

## Nitric acid



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### IDENTIFICATION

#### Nitric acid

Nitroso nitric acid

**ZVG No:** 1370  
**CAS No:** 7697-37-2  
**EC No:** 231-714-2  
**INDEX No:** 007-004-00-1  
007-030-00-3

### CHARACTERISATION

#### SUBSTANCE GROUP CODE

120510 Acids, inorganic  
128000 Nitrogen compounds, inorganic

#### STATE OF AGGREGATION

The substance is liquid.

#### PROPERTIES

Depending on concentration colourless to yellow.  
When exposed to light it slowly becomes reddish.  
pungent odour

#### CHEMICAL CHARACTERISATION

For nitric acid solution with more than 65% acid applies:

Oxidizing liquid.

The substance itself does not burn, but in contact with combustible substances it increases the risk of fire and can fuel any existing fire substantially.

Mixable with water.

Aqueous solution reacts strongly acidic.

Sensitive to air.

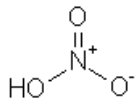
Acute or chronic health hazards result from the substance.

The substance is hazardous to the aquatic environment.

(see: chapter REGULATIONS).

[Substance information in Wikipedia](#)

## FORMULA

 $\text{HNO}_3$ 

**Molar mass:** 63,01 g/mol

**Conversion factor** (gaseous phase) at 1013 mbar and 20 °C:

1 ml/m<sup>3</sup> = 2,62 mg/m<sup>3</sup>

## PHYSICAL AND CHEMICAL PROPERTIES

[Melting point](#) | [Boiling point](#) | [Density](#) | [Vapour pressure](#) | [Solubility](#) | [Partition coefficient](#) | [Hazardous reactions](#)

### MELTING POINT

Melting point: -42 °C

Nitric acid, fuming, 100 %

Reference: [01221](#)

Melting point: ca. -47 °C

Commercially available concentration of 65 %.

Reference: [05200](#)

### BOILING POINT

Boiling Point: 121,8 °C

Azeotropic mixture with water of 69,2 %.

Reference: [05200](#)

Boiling Point: 86 °C

Nitric acid, fuming, 100 %

Reference: [01221](#)

### DENSITY

DENSITY

Value: 1,51 g/cm<sup>3</sup>

Temperature: 20 °C

Nitric acid, fuming, 100 %

Reference: [01211](#)

RELATIVE VAPOUR DENSITY

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

Value: 2 ... 3

Reference: [00453](#)

## DENSITY

Value: 1,4 g/cm<sup>3</sup>

Temperature: 20 °C

Commercially available concentration of 65 %.

Reference: [05200](#)

## RELATIVE DENSITY OF THE VAPOUR-AIR-MIXTURE

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

Value: 1,07

Reference: [99999](#)

## VAPOUR PRESSURE

Vapour pressure: 56 hPa

Temperature: 20 °C

Reference: [01211](#)

Vapour pressure: 84,1 hPa

Temperature: 25 °C

Reference: [00454](#)

Vapour pressure: 255 hPa

Temperature: 50 °C

Reference: [00106](#)

## SOLUBILITY IN WATER

mixable with water

Reference: [07570](#)

## PARTITION COEFFICIENT (octanol/water)

log K<sub>ow</sub>: -2,3

Reference: [01211](#)

## HAZARDOUS REACTIONS

### Thermal decomposition

Decomposition when heated.

Self-ignition possible.

### Hazardous chemical reactions

Risk of explosion in contact with:

