

N-Methyl-2-pyrrolidone



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IDENTIFICATION

N-Methyl-2-pyrrolidone

N-Methylpyrrolidone

N-Methyl-alpha-pyrrolidone

Methyl-alpha-pyrrolidone

ZVG No: 13700
CAS No: 872-50-4
EC No: 212-828-1
INDEX No: 606-021-00-7

CHARACTERISATION

SUBSTANCE GROUP CODE

144720 Lactams

STATE OF AGGREGATION

The substance is liquid.

PROPERTIES

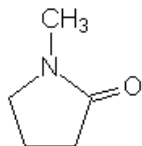
colourless
amine-like odour

CHEMICAL CHARACTERISATION

Combustible substance, poorly flammable (flash point > 60 up to 93 °C).
Vapours may form explosive mixtures with air when the substance is heated above its flash point.
Mixable with water.
Hygroscopic.
Aqueous solution reacts alkaline.
Very low-volatile.
Sensitive to light.
Sensitive to air.
Acute or chronic health hazards result from the substance.
(see: chapter REGULATIONS).

[Substance information in Wikipedia](#)

FORMULA

 C_5H_9NO **Molar mass:** 99,13 g/mol**Conversion factor** (gaseous phase) at 1013 mbar and 20 °C:1 ml/m³ = 4,12 mg/m³

PHYSICAL AND CHEMICAL PROPERTIES

[Melting point](#) | [Boiling point](#) | [Density](#) | [Vapour pressure](#) | [Evaporation number](#) | [Flash point](#) | [Ignition temperature](#) | [Explosion data](#) | [Solubility](#) | [pH-value](#) | [Partition coefficient](#) | [Viscosity](#) | [Hazardous reactions](#) | [Further Information](#)

MELTING POINT

Melting point: -24 °C

Reference: [00440](#)

BOILING POINT

Boiling Point: ca. 203 °C

Reference: [00440](#)

DENSITY

DENSITY

Value: 1,03 g/cm³

Temperature: 20 °C

Reference: [00440](#)

RELATIVE VAPOUR DENSITY

Ratio of the density to dry air at the same temperature and pressure

Value: 3,42

Reference: [00440](#)

RELATIVE DENSITY OF THE VAPOUR-AIR-MIXTURE

Ratio of the density to dry air at 20 °C and standard pressure

Value: 1,00

Reference: [99999](#)

VAPOUR PRESSURE

Vapour pressure: 0,32 hPa

Temperature: 20 °C

Reference: [01211](#)

Vapour pressure: 0,7 hPa

Temperature: 30,6 °C

Reference: [07520](#)

Vapour pressure: 1,33 hPa

Temperature: 40 °C

Reference: [01211](#)

Vapour pressure: 2,5 hPa

Temperature: 50 °C

Reference: [00105](#)

EVAPORATION NUMBER

The evaporation number is the time required for complete evaporation of a substance, related to the time required for evaporation of diethyl ether.

Evaporation number: 95

Reference: [08105](#)

FLASH POINT

Flash point: 86 °C

Closed cup

Reference: [00440](#)

IGNITION TEMPERATURE

Ignition temperature: 265 °C

Temperature class: T3

Reference: [00440](#)

EXPLOSION DATA

Lower explosion limit:

1,52 vol.%

63 g/m³

Upper explosion limit:

9,5 vol.%

392 g/m³

Lower explosion point:

79 °C

Max. exper. safe gap (MESG): 0,93 mm

Explosion group: IIA

Reference: [00440](#)

SOLUBILITY IN WATER

mixable with water

Reference: [00454](#)

pH-VALUE

pH-value: 8,5 ... 10,0

Temperature: 20 °C

Concentration: 100 g/l

Reference: [01211](#)

PARTITION COEFFICIENT (octanol/water)

log Kow: -0,54

Recommended value of LOG KOW Databank.

Reference: [02070](#)

VISCOSITY

Dynamic Viscosity: 1,80 mPa*s

Temperature: 20 °C

Conversion: Viscosity(kin) = Viscosity(dyn) / density

Reference: [01211](#)

HAZARDOUS REACTIONS

Decomposition temperature: > 300 °C

Hazardous chemical reactions

The substance can react dangerously with:
strong oxidizing agents
nitric acid
strong acids

FURTHER INFORMATION

Conductivity: $2 \cdot 10^{-6}$ S/m

Temperature: 25 °C

Reference: [08086](#)

TOXICOLOGY / ECOTOXICOLOGY

TOXICOLOGICAL DATA

LD50 oral rat

Value: 3910 mg/kg

Arzneimittel-Forschung. Drug Research. Vol. 26, Pg. 1581, 1976.

LD50 dermal

Species: Rabbit

Value: 8000 mg/kg

Raw Material Data Handbook, Vol.1: Organic Solvents, 1974. Vol. 1, Pg. 84, 1974.

Reference: [02071](#)

ECOTOXICOLOGICAL DATA

LC50 Crustaceans (48 hours)

Minimum: 1,23 mg/l

Maximum: 1,23 mg/l

Median: 1,23 mg/l

Study number: 1

Reference for median:

Lan, C.H., C.Y. Peng, and T.S. Lin 2004. Acute Aquatic Toxicity of N-Methyl-2-Pyrrolidinone to *Daphnia magna*. Bull.Environ.Contam.Toxicol. 73(2):392-397

Reference: 02072

OCCUPATIONAL HEALTH AND FIRST AID

[Routes of exposure](#) | [Toxic effects](#) |
[First Aid](#)

ROUTES OF EXPOSURE

Main routes of exposure

The main intake pathways for N-methyl-2-pyrrolidone (NMP) proceed via the respiratory tract and through the skin. [7619]

Respiratory tract

At normal temperatures, the volatility of NMP is relatively low. If the temperature is increased or the chemical evaporates from large surfaces, high concentrations in air can nevertheless be formed.

