintozene
24. Allethrins
25. Resmethrins
26. Pyrrolizidine Alkaloids
27. Magnetic Fields
28. Phosphine
29. Dimethyl Sulfate
30. Deltamethrin
31. Tetramethrin
32. d-Phenothrin
33. Permethrin
34. Fenvalerate
35. Phosphorus Trichloride and Phosphorus Oxychloride
36. Vinylidene Chloride
37. Ammonia
38. Cyhalothrin and Lambda-Cyhalothrin
39. Mirex
40. Camphechlor
41. Chlordecone
42. Vanadium
43. Dimethylformamide
44. Beryllium
45. Acrylamide
46. Barium
47. Atrazine
48. Bentazone
49. Captafol
50. Captan
51. Paraquat
52. Diquat
53. Alpha- and beta-hexachloro-cyclohexane
54. Lindane
55. 1,2-Dichloroethane
56. Hydrazine
57. Formaldehyde

IPCS

Health and Safety Guide No. 58

METHYL ISOBUTYL KETONE HEALTH AND SAFETY GUIDE

This is a companion volume to
Environmental Health Criteria 117: Methyl isobutyl ketone

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 1991

This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the United Nations Environment Programme, the International Labour Organisation, or the World Health Organization

WHO Library Cataloguing in Publication Data

Methyl isobutyl ketone : health and safety guide.

(Health and safety guide ; no. 58)

1.Ketones - standards I.Series

ISBN 92 4 151058 7 (NLM Classification: QV 633)
ISSN 0259-7268

Computer typesetting by HEADS, Oxford OX7 2NY, England
Printed by Wissenschaftliche Verlagsgesellschaft mbH · D-7000 Stuttgart 10

CONTENTS

		Page
INTRODUCTION		5
1. PRODUCT IDENTITY AND USES		7
1.1	Identity	7
1.2	Physical and chemical properties	7
1.3	Analytical methods	8
1.4	Uses	8
2. SUMMARY AND EVALUATION		9
2.1	Human exposure to MIBK	9
2.2	Uptake, metabolism, and excretion	9
2.3	Effects on animals	9
2.4	Effects on human beings	10
3. CONCLUSIONS AND RECOMMENDATIONS		11
4. HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION		12
4.1	Main human health hazards, prevention and protection, first aid	12
	4.1.1 Advice to physicians	12
	4.1.1.1 Symptoms of poisoning	12
	4.1.1.2 Medical advice	12
	4.1.2 Health surveillance advice	12
4.2	Safety in use	13
4.3	Explosion and fire hazards	13
	4.3.1 Flammability and explosion	13
	4.3.2 Fire	13
4.4	Storage	13
4.5	Transport	13

CONTENTS

		Page
4.6	Spillage and disposal	14
4.6.1	Spillage	14
4.6.2	Disposal	14
5.	HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION	15
6.	SUMMARY OF CHEMICAL SAFETY INFORMATION	17
7.	CURRENT REGULATIONS, GUIDELINES, AND STANDARDS	22
7.1	Regulation of emissions	22
7.2	Regulation of food and food wrappings	22
7.3	Regulation of beverages	22
7.4	Exposure limit values	22
7.5	Labelling and packaging	23
BIBLIOGRAPHY		27

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.

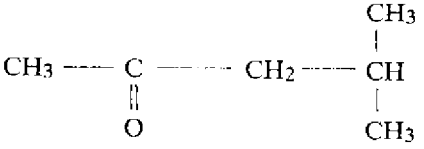
Revision of the information in this Guide will take place in due course, and the eventual aim is to use standardized terminology. Comments on any difficulties encountered in using the Guide would be very helpful and should be addressed to:

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:	methyl isobutyl ketone (MIBK)
Chemical structure	
Chemical formula:	$C_6H_{12}O$
Relative molecular mass:	100.16
CAS chemical name:	4-methyl-2-pentanone
CAS registry number:	108-10-1
RTECS registry number:	SA9275000
Purity:	MIBK is typically 99% (w/w) pure. Impurities that may be present include: dimethyl heptane (0.3%), water (0.1%), methyl isobutyl carbinol (0.06%), mesityl oxide (0.03%), acetic acid (0.002%), and non-volatile components (0.002%).

1.2 Physical and Chemical Properties

MIBK is a clear liquid with a sweet odour; the odour threshold is 1.64 mg/m^3 (0.4 ppm). It is moderately soluble in water.