alcohols

fluorine

reducing agents

acetone; acetonitrile; alkali acetylides; aminopropandiol; aminothiazole/acids; aniline (self-ignition possible); stibine; hydrogen arsenide; cotton; benzidine; benzene; calcium phosphide; cellulose; cellulose containing products; chlorobenzene; 4-chloronitroaniline; cyclohexanol; cyclohexylamine; cyclopentadiene; 1,2-dichloroethane; dichloromethane; diethyl ether (anhydrous); dimethylether; dimethylhydrazine; dinitrobenzene; dimethyl sulfide; dioxane; divinyl ether; acetic acid; acetic acid/acetone; acetic anhydride; ethylene glycol (heat); 5-ethyl-2-methylpyridine (heat); formic aldehyde; 2-formamido-1-phenyl-1,3-propanediol; glycerol/sulfuric acid; rubber; fuels; hexanol; hydrazin; hydrazones; potassium chlorate + organic substances; potassium permanganate + alcohol; coal; hydrocarbons; copper; lithium silicide; organic solvents; manganese (rarely); metal cyanides; metal powders; methanol + sulfuric acid; mesitylene (heat); methylcyclohexanone; methylethylpyridine (rarely); nitrobenzene/sulfuric acid; nitrochloroaniline; nitromethane; nitrotoluene; organic material + sulfuric acid; organ. material (especially with large surface area like saw dust, cleaning rag, cotton residues); petroleum; phosphorus trichloride; hydrogen phosphide; phthalic anhydride/sulfuric acid; pyrocatechol; mercury nitrate/ethanol; sulfur dioxide (rarely); hydrogen telluride; tetraborane; thiocyanates; titanium; toluene; triazine/trifluoroacetic anhydride; impurities; hydrogen peroxide/mercury oxide; p-xylol (rarely); tin (rarely); sugars

The substance can react dangerously with:

amines

ammonia

combustible substances

potassium

concentrated lye

lithium

sodium

acrylonitrile; formic acid; antimony; arsenic; boron; bromine pentafluoride; butanthiol; chlorine trifluoride; crotonaldehyde; iron(II)-oxide (powder); ethylaniline; furfuryl alcohol; germanium; glycerol/hydrochloric or hydrofluoric acid; wood; hydrogen iodide; copper (I)-nitride; magnesium (heat); magnesium phosphides; mellitic acid; methyl thiophene; sodium hydride; sodium hypochlorite; sodium hydroxide (heat); sodium hydroxide solution (heat); phenylenediamine; phosphonium iodide; phosphorus (heat/vapour); polyethylene; polypropylene; pyridine; sawdust; sulfur halogenides; conc. sulfuric acid; hydrogen sulfide; selenium; hydrogen selenide; turpentine (catalyst); thiols; thiophene; toluidine; triethylamine; uranium; uranium disulfide; water/nitric acid; bismuth; xylidine

## TOXICOLOGY / ECOTOXICOLOGY

### ECOTOXICOLOGICAL DATA

#### LC50 Crustaceans (48 hours)

Minimum: 180 mg/l

Maximum: 180 mg/l

Median: 180 mg/l

Study number: 1

Reference for median:

Portmann, J.E., and K.W. Wilson 1971. The Toxicity of 140 Substances to the Brown Shrimp and Other Marine Animals. Shellfish Information Leaflet No.22 (2nd Ed.), Ministry of Agric.Fish.Food, Fish.Lab.Burnham-on-Crouch, Essex, and Fish Exp.Station Conway, North Wales :12 p.

Reference: 02072

## OCCUPATIONAL HEALTH AND FIRST AID

Routes of exposure | Toxic effects |  
First Aid

### ROUTES OF EXPOSURE

#### Main routes of exposure

An intake of nitric acid (HNO<sub>3</sub>) is mainly to be expected via the respiratory tract. [7619]

#### Respiratory tract

Concentrated HNO<sub>3</sub> releases vapors even at normal temperature (noticeable in moist air as a mist). Following the heating of the diluted acid, initially more water than HNO<sub>3</sub> is transferred into the vapor phase, until in the liquid phase an azeotropic mixture of approx. 70% HNO<sub>3</sub> and 30% water is reached. [7942]

Independent of this, there is always a mixture of acid molecules and decomposition products (nitrogen oxides, in particular nitrogen dioxide, oxygen and water) in the vapors released from the acid. In each case the composition is dependent on humidity, temperature and other factors (e.g. contact with metals). [7619]

No studies are available on the kinetic behavior in the respiratory tract. [99983]

For nitrogen oxides which partially react to form HNO<sub>3</sub> and HNO<sub>2</sub>, effective absorption via the airways was demonstrated. [7619]

Partial absorption is therefore expected for HNO<sub>3</sub> vapor. [99999]

#### Skin

No studies are available on absorption through the skin. [99983]

Based on the severe local action, the question of dermal absorption is probably relevant only in cases of handling very diluted solutions. [7619]

#### Gastrointestinal tract

Kinetic studies are not available for the oral intake pathway. [99983]

Absorption should be considered possible. [99999]

### TOXIC EFFECTS

#### Main toxic effects

Acute:

Irritation and corrosion to the eyes, airways and skin,  
danger of severe damage to the eyes and lungs,  
after swallowing life threatening chemical burns in the gastrointestinal tract [7619, 419]

Chronic:

Diseases of the airways, damage to the teeth [7748, 7619]

#### Acute toxicity

HNO<sub>3</sub> is a strong acid with oxidizing action. Local tissue-damaging effects, which are dependent on the concentration, are of the greatest concern. [7619]

Even after short contact, the concentrated acid causes (yellowish discolored) chemical burns to the conjunctiva and cornea with impairment of visual capability. In serious cases irreversible damage to the eye is to be feared (opacity of the cornea, symblepharon or shrinkage of the eyeball). Following small splashes of less concentrated acid and immediate rinsing, the epithelium of the affected eye can regenerate rapidly. The damaging action of HNO<sub>3</sub> to the eye is in principle similar to that of other mineral acids (such as hydrochloric acid or sulfuric acid); the tendency to penetrate the cornea was reported not to be stronger. [7979]

Contact of the skin with concentrated HNO<sub>3</sub> can rapidly cause chemical burns (blistering, necrosis and ulceration) with a weak tendency to heal. Typical is a (persistent) yellow to brown discoloration on the contact site due to the reaction of HNO<sub>3</sub> with proteins in the tissues (xanthoproteine reaction). [7619, 419, 7942]

On the skin (forearm) of test persons, contact with 0.1 ml of an approx. 39% solution of HNO<sub>3</sub> for 2 min caused reddening persistent for 30 min; and blistering after contact for 5 min. [7619]

In tests on rabbits' skin (4 h contact, occlusively) a corrosive effect was found for 7% and higher concentrations of aqueous HNO<sub>3</sub>. [220]

At lower concentrations, the acid can cause irritation and hardening of the skin (without corrosive damage). [7748, 419]

No indications are available from occupational handling with regard to a skin sensitizing potential; specific tests are not available. [99983]

Exposure to acid vapors caused irritation to the eyes and skin but damage to the airways is of the greatest concern.

In a study on healthy volunteers, a single exposure to 1.6 ppm for 10 minutes was tolerated. No disturbances to the lung function were demonstrable.

11.5 - 12.2 ppm for 1 hour caused sneezing, pressure in the chest, slight stabbing pain in the larynx/trachea, cough (and therefore shallow breathing), severe rhinorrhea and salivation, lacrimation, moderate burning sensation to the eyes and facial skin. After 20 minutes, the symptoms became more tolerable, but the rhinorrhea was increased, headache, chest pain and tiredness appeared (after the end of exposure, sometimes persistent for up to one hour). Prolonged exposure was assessed by the experimenters to be dangerous to health under these conditions.

84 ppm was tolerated by one test person for only 2 - 3 min (analogous symptoms, after cessation of exposure persistent for longer time periods. [7619]

Accidents due to inhalation of concentrated vapors of HNO<sub>3</sub> frequently took a serious course. Death occurred as early as within 1 - 24 hours or less due to lung damage (pulmonary edema) and cardiac arrest. A 3 phase-symptom complex was also reported: immediately after inhalation severe irritation to the eyes and upper airways (burning sensation, cough, tightness and pain in the chest, dyspnea), then an interval free of symptoms for hours through to several days, finally increased difficulties in breathing, weakness, cyanosis, manifestation of serious lung damage (edema, emphysema, pneumonia, fibrosis). [7619, 419, 7978] No information is available on concentrations of HNO<sub>3</sub> in the ambient air which caused these damages. [99983]

Animal experiments do not allow direct conclusions to be drawn as to the risk for humans. Regarding irritative and damaging effects of HNO<sub>3</sub> to the airways, rodents and cats were shown to be by far less sensitive than humans (rats tolerated concentrations of 24 ppm without any effects). [7619]

The local effects are also of the greatest concern following oral intake of HNO<sub>3</sub>.

There are reports on some poisoning cases due to swallowing of concentrated solution. In most cases, death occurred even in case of small amounts (e.g. 5 ml) because of the corrosive effects. These immediately cause chemical burns to all mucous membranes in contact with the acid (danger of glottic edema and of perforation of the esophagus/stomach, later strictures) which can lead to death within hours or only a few days. Cardiovascular responses due to chemical burns can also trigger acutely life threatening situations (shock with danger of renal failure; reflex cardiac or respiratory arrest). [7836, 7619]

The risk of such damage decreases only if the acid is extremely diluted.