NMP can then occur as a vapor or aerosol. [99996]

NMP shows a distinct tendency to form aerosols. This increases with increasing vapor concentrations and moisture and if the temperature decreases. At 100% humidity, it exists completely as an aerosol. On the other hand, no formation of aerosols is assumed under normal conditions and provided the limits for workplaces are observed (range up to approx. 80 mg/m³). [7619]

In experiments on volunteers, effective absorption of NMP vapors in the respiratory tract was detected (absorption of about 90%). [7985]

Aerosols are assumed to be partially absorbed in the respiratory tract and partially transferred into the gastrointestinal tract. [7619]

Skin

If the skin comes in contact with the liquid or aerosols, the possibility of percutaneous absorption is to be taken into account. [7619]

In experiments on volunteers, NMP (300 mg, single application) was absorbed rapidly and to a high degree through the skin (22 - 24% within 6 hours). [7985]

Studies on skin preparations and animal experiments confirm an effective dermal absorption.

The absorption rates were particularly high when undiluted NMP was applied in copious quantities and caused damage to the skin. NMP can penetrate the skin still more easily if it is dissolved in lipophilic solvents. In contrast, NMP is less likely to be taken up from aqueous solution. [7619]

Gastrointestinal tract

NMP is effectively absorbed via the gastrointestinal tract.

In experiments on volunteers, absorption were at least 65% (based on the elimination of the metabolites in the urine). [7985]

TOXIC EFFECTS

Main toxic effects

Acute:

Irritation to the eyes, airways and skin,
disturbance to general well-being

Chronic:

Damage to the skin, irritation to the mucous membranes [7985]

Acute toxicity

Following exposure to NMP, irritation to the mucous membranes and skin as well as offensive odor are considered to be the most significant effects. [99996, 2051]

Undiluted NMP and 50% aqueous solution acted distinctly irritating in tests on rabbits' eyes. [220, 2051] 10 - 25% aqueous NMP solutions examined in corresponding tests did not show any irritation and were assessed not to be eye irritating. [220]

Persistent eye damage due to NMP is not expected.

Persons exposed occupationally to vapors/aerosols of NMP felt irritation to their eyes (see below). [7985]

The irritative effect of pure NMP or its 50% solution following a single application in tests on rabbits and guinea pigs was slight, [220] but in one test following repeated application distinctly pronounced. [7985, 99996]

However, during occupational handling with pure NMP, distinct skin reactions were already observed after 1 - 3 days: local reddening, swelling, pain, formation of small blisters. The employees had sometimes worked with gloves and sometimes without gloves and the glove material (latex) was permeable to NMP. It was assumed that the occlusive contact connected with increased skin moisture under the glove favored the skin damaging effect. [99996] The hygroscopic effect of NMP can also contribute to its potential to damage the skin. [2051]

No sensitizing effect for NMP was detectable in the test on volunteers mentioned above and also not in two independent tests in guinea pigs. [7985, 7619]

The dermal toxicity was low (LD50, rabbit: 2000 - 8000 mg/kg bw). [220]

Employees exposed inhalatively to NMP suffered from eye irritation and headache. Concentrations in the workplaces (8 h average) were estimated to be at 3 - 280 mg/m³. However, the analysis of the exposure and the methodology of examination were not suitable to derive valid dose-effect relationships.

Under controlled conditions in an experiment on volunteers, concentrations of 50 mg/m³ for 8 hours were detectable by odor by 2 of 6 volunteers but they did not feel any irritation. [7985] In a more recent test, 80 mg/m³, with and without physical exertion for 8 hours was shown to be moderately odiferous but not irritating. Slight irritation to the eyes and nose were felt only when peaks of exposure of 160 mg/m³ occurred. [7619]

In inhalative animal experiments, the toxicity was low. Rodents (several species) and cats tolerated an atmosphere enriched with NMP at 20 or 50 degrees C without any signs of poisoning. [220]

Inhalative exposure of rats to 5100 mg NMP/m³ for 4 h (aerosol with MMAD: 4.6 µm) triggered irritation and nervous disorders (difficulties in breathing, slight bloody nasal secretion, degreased pain reflex) but no deaths. [7985]

In animal experiments, the oral toxicity was also low. [220]

Cats which received 1033 mg/kg bw showed gastrointestinal and nervous symptoms (vomiting, anorexia, salivation, ataxia). The lethal dose for rodents was between 3500 and 7900 mg/kg bw. Narcosis and unspecific symptoms occurred. [7619]

Chronic toxicity

Skin damage from occupational handling has been reported in some cases. Following contact with undiluted NMP for long time periods, dermatitis became apparent with reddening, fissures, edema and blistering.

Irritation to the eyes and headache (see "Acute toxicity") felt by employees were possibly also consequences of repeated exposure. [7985]

Studies in workplaces with reliable registration and analysis of exposure conditions and the physical state of employees exposed are not available. [99983]

A significant finding in an animal experiment was the distinct influence of the exposure conditions on the toxicity. Rats exposed subacutely inhalatively to 1000 mg/m³ (6 h/d, 5 d/w) for 2 weeks showed only slight nasal irritation but no other effects following head-nose exposure, independent of the aerosol fraction. By comparison, when the rats were exposed in the whole body mode and the aerosols part was high (increased moisture), nasal irritation and distinct systemic effects were noticeable. Aerosols having large droplets caused particularly serious symptoms (respiratory disturbances, tremor, cramps) and high mortality with damage to inner organs (pulmonary edema, pneumonia, necrotic alterations in liver and spleen, cell depletion in the bone marrow and gastric ulcer). [7985]

In view of common occupational exposure situations 2 studies are relevant, in addition to an inhalative multi-generation study (see "Reproductive toxicity"). [99983].