Some physical and chemical properties of MIBK are given in the Summary of Chemical Safety Information (section 6).

MIBK can react violently with oxidizing and reducing agents. When heated, peroxides may form by auto-oxidation and may explode spontaneously.

1.3 Analytical Methods

Gas chromatography combined with flame ionization or mass spectroscopy is a suitable technique for the determination of MIBK, which can be detected in air (by trapping with, e.g., charcoal), in water (e.g., headspace or extraction), and in biological tissues (e.g., headspace or extraction).

1.4 Uses

MIBK, which occurs naturally in food, is a permitted flavouring agent and is used in food-contact materials. It is a component of cellulose and polyurethane lacquers and paint solvents. It is also used: as an extraction solvent; in the manufacture of methyl amyl alcohol; and as a denaturant for ethyl alcohol.

2. SUMMARY AND EVALUATION

2.1 Human Exposure to MIBK

The general population is exposed to low levels of MIBK, which has been detected in certain foods at levels in the mg/kg range. Two countries have established maximum ambient air concentrations in the range of 0.1–0.2 mg/m^3 for general population exposure.

Occupational exposure occurs particularly in the production and use of lacquers, paints, and extraction solvents. The major route of exposure is inhalation.

2.2 Uptake, Metabolism, and Excretion

MIBK is absorbed in animals via inhalation, ingestion, and through the skin. It is widely distributed throughout the body. MIBK is readily metabolized to water-soluble excretory products and can induce metabolic activation in the liver. The urine is the major route of excretion for metabolites.

2.3 Effects on Animals

In animal studies, the acute systemic toxicity of MIBK, via the oral and inhalation routes of exposure, is low. In a 90-day gavage study on rats, a no-observed-effect level (NOEL) of 50 mg/kg per day was found. In 90-day inhalation studies on rats and mice, concentrations of up to 4100 mg/m^3 (1000 ppm) did not result in significant toxicity, though compound-related reversible morphological changes were reported in the liver and kidney. Evidence of central nervous system depression was seen in animals exposed to a level of 4100 mg/m^3 (1000 ppm). In a number of studies, exposure to MIBK concentrations as low as 1025 mg/m^3 (250 ppm) resulted in an increase in liver size and induced hepatic microsomal metabolism. This may be responsible for the exacerbation of haloalkane toxicity and for the potentiation of the neurotoxicity of *n*-hexane. MIBK was also found to potentiate the cholestatic effects of manganese given with, or without, bilirubin. In 90-day studies on mice, rats, dogs, and monkeys, only male rats developed hyaline droplets in the proximal tubules

of the kidney. Effects on behaviour were reported in baboons exposed for 7 days to 205 mg/m^3 (50 ppm).

At a concentration of 4100 mg/m^3 (1000 ppm), MIBK was not embryotoxic, fetotoxic, or teratogenic in rats or mice. Fetotoxicity was only observed at concentrations of MIBK that caused maternal toxicity.

MIBK did not induce gene mutations in *in vitro* bacterial test systems with, or without, metabolic activation. Negative results were also obtained *in vitro* with, or without, metabolic activation, in tests for mitotic gene conversion in yeast, and for gene mutation in cultured mammalian cells. The results of *in vitro* assays for unscheduled DNA synthesis in primary rat hepatocytes and for structural chromosome damage in cultured rat liver cells were negative. An *in vivo* micronucleus test on mice was negative. These data indicate that MIBK is not genotoxic. No long–term or carcinogenicity studies are available.

The toxicity of MIBK for aquatic organisms and microorganisms is low.

2.4 Effects on Human Beings

The low odour threshold (1.64 mg/m^3) and the irritant effects can provide warning of high concentrations. Exposure to levels of 10–410 mg/m^3 (2.4–100 ppm) produced perceptible irritation of the eyes, nose, or throat, and 820 mg/m^3 (200 ppm) produced discomfort. Symptoms, such as headache, nausea, or vertigo, also occurred at 10–410 mg/m^3 (2.4–100 ppm). A 2-h exposure of up to 200 mg/m^3 (50 ppm) did not produce any significant effects on a simple reaction-time task or a test of mental arithmetic.