A 0.63% solution of HNO<sub>3</sub> was reported not to have caused chemical burns to the mouth and esophagus. [220, 7619]

## Chronic toxicity

Only little information is available on consequences of long-term exposure. [99983]  
It is generally advised that following repeated contact inflammatory skin reactions (dermatitis) can occur, even after contact with extremely diluted acid, acid mist or vapors. [419]  
However, irritation to the airways is also the critical effect following chronic exposure.  
Prolonged high exposure can cause chronic bronchitis or, following higher exposure, damage to the lungs (pneumonia). [7748] In isolated cases, following overexposure to mineral acids, an nonspecific hyperreactivity of the airways (reactive airways dysfunction syndrome) can persist. [419]  
In a workplace study on persons exposed to HNO<sub>3</sub> vapors, restrictive reactions of the airways were reported (difficulties in breathing, dry cough, sputum, irritation to the throat, reduced lung function). Shortcomings in the study design (exposure not characterized, inadequate control group) limit the informative value of the study. [220, 419]  
From a further study on workers exposed long-term to HNO<sub>3</sub> vapors, damage to the teeth was reported (erosion of the dental enamel for 3 of 22 workers). A higher incidence of erosive teeth damage for workers was found when there was mixed exposure to sulfuric acid and HNO<sub>3</sub>. In the most cases the incisors, more seldom canine teeth were concerned. The gingiva remained unaffected. Because there are no exposure data, also these studies can be assessed only with limitations, [7619, 419] but it was concluded that vapors of HNO<sub>3</sub> are probably less damaging to the teeth than vapors of sulfuric acid or hydrochloric acid. [7748]  
In an animal study with average exposure to 4 ppm (measured as NO<sub>2</sub>) for 4 h daily, 5 d/w for 6 months, mice, rats and guinea pigs did not show any effects (autopsy without findings).  
In a more recent study on rats, at 0.02 ppm HNO<sub>3</sub>, 4 h/d, 3 d/w for 40 weeks, no signs of inflammation in the lungs were demonstrable.  
On the whole, neither experience of humans nor the animal experimental data available are considered sufficient to derive a scientifically well-founded tolerable workplace threshold value. [7619]

### **Reproductive toxicity, mutagenicity, carcinogenicity**

Reproductive toxicity:

No substance-specific data is available. [99983]

In studies carried out with nitrate on rats, a slightly delayed development of the fetes was found only at very high dosages (> 2 g/l drinking water). [220]

Occupational exposures to HNO<sub>3</sub> are not expected to include such a high intake. [99999]

Mutagenicity:

Insufficient data is available. [99983]

Various microbiological tests had negative results. [220]

Carcinogenicity:

Insufficient data is available. [99983]

In two workplace studies, an increased incidence of tumors in the respiratory tract was found.

However, the study design was inadequate in order to derive a causal relationship. No valid animal experimental studies are available.

There is an indication of the possibility of the formation of carcinogenic nitrosamines if the room air simultaneously contains amines. [7619]

### **Biotransformation and excretion**

The toxicokinetics are considered relevant only if very diluted solutions are handled, because otherwise local actions dominate. [7619]

However, there are no studies available concerning the distribution and elimination following exposure to HNO<sub>3</sub>. [99983]

### **Annotation**

This occupational health information was compiled on 17.01.2012.

It will be updated if necessary.

### **FIRST AID**

#### **Eyes**

Risk of blindness!

As soon as possible:

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

Point the mild water jet directly into the eye in order to remove the acid residues as soon and as completely as possible.

Then, immediately transport the casualty to an eye doctor / to hospital.

Continue rinsing during the transport with isotonic saline solution, alternatively with water.

[454, 160]

### **Skin**

Remove contaminated clothing while protecting yourself.

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

When the skin has been in contact with highly concentrated acid, firstly carefully blot it up with textile or tissue paper, provided this can be done without any loss of time. Otherwise rinse with a lot of water.

After extensive contamination:

Immediately use a (deluge) shower and avoid inhalation of acid mists!

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

Always ensure rapid medical treatment (call a physician to the site of accident).