Rats were exposed in the head only mode to 500 - 3000 mg NMP/m³ (82 - 92% as an aerosol) for 13 weeks. The animals of the highest exposure group showed irritation to the airways and systemic effects (slight influence to the hemopoiesis and lymphatic system, effects to the testes). 1000 mg/m³ still caused nasal irritation. 500 mg/m³ was tolerated by the animals (NOAEL). [7985]

In a 2-year study on rats, 400 mg/m³ led to slight signs of inflammation in the lungs and slight systemic effects after 18 months, but no longer after 24 months. 400 mg/m³ was considered to be the borderline between NOAEL and LOAEL. [2051]

For oral administration only relatively high doses had an effect. In part they caused organ damage, in part only nervous disorders. Following exposure of rats for 90 days, the NOAEL was 170 - 220 mg/kg bw x d. [7985] The NOAEL resulting from a 18-month study on mice was in the same range (90 - 115 mg/kg KG). [7619]

The target organs for chronic-toxic action as a whole could not definitely be derived from the experiments. [7985]

Reproductive toxicity, mutagenicity, carcinogenicity

For classifying the reproductive toxicity and mutagenic and carcinogenic potential see list in Annex VI of the CLP regulation / TRGS 905 / List of MAK values (see section REGULATIONS).

Reproductive toxicity:

According to the information material available a risk of reproductive-toxic action is suspected. For classification of damage to the developing embryo or fetus / impairment of reproductive capability see section REGULATIONS.

[7510]

In studies on rodents, developmentally toxic effects were observed only following exposures which also caused maternally toxic effects. [2051] In multi-generation studies on rats, inhalative exposures to 206 mg/m³ and oral dosages of 160 mg/kg bw x d were without any effect. Exposures to approx. 500 mg/m³ (approx. 120 ppm) caused reduced body weight gain of the dams and reduced fetal weights. More distinct developmentally toxic effects (even malformations) were caused by oral doses from 350 mg/kg bw x d upwards. [7619, 5334]

In view of exposure in occupational situations it was stated:

There is no reason to fear a risk of damage to the developing embryo or foetus when MAK and BAT values are observed.

Also only at high dosages, indications of disturbances to fertility have been observed. In an oral two-generation study on rats, corresponding effects were registered at dosages of 500 mg/kg bw x d.

[7619]

Mutagenicity:

NMP was shown to be non genotoxic in in-vitro tests and in-vivo tests on rodents. [7619]

Carcinogenicity:

Carcinogenic activity was observed neither in a 2-year inhalative study nor in a long-term study with oral administration on rats.

In a feeding study on mice, an increased incidence of liver tumors was found exclusively in the highest dose group, at dosages of above 1000 mg/kg bw x d. Based on the lack of genotoxicity and the high sensitivity of mice to develop liver tumors, this study is assessed to as not relevant for humans. [7619, 2051]

Biotransformation and excretion

Irrespective of the intake pathway, NMP is rapidly distributed in the organism. In animal experiments highest portions of noxa absorbed were found in the liver, bile, small bowel, kidneys, stomach and testes.

The substance is rapidly and effectively metabolized. Through hydroxylation, first 5-hydroxy-N-methylpyrrolidone (5-HNMP) is formed and this reacts further to form N-methylsuccinimide (MSI) and further to 2-hydroxy-N-methylsuccinimide (2-HMSI). Also 2-pyrrolidone was identified in small amounts. The metabolites and minor amounts of unchanged NMP are eliminated relatively rapidly, primarily with the urine.

Volunteers exposed inhalatively to NMP were found to eliminate 2% in their urine unchanged, 60% as 5-HNMP, 0.1% as MSI and 37% as 2-HMSI. The elimination half-lives for the single compounds were about 4.5 h for NMP, 7 h for 5-HNMP, 8 h for MSI and 17 h for 2-HMSI. [7985, 7620]

After contact with the skin, elimination proceeds somewhat more slowly. Following the dipping of one hand into an aqueous solution, the elimination half-life for 5-HNMP was about 11 hours.

The determination of unchanged NMP or the main metabolites 5-HNMP and/or 2-HMSI in the blood or urine is suitable as a biomonitoring parameter for the observation of internal exposure. A BAT value (biological tolerance value for working material) could be derived to date only for 5-HNMP. [7620, 99996]

Annotation

This occupational health information was compiled on 08.05.2012.
It will be updated if necessary.

FIRST AID

Eyes

Rinse the affected eye with widely spread lids for 10 minutes under running water whilst protecting the unimpaired eye.

Arrange medical treatment.

[7985]

Skin

Remove contaminated clothing while protecting yourself.

Rinse the affected skin areas for at least 10 to 20 minutes under running water.

Under no circumstances should alcohol, gasoline or other solvents be used.

[7985]

For irritation or following extensive contamination:

Arrange for medical treatment.

[99999]

Respiratory tract

Whilst protecting yourself remove the casualty from the hazardous area and take him to the fresh air.

Lay the casualty down in a quiet place and protect him against hypothermia.

In the case of breathing difficulties have the casualty inhale oxygen.