3. CONCLUSIONS AND RECOMMENDATIONS

Because of the irritant effects of MIBK, contact with the skin and eyes should be avoided. Ingestion of MIBK should not occur with good practices; workers who come into contact with MIBK should not be at risk, provided that exposure levels in the workplace are kept as low as possible and within the prescribed control limits.

The half-life of MIBK in the environment is short and its toxicity for aquatic organisms is low. Consequently, there is no risk for the environment, provided that there are adequate controls on disposal.

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

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

MIBK causes eye and respiratory tract irritation and has reversible depressant effects on the central nervous system.

The hazards can be avoided by taking the appropriate precautions and by controlling exposure.

4.1.1 *Advice to physicians*

4.1.1.1 Symptoms of poisoning

Symptoms and signs include: irritation of the eyes, skin, and respiratory tract, and depression of the central nervous system, manifested by headaches, nausea, and narcosis. Gastrointestinal pain and hepatic toxicity may occur with exposure to high concentrations.

4.1.1.2 Medical advice

In case of poisoning by MIBK, contact the nearest Poisons Information Centre for detailed advice on treatment. Information on first aid is provided in the Summary of Chemical Safety Information. If breathing ceases or becomes weak and irregular, artificial respiration should be applied and oxygen administered. If there has been ingestion, vomiting should not be induced, because of the risk of aspiration into the lungs and the production of chemical pneumonitis. Gastric lavage can be given if a cuffed endotracheal tube is used.

4.1.2 *Health surveillance advice*

A pre-employment medical examination is advised for workers who will be regularly exposed to MIBK. If routine medical checks are undertaken, emphasis should be placed on examination of the central nervous system, respiratory tract, gastrointestinal tract, and skin.

4.2 Safety in Use

Air levels should be kept as low as practicable using suitably designed plant and engineering controls, such as local exhaust ventilation. Respiratory protection should be readily available for use in enclosed spaces, and for certain maintenance operations. Self-contained breathing apparatus should be available for use in emergencies. Skin and eye protection is recommended, when exposure to liquid MIBK is likely to occur.

4.3 Explosion and Fire Hazards

4.3.1 *Flammability and explosion*

MIBK is highly flammable and adequate ventilation should be provided. Smoking should be prohibited and electrical equipment should be designed to a recognized, explosion-proof standard.

4.3.2 *Fire*

Fire extinguishers containing carbon dioxide, dry powder, or foam are recommended. Flashback along a vapour trail may occur. Water should not be used, since this may cause the fire to spread, though a water spray can be used to cool containers.

4.4 Storage

Drums should be stored in a well-ventilated area away from sources of ignition and heat. The storage temperature should not exceed 40 °C.

4.5 Transport

Comply with national and international requirements regarding the transport of hazardous material. Containers should be in good condition and properly labelled. Keep containers in a well-ventilated place, away from sources of ignition. When pumping, the flow of MIBK may generate electrostatic charges and, therefore, all equipment should be earthed.

4.6 Spillage and Disposal

4.6.1 *Spillage*

In the event of spillage, naked flames, sparks, and heat should be avoided. Contact with skin and eyes should be avoided by wearing suitable protective gloves, face-shield and boots. Liquid should be prevented from entering drains and sewers. Spillages (small-scale) should be absorbed on paper towels, sawdust, or sand, and all material should be removed to a safe place for subsequent disposal.

4.6.2 *Disposal*

The International Register of Potentially Toxic Chemicals recommends:

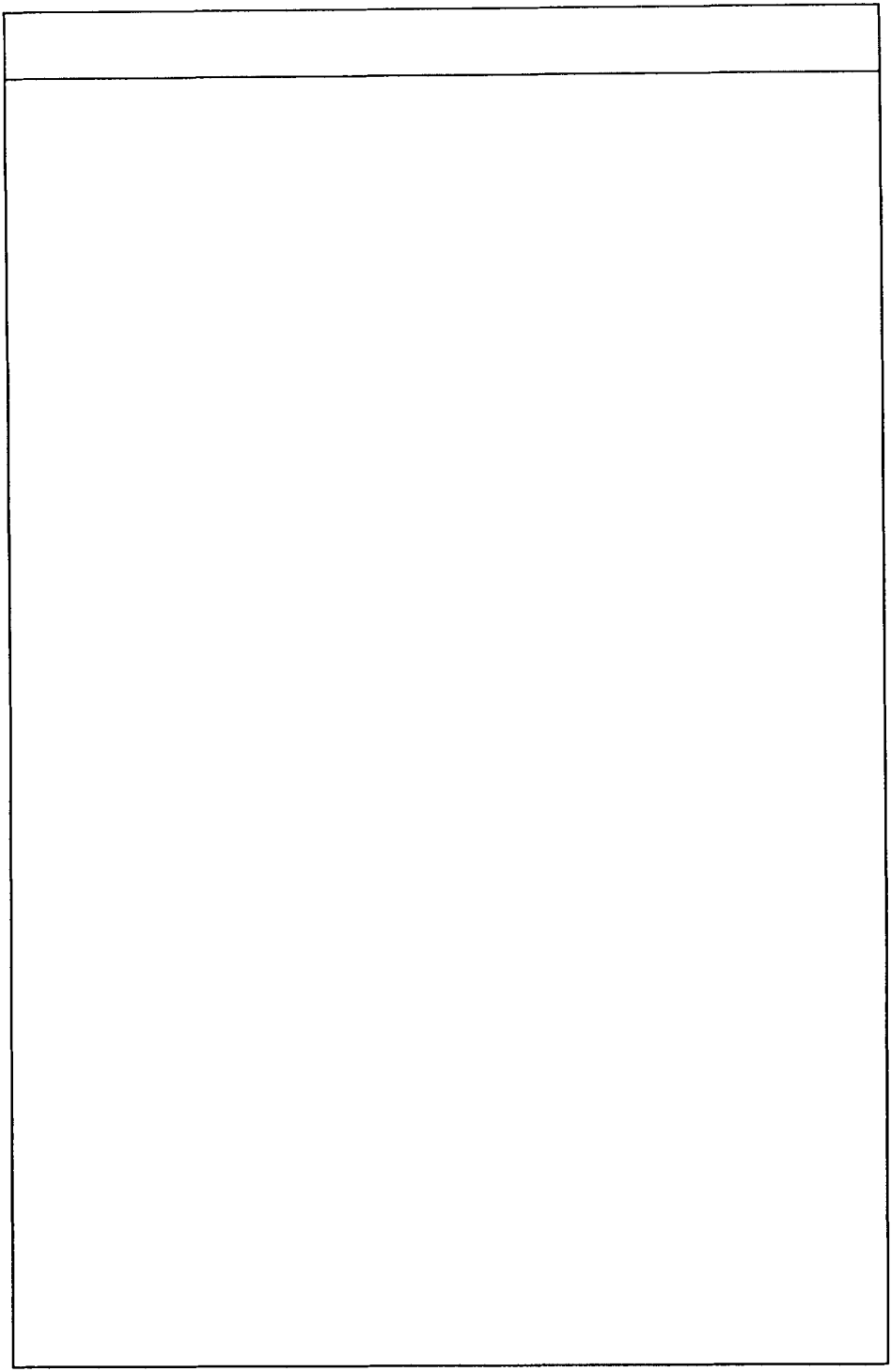
"Incineration, open burning, use as a boiler fuel. Spray into the furnace. Incineration will become easier by mixing with a more flammable solvent."

5. HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION

Industrial discharges from the manufacture, formulation, and technical applications of MIKB should be controlled.

MIBK has a short half-life in the atmosphere and is also biodegraded in water. It is not expected to bioaccumulate.

The toxicity of MIBK for microorganisms and aquatic organisms is low.



6. SUMMARY OF CHEMICAL SAFETY INFORMATION

This summary should be easily available to all health workers concerned with, and users of, methyl isobutyl ketone. It should be displayed at, or near, entrances to areas where there is potential exposure to methyl isobutyl ketone, 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 local trade names.

SUMMARY OF CHEMICAL SAFETY INFORMATION

METHYL ISOBUTYL KETONE (MIBK)

CAS name: 4-methyl-2-pentanone Chemical formula: $C_6H_{12}O$

CAS registry number: 108-10-1 RTECS registry number: SA9275000

PHYSICAL PROPERTIES		OTHER CHARACTERISTICS
Boiling point (C)	116	Colourless, volatile liquid with a sweet odour;
Freezing point (C)	–80	odour threshold approximately 1.6 mg/m^3 (0.4ppm)
Specific gravity (20 °C/4 °C)	0.8017	
Vapour pressure (KPa; 20 °C)	1.99	
Relative molecular mass	100.16	
n-Octanol/water partition coefficient (low P_{ow})	1.38	
Solubility in water (g/litre; 20 °C)	17	
Vapour density (air = 1)	3.45	
Autoignition temperature (°C)	460	
Explosion limits in air (% by volume)	1.4–7.5	
Closed-cup flashpoint (°C)	14	