[419, 160, 99999]

### **Respiratory tract**

Following release of acid vapors/ acid aerosols:

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

The casualty should be carried or driven (horizontal position; for dyspnea place the casualty in a half-upright position). Avoid physical effort.

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

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

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

Immediately call a physician (even if there are no complaints).

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

For respiratory arrest, carry out artificial ventilation, if possible with breathing apparatus (e.g. bag valve mask); the first aider must pay attention to protect him or herself.

In case of cardiac arrest (no response and no normal breathing), immediately perform chest compressions and ventilation. If available, use Automated External Defibrillator (AED). The protection of the vital functions (respiration and circulation) takes priority over all other measures.

Poisoning symptoms can appear after a period of delay.

[419, 22, 8088]

### **Swallowing**

If the casualty is conscious: have the casualty rinse his or her mouth and spit out the liquid.

Immediately have the casualty drink a glass of water in sips. [8088, 7978]

Do not make the casualty vomit.

Do not try to neutralize the acid with alkaline and do not use charcoal! [160, 8088]

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

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

In the meantime, call a physician to the site of the accident. [2001]

### **Information for physicians**



The damaging effect of the acid is mainly dependent on the concentration, the contact duration and the amount; the corrosive action starts even at low concentrations. [419, 7978]

- Symptoms of acute poisoning:

Eyes: pain, blepharospasm, eyelid swelling, (yellowish) corrosions on the conjunctiva/ cornea (opacity of the cornea through to symblepharon, shrinkage of the eyeball), [7656, 7979] after exposure to vapors mostly only burning/pain, lacrimation [7619]

Skin: reddening, swelling; due to > 5% acid blistering, necrosis, ulceration, mostly yellowish through to brown permanent discoloration; [419, 7619, 160] following extensive corrosion, possible shock and consequences from defunctionalization of the skin [8088]

Inhalation: stinging/ burning sensation in the nose and throat, cough, headache, pressure/stinging in the chest, difficulties in breathing, persistent rhinorrhea and salivation; development of pulmonary edema within one hour or several days, or initially disappearance of the symptoms and reappearance after a latency period: increasing weakness, dyspnea, cyanosis, tachycardia and lung damage (edema, emphysema, pneumonia, fibrosis); [7619, 7978] following high exposure possibly immediate danger of glottic edema, laryngospasm, bronchospasm or reflex respiratory or cardiac arrest [8088]

Ingestion: burning sensation, pain and swelling in the mouth, throat, esophagus, stomach, whitish through to yellowish discoloured chemical burns, retching, dysphagia, vomiting, cardiovascular affection (possible reflex respiratory/cardiac arrest), ischuria; [7836] danger of glottic edema, perforation of esophagus/stomach, gastrointestinal bleeding, shock, acidosis microthrombosis, disseminated intravascular coagulation, renal failure, possible formation of methaemoglobin, hemolysis; possible sequelae: mediastinitis, peritonitis, strictures. [8088, 7836, 160, 454]

- Medical advice:

Following contact with the eyes, continue rinsing (with water, better with RINGER-lactate solution or physiological saline solution or still better with balanced salt solution), alleviation of pain, then ensure immediate ophthalmological treatment. [8088, 99999]

Rinse contaminated skin repeatedly with water/ physiological saline. Then, apply a dermatocorticoid foam spray to irritated areas and apply a sterile cover to chemical burns. Treatment for shock could become necessary (see below). [454, 8088]

Following inhalation of acid mists - independent of whether there are symptoms or not - administer glucocorticoids (inhalatively and i.v.), administer oxygen and carry out all further measures for pulmonary edema prophylaxis. Avoid physical effort. Treat cough with codeine. For bronchial spasm administer bronchodilators.