[7985]

For signs of irritation:

As soon as possible repeatedly have the casualty deeply breathe a glucocorticoid inhalation spray in.

If the casualty is unconscious but breathing lay him in a stable manner on his side.

[22]

Always:

Arrange medical treatment.

[7985]

Swallowing

Rinse the mouth and spit the fluids out.

If the casualty is conscious have him drink 1 glass of water (ca 200 ml).

Do not make the casualty vomit.

Arrange medical treatment.

[7985]

During spontaneous vomiting hold the head of the casualty low with the body in a prone position in order to avoid aspiration. [7638]

Information for physicians

No reports are available on serious poisoning cases with N-methyl-2-pyrrolidone. Some experience with persons exposed and animal experimental results confirm local irritation, in particular to the eyes. Only a few indications are available on systemic effects and these effects are only to be expected at the high dose level. [99983]

- Symptoms of acute poisoning:

Eyes: distinct irritation with reddening, pain, blurred vision following contact with concentrated solutions, vapors or aerosols [7985]

Skin: following short-term/open contact generally no or minor irritation, [220] however, following prolonged/occlusive contact reddening, pain, swelling, blistering; [99996]

uptake through the skin is to be taken into account [7985]

Inhalation: due to high concentrations possible irritation to the airways (burning sensation in the nose/throat, cough), in extreme cases (in particular following exposure to aerosols) pulmonary damage possible; [99999]

but probably more likely disturbance of well-being, particularly headache; further absorptive-toxic effects dependent on the concentration [7985]

Ingestion: irritation to mucous membranes contacted and gastrointestinal complaints (nausea, vomiting); absorptive-toxic effects following high doses possible;

a danger of aspiration already for ingestion of small amounts [99999]

Absorption: disturbance to the well-being with headache, nausea etc.; further signs of increasing CNS depression probably dependent on the dose, possibly also functional disturbances to the liver and kidneys. [7985]

- Medical advice:

Thoroughly rinse contaminated eyes, treatment of pain as necessary, further treatment by an ophthalmologist is necessary as soon as possible. [7985]

Thoroughly cleanse contaminated skin with soap and water. Following extensive exposure observe the casualty for systemic effects. [99999]

Following inhalation treat symptomatically. Signs of irritation require application of glucocorticoids (at least inhalatively). Carry out all further prophylactic measures for pulmonary edema as necessary. [22]

Following swallowing of high doses, gastrolavage should be considered for primary elimination. [99999]

The effectiveness of charcoal to bind the noxa is unknown. [99983] Because an endoscopy could be necessary later, better not to apply charcoal. Further treatment should be done symptomatically.

Following ingestion, massive inhalation and persistent skin contact, further observation in hospital is recommended. Observe parameters of the heart/circulatory system, CNS, liver, kidneys, blood and lung in particular. [99999]

Recommendations

Provide the physician information about the substance/product and treatment already administered. [99983]

Annotation

This first aid information was compiled on 08.05.2012.
It will be updated if necessary.

SAFE HANDLING

[Handling](#) | [Storage](#) | [Fire and explosion protection](#) | [Organisational measures](#) | [Personal protection](#) | [Disposal considerations](#) | [Accidental release measures](#) | [Fire fighting measures](#)

TECHNICAL MEASURES - HANDLING

Workplace

Provision of very good ventilation in the working area.

Washing facility at the workplace required.

Eye bath required. These locations must be signposted clearly.

Equipment

Use only closed apparatus.

If release of the substance cannot be prevented, then it should be suctioned off at the point of exit.

Exhaust especially required at higher temperatures.

Consider emission limit values, a purification of waste gases if necessary.

Label containers and pipelines clearly.

Plastics have to be proven for their resistibility.

Advice on safer handling

Take care to keep workplace clean and dry.

The substance must not be present at workplaces in quantities above that required for work to be progressed.

Do not leave container open.

Use leak-proof equipment with exhaust for refilling or transfer.

Provide leak control and facilities for rinsing with air or inert gas.

Avoid splashing.

Fill only into labelled container.

Avoid any contact when handling the substance.

Do not transport together with incompatible substances.

Use an appropriate exterior vessel when transporting in fragile containers.

Cleaning and maintenance

Use protective equipment while cleaning if necessary.

Only conduct maintenance and other work on or in the vessel or closed spaces after obtaining written permission.

TECHNICAL MEASURES - STORAGE**Storage**

Do not use any food containers - risk of mistake.

Containers have to be labelled clearly and permanently.

Store in the original container as much as possible.

Place fragile vessels in break-proof outer vessels.

Keep container tightly closed.

Store in a cool place.

Store in a dry place.

Keep container in a well-ventilated place.

Substance is sensitive to light, protect from exposure to light.

Substance is sensitive to air, protect from air/oxygen.

Protect from overheating/heating up.

Substance is hygroscopic, protect from moisture.

Conditions of collocated storage

Storage class 6.1 C (Combustible, acutely toxic Cat. 3 or chronic effecting substances)

Only substances of the same storage class should be stored together.

Collocated storage with the following substances is prohibited:

- Pharmaceuticals, foods, and animal feeds including additives.
- Infectious, radioactive und explosive substances.
- Gases.
- Other explosive substances of storage class 4.1A.
- Strongly oxidizing substances of storage class 5.1A.
- Ammonium nitrate and preparations containing ammonium nitrate.
- Organic peroxides and self reactive substances.

Under certain conditions the collocated storage with the following sub-stances is permitted (For more details see [TRGS 510](#)):

- Pyrophoric substances.