HAZARDS/SYMPTOMS	PREVENTION AND PROTECTION	FIRST AID
Vapour/fumes		
SKIN: MIBK liquid may irritate the skin, when in close contact; repeated contact may produce dermatitis because of its defatting properties	Avoid skin contact; wear protective clothing	Remove from exposure; remove contaminated clothing; wash skin thoroughly with soap and plenty of water
EYES: Undiluted MIBK is an irritant; high vapour concentrations are irritant	Wear face-shield or goggles	Remove from exposure; irrigate the eyes thoroughly with water or eyewash solution for 15 minutes; obtain medical attention
INHALATION: MIBK at high concentrations is a respiratory irritant; it may cause depression of the central nervous system, such as dizziness, fatigue, and nausea	Control work environment to within recommended exposure limit; otherwise provide respiratory protection, such as a respirator	Remove patient to fresh air and keep warm; if breathing has stopped, apply artificial respiration; obtain medical attention

SUMMARY OF CHEMICAL SAFETY INFORMATION (*continued*)

HAZARDS/SYMPTOMS	PREVENTION AND PROTECTION	FIRST AID
INGESTION: should not occur with good work practices	Do not eat, drink, or smoke during work	Rinse mouth; vomiting should not be induced; keep patient warm and rested; obtain medical attention
ENVIRONMENT: half-life in the environment is short; low toxicity for microorganisms and aquatic organisms; should not pose a risk, provided there are adequate controls to minimize emissions	Industrial discharges should be minimized and regulated; disposal should only be via incineration	

SPILLAGE STORAGE	FIRE AND EXPLOSION	
Take appropriate personal precautions; absorb spillage on paper towel, sawdust, or sand, for subsequent action; avoid spills entering drains or surface waters	Store drums in a well-ventilated area in fire-resistant containers; metal containers should be electrically-grounded, when transferring liquid	Adequate ventilation should be provided and there should be no sources of sparks, heat, or naked flames; flashback along a vapour trail may occur; fire extinguishers containing carbon dioxide, dry powder, or foam are recommended; water sprays should not be used, except to cool containers
WASTE DISPOSAL		LABELLING
Waste material should be incinerated in an approved manner	National Occupational Exposure Limit: National Poison Control Centre: Local trade names:	United Nations 1245 Hazard Class 3 (flammable liquid) Packing Group III (medium danger)

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. A full reference to the original national document from which the information was extracted can be obtained from IRPTC. 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).

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. The regulations and guidelines of all countries are subject to change and should always be verified with appropriate regulatory authorities before application

7.1 Regulation of Emissions

In the Federal Republic of Germany, MIBK belongs to Class III, the air emissions of which must not exceed (as the sum of all compounds in any class) 150 mg/m^3 (37 ppm), at a mass flow of ≥ 3 kg/h. The maximum recommended ambient concentration is 0.2 mg/m^3 (0.05 ppm) in Czechoslovakia, and it must not exceed 0.1 mg/m^3 (0.025 ppm) in the USSR.

7.2 Regulation of Food and Food Wrappings

MIBK is allowed as a component of food-packaging materials in the EEC and in the USA.

7.3 Regulation of Beverages

The Council of Europe Committee of Experts on Flavouring Substances suggested a limit of 5 mg/litre in beverages.

7.4 Exposure Limit Values

Some occupational air exposure limit values are given in the table on pages 24–26.

7.5 Labelling and Packaging

The United Nations recommends labelling as Hazard Class 3 (flammable liquid), Packing Group III (medium danger).

In the European Economic Community, MIBK is labelled as follows:

Highly flammable, keep container in a well-ventilated place, keep away from sources of ignition, no smoking, do not breathe gas/fumes/vapour spray. Take precautionary measures against static discharges.