- Substances liberating flammable gases in contact with water.
- Oxidizing substances of storage class 5.1B.

The substance should not be stored with substances with which hazardous chemical reactions are possible.

TECHNICAL MEASURES - FIRE AND EXPLOSION PROTECTION

Technical, constructive measures

Substance is combustible.

Fire fighting equipment must be available.

Precaution on handling

Areas in which the substance is heated to above its flash point and processed are areas of fire hazard.

Keep away from open flames.

Welding only under supervision.

ORGANISATIONAL MEASURES

Instruction on the hazards and the protective measures using instruction manual ([TRGS 555](#)) are required with signature if just more than one minor hazard was detected.

Instruction must be provided before employment and then at a minimum of once per annum thereafter.

It must be assured that the workplace limit values are being maintained. If the limit values are exceeded, additional protection measures are necessary.

The measurements must be recorded and kept on file.

The number of employees who work with the hazardous substance must be kept to a minimum.

Observe the restrictions on juvenile employment as defined in the "Jugendarbeitsschutzgesetz".

Observe the restrictions on activities of pregnant women according to the the „Mutterschutzgesetz“ (German Maternity Protection Act)

PERSONAL PROTECTION

Body protection

Depending on the risk, wear a suitable protective clothing or a suitable chemical protection suit.

Respiratory protection

In an emergency (e.g.: unintentional release of the substance, exceeding the occupational exposure limit value) respiratory protection must be worn. Consider the maximum period for wear.

Respiratory protection: Gas filter A, Colour code brown.

Use insulating device for concentrations above the usage limits for filter devices, for oxygen concentrations below 17% volume, or in circumstances which are unclear.

Eye protection

Sufficient eye protection must be worn.

Wear glasses with side protection.

Hand protection

Use protective gloves. The glove material must be sufficiently impermeable and resistant to the substance. Check the tightness before wear. Gloves should be well cleaned before being removed, then stored in a well ventilated location. Pay attention to skin care.

Skin protection cremes do not protect sufficiently against the substance.

The following materials are suitable for protective gloves (Permeation time \geq 8 hours):

Butyl rubber - Butyl (0,5 mm)

Following materials are unsuitable for protective gloves because of degradation, severe swelling or low permeation time:

Natural rubber/Natural latex - NR

Polychloroprene - CR
Nitrile rubber/Nitrile latex - NBR
Fluoro carbon rubber - FKM
Polyvinyl chloride - PVC

The times listed are suggested by measurements taken at 22 °C and constant contact. Temperatures raised by warmed substances, body heat, etc. and a weakening of the effective layer thickness caused by expansion can lead to a significantly shorter breakthrough time. In case of doubt contact the gloves' manufacturer. A 1.5-times increase / decrease in the layer thickness doubles / halves the breakthrough time. This data only applies to the pure substance. Transferred to mixtures of substances, these figures should only be taken as an aid to orientation.

Occupational hygiene

Foods, beverages and other articles of consumption must not be consumed at the work areas. Suitable areas are to be designated for these purposes.

Avoid contact with skin. In case of contact wash skin.

Avoid contact with eyes. In case of contact rinse the affected eye(s).

Avoid inhalation of vapour or mist.

Avoid contact with clothing. Contaminated clothes must be exchanged and cleaned carefully.

Increased risk of combustion from wicking.

Before a break it might be necessary to change clothes.

Provide washrooms with showers and if possible rooms with separate storage for street clothing and work clothing.

The skin must be washed with soap and water before breaks and at the end of work. Apply fatty skin-care products after washing.

Take care of personal hygiene.

DISPOSAL CONSIDERATIONS

Hazardous waste according to Waste Catalogue Ordinance (AVV).

If there is no way of recycling it must be disposed of in compliance with the respective national and local regulations.

Collection of small amounts of substance:

Place in a collection container for halogen-free organic solvents and solutions of halogen-free organic substances.

Collection vessels must be clearly labelled with a systematic description of their contents. Store the vessels in a well-ventilated location. Entrust them to the appropriate authorities for disposal.

ACCIDENTAL RELEASE MEASURES

Evacuate area. Warn affected surroundings.

The hazardous area may only be entered once suitable protective measures are implemented. Only then can the hazardous situation be removed (see chapter Personal Protection).

Take up with an absorbent (absorbent and neutralizer for spilled alkalis) and dispose of according to regulations.

Afterwards ventilate area and wash spill site.

Endangerment of water:

Low hazard to waters. Inform the responsible authorities when very large quantities get into water, drainage, sewer, or the ground.

FIRE FIGHTING MEASURES

Classes of fires

B liquid or melting
substances

Suitable extinguishing media

Water (spray - not splash)
Dry extinguishing powder
Alcohol resistant foam
Carbon dioxide
Fight large fire with alcohol resistant foam or water spray.

Instructions

Cool surrounding containers with water spray.
If possible, take container out of dangerous zone.
Heating causes a rise in pressure, risk of bursting and explosion.
Shut off sources of ignition.

Special protective equipment

In the case of a fire hazardous substances can be released.
Nitrous gases (nitric oxides)
Carbon monoxide and carbon dioxide
Wear self-contained breathing apparatus and special tightly sealed suit.