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

OCCUPATIONAL AIR EXPOSURE LIMITS

Country/ organization	Exposure limit description[a]	Value (mg/m^3)	Effective date[b]
Australia	Recommended threshold limit value (TLV)		
	-Time weighted average (TWA)	205	1983(r)
	-Short-term exposure limit (STEL)	300	
Belgium	Recommended threshold limit value (TLV)		
	-Time weighted average (TWA)	205	1988(r)
	-Short-term exposure limit (STEL)	300	
Finland	Permissible exposure limit (MPC)		
	-Time weighted average(TWA)	210	1987
	-Short-term exposure limit (STEL)	315	
Germany (Federal Republic of)	Recommended threshold limit value (MAK)		
	-Time weighted average (TWA)	400	1988(r)
	-Short-term exposure limit (STEL)	2000	
Japan	Administrative concentration		
	-Time weghted average (TWA)	205	1990(n)

Netherlands	Recommended threshold limit value (MXL) -Time weighted average (TWA)	 240	 1989(r)
Poland	Permissible exposure limit (MPC) -Time weighted average (TWA)	 200	 1982(r)
Romania	Permissible exposure limit (MPC) -Time weighted average (TWA) -Ceiling value (CLV)	 200 300	 1984(r)
Switzerland	Permissible exposure limit (MAK) -Time weighted average (TWA)	 205	 1987(r)
Sweden	Permissible exposure limit (HLV) -Time weighted average (TWA) -Short-term exposure limit (STEL)	 100 200	 1990(n)
United Kingdom	Occupational exposure standard (OES) -Time weighted average (TWA) -Short-term exposure limit (STEL)	 205 300	 1990(n)
USA (ACGIH)	Recommended threshold limit value (TLV) -Time weighted average (TWA) -Short-term exposure limit (STEL)	 205 307	 1989

OCCUPATIONAL AIR EXPOSURE LIMITS (*continued*)

Country/ organization	Exposure limit description[a]	Value (mg/m^3)	Effective date[b]
USA (OSHA)	Permissible exposure limit (PEL) -Time weighted average (TWA)	410	1974
USSR	Temporary exposure limit (TSEL) -Ceiling value (CLV)	5	1989
Yugoslavia	Permissible exposure limit (MAC) -Time weighted average (TWA)	410	1971(r)

[a] TWA = a maximum mean exposure limit, generally, over the period of a working day.
STEL = a maximum concentration of exposure for a specified time duration (generally 10-30 min).
[b] n = Notified direct by country.

BIBLIOGRAPHY

ACGIH (1986) *Documentation of the threshold limit values and biological exposure indices*. Cincinnati, American Conference of Governmental Industrial Hygienists.

ACGIH (1989) *Threshold limit values and biological exposure indices for 1989-1990*. Cincinnati, American Conference of Governmental Industrial Hygienists.

CLAYTON, G.D. & CLAYTON, F.E. (1981) *Patty's industrial hygiene and toxicology*. Vol. 2 C. New York, Wiley-Interscience, John Wiley & Sons.

GOSSELIN, R.E., HODGE, H.C., SMITH R.P., & GLEASON, M.N. (1976) *Clinical toxicology of commercial products*. 4th ed. Baltimore, Maryland, The Williams and Wilkins Company.

HANDLING CHEMICALS SAFELY (1989) *Handling chemicals safely*. 2nd ed. Dutch Association of Safety Experts, Dutch Chemical Industry Association, Dutch Safety Institute.

IRPTC (1988) *Data profile (legal file)*. Geneva, International Register of Potentially Toxic Chemicals.

SAX, N.I. (1984) *Dangerous properties of industrial materials*. New York, Van Nostrand Reinhold Company.

US NIOSH (1976) *A guide to industrial respiratory protection*. 3 Vol. Cincinnati, Ohio, US National Institute for Occupational Safety and Health. Occupational Safety and Heath Administration,

US NIOSH/OSHA (1981) *Occupational health guidelines for chemical hazards*. 3 Vol. Washington, DC, US Department of Health and Human Services, US Department of Labor (Publication No. DHHS(NIOSH) 81-123).

US NIOSH/OSHA (1985) *Pocket guide to chemical hazards*. Washington DC, US National Institute for Occupational Safety and Health, Occupational Safety and Heath Administration (Publication No. 85.114).

BIBLIOGRAPHY

WHO (1990) *Environmental Health Criteria 117: Methyl isobutyl ketone.* Geneva, World Health Organization.

Price: Sw. fr. 5.–
Price in developing countries: Sw. fr. 3.50

ISBN 92 4 151058 7