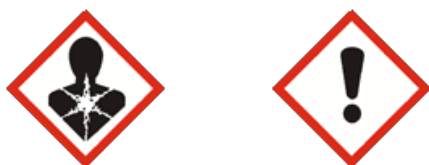
REGULATIONS

[GHS Classification/Labelling](#) | [Workplace labelling](#) | [Water hazard class](#) | [Air quality control](#) | [Transport Regulations](#) | [Threshold limit values](#) | [EC-Threshold limit values](#) | [REACH](#) | [MAK recommendations](#) | [Biological exposure indices](#) | [Restriction of use](#) | [Technical rules](#) | [Regulations of accident insurers](#)

EUROPEAN GHS CLASSIFICATION AND LABELLING

Classification

Skin irritation, Category 2; H315
Eye irritation, Category 2; H319
Specific Target Organ Toxicity (single exposure), Category 3; H335
Reproductive toxicity, Category 1B; H360D



Signal Word "Danger"

Hazard Statement - H-phrases

H315: Causes skin irritation.
H319: Causes serious eye irritation.
H335: May cause respiratory irritation.
H360D: May damage the unborn child.

Precautionary Statement - P-phrases

P201: Obtain special instructions before use.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313: IF exposed or concerned: Get medical advice/attention.

Manufacturer's specification by Merck

Reference: [01211](#)

State: 2018

Checked: 2019

The substance is listed in appendix VI, table 3 of CLP regulation.

The given classification can deviate from the listed classification, since this classification is to be complemented concerning missing or divergent danger classes and categories for the respective substance.

Reference: [99999](#)

GHS-CLASSIFICATION OF MIXTURES

Specific Concentration Limits

STOT SE 3; H335: C \geq 10 %

The general concentration limits from Annex 1 of the Regulation (EU) 1272/2008 are to be used for possibly unspecified concentration ranges or further available substance classifications.

Reference: [07509](#)

WORKPLACE LABELLING ACCORDING TO GERMAN [ASR A1.3](#)

Prohibition label



No Smoking



No admittance for unauthorized persons



No eating and drinking

Precept label



Use safety goggles



Wear safety gloves

GERMAN WATER HAZARD CLASS

Substance No: 1181

WGK 1 - low hazard to waters

Classification according to the announcement of the list of substances hazardous to water in the Federal Register of 10.08.2017, last update 24.11.2023

TECHNICAL INSTRUCTIONS ON AIR QUALITY CONTROL ([TA LUFT](#))

Chapter 5.2.7.1.3 Substances toxic to reproduction

Mass flow: 2,5 g/hr

or

Mass conc.: 1 mg/m³

TRANSPORT REGULATIONS

Not subject to transport regulations.

Reference: [01211](#)

TRGS 900 - GERMAN OCCUPATIONAL EXPOSURE LIMIT VALUES

20 ml/m³

82 mg/m³

Peak limitation: Excursion factor 2

Duration 15 min, mean; 4 times per shift; interval 1 hour

Category I - Substances for which local irritant effects determine the exposure limit value, also respiratory allergens

Risk of percutaneous absorption

There is no reason to fear a risk of damage to the developing embryo or foetus when AGW and BGW are adhered to.

Source: EU, DFG, AGS

Scope:

Steam

Sum of vapours and aerosols.

According to the amendment of Annex XVII of Regulation (EC) No 1907/2006, a restriction on the use of NMP shall apply from 10 May 2020 if the air limit value (DNEL) specified in that Annex is not complied with.

EC OCCUPATIONAL EXPOSURE LIMIT VALUES

Directive 2002/431/EU

Binding occupational exposure limit value of the European Union

8 hours limit value: 40 mg/m³ (10 ppm)

Short term limit value: 80 mg/m³ (20 ppm)

Notation skin: Substantial contribution to the total body burden via dermal exposure possible.

REACH - REGULATION

The substance is specified in the [REACH Candidate list](#) of substances of very high concern for authorisation.

RECOMMENDATIONS OF MAK-COMMISSION

This data is recommended by scientific experience and is not established law.

20 ml/m³

82 mg/m³

Peak limitation: Excursion factor 2

Duration 15 min, mean; 4 times per shift; interval 1 hour

Category I - Substances for which local irritant effects determine the exposure limit value, also respiratory allergens

Risk of percutaneous absorption

Pregnancy: Group C

There is no reason to fear damage to the embryo or foetus when MAK and BAT values are observed.

N-Methyl-2-pyrrolidone, steam

The substance can be present as vapour and aerosol at the same time.

GERMAN BIOLOGICAL EXPOSURE INDICES

Parameter: 5-Hydroxy-N-methyl-2-pyrrolidone
Value: 150 mg/l
Assay material: Urine
Sampling time: end of exposure/end of shift
Reference: 05347

RESTRICTIONS OF USE / BANS OF USE

REACH Regulation (EC) No 1907/2006 Annex XVII

Annex XVII, Point 3

1. The putting into circulation and the utilisation of the substance is not allowed in decorative objects, games and joke articles.
 2. Substances labelled with H304 which can be utilised as fuels in decorative lamps and are put in circulation in amounts of 15 l or less must not contain a dye and/or a perfume.
- Further information on prohibitions can be taken from the regulation.

Annex XVII, Point 28 and Point 29 and Point 30

The substance shall not be placed on the market or used as a substance or as a constituent of other substances or in mixtures for supply to the general public when the concentration of the substance or mixture reaches or exceeds the concentration limits according to the CLP Regulation. When placing the substance or mixture on the market for professional users, the supplier shall ensure that the packaging of such substances and mixtures is marked with the label "Restricted to professional users." For further details, please refer to the Regulation.

Annex XVII, Point 71

1. Shall not be placed on the market as a substance on its own or in mixtures in a concentration equal to or greater than 0,3 % after 9 May 2020 unless manufacturers, importers and downstream users have included in the relevant chemical safety reports and safety data sheets, Derived No-Effect Levels (DNELs) relating to exposure of workers of 14,4 mg/m³ for exposure by inhalation and 4,8 mg/kg/day for dermal exposure.
 2. Shall not be manufactured, or used, as a substance on its own or in mixtures in a concentration equal to or greater than 0,3 % after 9 May 2020 unless manufacturers and downstream users take the appropriate risk management measures and provide the appropriate operational conditions to ensure that exposure of workers is below the DNELs specified in paragraph 1.
- Further information on the prohibition and exceptions can be taken from the regulation.

Annex XVII, Point 72

The substance shall not be placed on the market after 1 November 2020 in any of the following:

- (a) clothing or related accessories;
- (b) textiles other than clothing which, under normal or reasonably foreseeable conditions of use, come into contact with human skin to an extent similar to clothing;
- (c) footwear;

if the clothing, related accessory, textile other than clothing or footwear is for use by consumers and the substance is present in a concentration, measured in homogeneous material, equal to or greater than that specified for that substance in Appendix 12.

Further information on the prohibition and the concentration limits can be taken from the regulation.

Annex XVII, Point 75

Mixtures containing certain hazardous substances shall no longer be placed on the market for tattooing purposes. Mixtures containing such substances in specified concentrations shall no longer be used for tattooing purposes after 04.01.2022. Substances falling within one or more of the following points:

- carcinogenic or reproductive toxic substances according to Part 3 of Annex VI to CLP Regulation (excluding the classification due to effects only following exposure by inhalation),
- skin-sensitising, skin-corrosive, skin-irritant, serious eye-damaging or eye-irritant substances according to Annex VI Part 3 of the CLP Regulation,
- substances listed with specified conditions in Annex II or IV to Regulation (EC) No 1223/2009 [Cosmetics Regulation], and
- substances listed in Appendix 13 to Annex XVII (point 75) of the REACH Regulation.

In general, mixtures placed on the market for use for tattooing purposes must be labelled "Mixture for use in tattoos or permanent make-up." from 04.01.2022 on and may not be used for tattooing purposes without this labelling. Further safety information shall be provided on the packaging or in the instructions for use. Before using a mixture for tattooing purposes, the person using the mixture shall provide this information to the person undergoing the procedure.

Further information on the restrictions, concentration limits and exemptions can be taken from the Regulation.

Annex XVII to Regulation (EC) No 1907/2006, [consolidated version](#) (BAUA) (only in German)

Consumer Goods Ordinance

Attachment 1 to § 3, Point 5

The substance must not be utilised for the production or treatment of joke articles.

TECHNICAL RULES FOR HAZARDOUS SUBSTANCES

[TRGS 201](#)

Einstufung und Kennzeichnung bei Tätigkeiten mit Gefahrstoffen; Ausgabe Februar 2017, zuletzt geändert und ergänzt April 2018

[TRGS 400](#)

Gefährdungsbeurteilung für Tätigkeiten mit Gefahrstoffen; Ausgabe Juli 2017

[TRGS 555](#)

Betriebsanweisung und Information der Beschäftigten; Ausgabe Februar 2017

[TRGS 600](#)

Substitution; Ausgabe Juli 2020

[TRGS 402](#)

Ermitteln und Beurteilen der Gefährdungen bei Tätigkeiten mit Gefahrstoffen: Inhalative Exposition; Ausgabe September 2023

[TRGS 401](#)

Gefährdung durch Hautkontakt, Ermittlung - Beurteilung - Maßnahmen; Ausgabe Oktober 2022

[TRGS 500](#)

Schutzmaßnahmen; Ausgabe September 2019

[TRGS 509](#)

Lagern von flüssigen und festen Gefahrstoffen in ortsfesten Behältern sowie Füll- und Entleerstellen für ortsbewegliche Behälter; Ausgabe Juni 2022

[TRGS 510](#)

Lagerung von Gefahrstoffen in ortsbeweglichen Behältern; Ausgabe Januar Dezember 2020

[TRGS 800](#)

Brandschutzmaßnahmen; Ausgabe Dezember 2010

REGULATIONS OF GERMAN ACCIDENT INSURERS

LINKS

[Statement concerning the Occupational Exposure Limit Value \(in german only, source BAuA\)](#)

[International Limit Values](#)

[OECD Screening Information DataSet \(SIDS\)](#)

[ECHA - Candidate List of Substances of Very High Concern for Authorisation](#)

[The MAK Collection for Occupational Health and Safety](#)

REFERENCES

Quelle: 00001

IFA: Erfassungs- und Pflegehandbuch der GESTIS-Stoffdatenbank (nicht öffentlich)

Data acquisition and maintenance manual of the GESTIS substance database (non-public)

Quelle: 00022

G. Hommel

"Handbuch der gefährlichen Güter" Loseblattsammlung mit Ergänzungslieferungen

"Handbook of dangerous goods " loose-leaf collection with supplement deliveries

Springer-Verlag, Heidelberg

Quelle: 00105

Sorbe "Sicherheitstechnische Kenndaten chemischer Stoffe" ("Safety-related characteristics of chemical substances"), sicherheitsNet.de, Landsberg

Quelle: 00220

IUCLID-CD-ROM, Year 2000 edition; European Commission, Joint Research Centre, Institute for Health and Consumer Protection, European Chemicals Bureau; Ispra, Italy

Quelle: 00440

Datenbank CHEMSAFE, Version 2016.0, DECHEMA-PTB-BAM

Quelle: 00454

Hazardous Substances Data Bank (HSDB)

Quelle: 01211

GHS-Sicherheitsdatenblatt, Merck

GHS Material Safety Data Sheet, Merck

Quelle: 01221

GHS-Sicherheitsdatenblatt, Sigma-Aldrich

GHS Material Safety Data Sheet, Sigma-Aldrich

Quelle: 01231

GHS-Sicherheitsdatenblatt, Thermo Fisher Scientific

GHS Material Safety Data Sheet, Thermo Fisher Scientific

Quelle: 02051

Scientific Committee for Occupational Exposure Limits to Chemical Agents (SCOEL):

SCOEL Recommendations

<http://ec.europa.eu/social/main.jsp?catId=148&intPagId=684&langId=de>

Quelle: 02070

LOG KOW Databank, compiled by Dr. James Sangster, Sangster Research Laboratories, Montreal, Canada, distributed by Technical Database Services (TDS), New York

Quelle: 02071

Toxicological Data, compiled by the National Institute of Health (NIH), USA, selected and distributed by Technical Database Services (TDS), New York, 2009

Quelle: 02072

Ecotoxicological Data, compiled by the US Environmental Protection Agency (EPA), selected and distributed by Technical Database Services (TDS), New York, 2009

Quelle: 05200

Kühn-Birett "Merkblätter Gefährliche Arbeitsstoffe" Loseblattsammlung mit Ergänzungslieferungen, ecomed Sicherheit, Landsberg

Quelle: 05300

[TRGS 510](#) "Lagerung von Gefahrstoffen in ortsbeweglichen Behältern" Ausgabe Dezember 2020

Quelle: 05334

Begründung zum Arbeitsplatzgrenzwert (Quelle BAuA)

Quelle: 05347

[TRGS 903](#) "Biologische Grenzwerte (BGW)" Ausgabe Februar 2013; zuletzt geändert Juni 2023

Quelle: 05350

[TRGS 900](#) "Arbeitsplatzgrenzwerte" Ausgabe Januar 2006, zuletzt geändert und ergänzt Juni 2023

Quelle: 06002

L. Roth, U. Weller

"Gefährliche Chemische Reaktionen" Loseblattsammlung mit Ergänzungslieferungen, ecomed-Verlag ("Dangerous chemical reactions" loose-leaf collection with supplement deliveries)

Quelle: 07509

Verordnung (EU) Nr. 2016/1179 der Kommission vom 19. Juli 2016 zur Änderung der Verordnung (EG) Nr. 1272/2008 des Europäischen Parlaments und des Rates über die Einstufung, Kennzeichnung und Verpackung von Stoffen und Gemischen (EG-GHS-Verordnung, 9. Änderung).

Quelle: 07510

Verordnung (EG) Nr. 1272/2008 des Europäischen Parlaments und des Rates vom 16. Dezember 2008 über die Einstufung, Kennzeichnung und Verpackung von Stoffen und Gemischen, geändert durch Verordnung (EG) Nr. 790/2009 der Kommission vom 10. August 2009 (EG-GHS-Verordnung) (ehemals Richtlinie 67/548/EWG mit Anpassungsrichtlinien in der jeweils gültigen Fassung).

Quelle: 07520

Europäische Chemikalienagentur ECHA: Informationen über registrierte Substanzen
European Chemicals Agency ECHA: Information on registered substances

Quelle: 07580

Bekanntmachung der Liste der wassergefährdenden Stoffe im Bundesanzeiger vom 10.08.2017, zuletzt geändert 24.11.2023

Quelle: 07596

REACH Kandidatenliste; Stand 14.06.2023

Quelle: 07619

DFG Deutsche Forschungsgemeinschaft: The MAK-Collection for Occupational Health and Safety, nach Veröffentlichungsdatum zu finden unter:

bis 2002 Verlag Chemie

ab 2002 Online: <http://onlinelibrary.wiley.com/book/10.1002/3527600418/topics?filter=#>

ab 2020 Online:

<https://series.publisso.de/en/pgseries/overview/mak/dam/allContents/alphabetical>

Quelle: 07620

DFG: Arbeitsmedizinisch-toxikologische Begründungen von BAT-Werten; Verlag Chemie

Quelle: 07635

AUERDATA 98

Quelle: 07638

M. Daunderer "Toxikologische Enzyklopädie - Klinische Toxikologie - Giftinformation, Giftnachweis, Vergiftungstherapie" Loseblatt-Ausgabe, ecomed-Verlagsgesellschaft mbH, Landsberg

Quelle: 07795

H. Geerßen "GloSaDa 2000 Plus - Glove Safety Data"

Quelle: 07985

IPCS: CICADs - Concise International Chemical Assessment Documents. WHO, Genf, Serie ab 1998

Quelle: 08086

BG RCI Merkblatt T 033 / DGUV Information 213-060: "Vermeidung von Zündgefahren infolge elektrostatischer Aufladung", Stand 8/2016

Quelle: 08105

Brock, Groteklaes, Mischke: Lehrbuch der Lacktechnologie. Vincentz, Hannover 2000, ISBN 3-87870-569-7, S. 100

Quelle: 08112

DFG Deutsche Forschungsgemeinschaft: MAK- und BAT-Werte-Liste 2023, Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe, Mitteilung 59; GMS PUBLISSO

Quelle: 99983

Liste arbeitsmedizinisch-toxikologischer Standardwerke (2)

List of standard references regarding occupational health and toxicology (2)

Quelle: 99996

Projektgebundene arbeitsmedizinisch-toxikologische Literatur (2)

Project related bibliographical references regarding occupational health and toxicology (2)

Quelle: 99999

Angabe des Bearbeiters

Indication of the editor

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