Support cardiovascular functions. In serious cases, intubation, artificial ventilation and further measures for cardiopulmonary cerebral resuscitation can become necessary. Hospitalize the casualty as soon as possible for further monitoring and treatment. [22, 7980, 8088]

After swallowing of small amounts of the acid, immediate administration of liquid is recommended in order to achieve a rinsing effect in the esophagus. [7906, 8088]

After intake of larger amounts of the acid, there are differing views on the advisability of administration of liquids (minor influence on the pH value but with possible simultaneous strong development of heat and increased probability of vomiting -> possibly leading to even greater adverse effect on the tissues). [7978] In such cases, consideration should be given to drawing off the stomach contents via a thin, flexible tube (by an expert under endoscopic visual control). The decision should be made depending on the poisoning situation/findings (watch for a danger of perforation). [160, 8088]

After ingestion also early prophylaxis for glottic edema with glucocorticoids and nasal intubation as needed. [7906, 160]

In all cases, safeguard vital functions. For hypotension early infusion of electrolyte solutions and laying the casualty in a flat position are recommended. [8088, 7978]

In hospital, inspection and treatment of chemical burns, prophylaxis for pulmonary edema and pneumonia and monitoring of cardiovascular and respiratory functions are of priority. Soon also check/ correct the acid base balance, observe kidney and liver functions and carry out analysis of blood gases and hemogram (also methemoglobin) as well as coagulation status. [8088, 160]

## Recommendations

Provide the physician information about the substance/product and treatment already administered. [99999]

## Annotation

This first aid information was compiled on 17.01.2012.  
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.

The floor should not have a floor drain.

Washing facility at the workplace required.

Eye bath required. These locations must be signposted clearly.

When handling excessive amounts of the substance an emergency shower is required.

#### Equipment

Use only closed apparatus.

If dangerous pressure can arise from contact with heat, suitable safety measures and equipment should be provided.

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

Label containers and pipelines clearly.

Suitable materials:

Glass

Polyvinyl chloride

Polytetrafluoro ethylene PTFE (Teflon)

Suitable sealing materials:

Polytetrafluoro ethylene PTFE (Teflon)

(up to 200 degree C)

Unsuitable materials:

Copper

Nickel alloys

Nickel

Silver, tin and some iron alloys.

#### Advice on safer handling

Take care to maintain clean working place.

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.

Avoid splashing.

Fill only into labelled container.

Avoid any contact when handling the substance.

Prepare mixtures with other substances only after being instructed by a specialist in chemistry.

Emission of nitrogen oxides!

Prevent seepage into flooring (use of a steel tub).

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.

Only work with vessels and lines after they have been thoroughly rinsed.

## TECHNICAL MEASURES - STORAGE

### Storage

Keep in locked storage or only make accessible to specialists or their authorised assistants.

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.

Do not use any metal containers.

Preferably use unbreakable containers rather than glass containers.

Place fragile vessels in break-proof outer vessels.

For concentrations > 65 % it is recommended that only special instructed personnel hands it out to authorised persons.

Do not set out of operation the pressure relief equipment.

Pay attention to pressure increase in the containers, if necessary deaerate repeatedly.

Keep container tightly closed.

Store in a cool place.

Keep container in a well-ventilated place.

Install sufficiently large collection rooms (depressions, walls, or stable freestanding walls).

### Conditions of collocated storage

For concentrations greater or equal 65 % applies:

Storage class 5.1 B (Oxidizing 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.
- Aerosols (spray bottles).
- Other explosive substances of storage class 4.1A.

- Pyrophoric substances.

- Substances liberating flammable gases in contact with water.

- 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](#)):

- Flammable liquids of storage class 3.
- Flammable solid substances or desensitized substances of storage class 4.1B.
- Ammonium nitrate and preparations containing ammonium nitrate.
- Combustible and non combustible acutely toxic substances of storage classes 6.1A and 6.1B.
- Combustible toxic or chronically acting substances of storage class 6.1C.
- Noncombustible toxic or chronically acting substances of storage class 6.1D.
- Combustible corrosive substances of storage class 8A.
- Combustible liquids of storage class 10.
- Combustible solids of storage class 11.

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

For concentrations less than 65 % applies:

Storage class 6.1 D (Not 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](#)):

- Flammable liquids of storage class 3.
- Flammable solid substances or desensitized substances of storage class 4.1B.
- 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

For concentrations greater or equal to 70% :

Substance has an oxidizing effect.

Fire fighting equipment must be available.

Inspect the electrical fittings regularly against the higher risk of corrosion.

### Precaution on handling

For concentrations greater 70% :

Keep away from open flames.

Observe the smoking prohibition!

Absolutely no welding in the working area.

Only work with vessels and lines after these have been thoroughly rinsed and inerting.

Work done with fire or open flame should only be carried out with written permission if the risk of fire or explosion cannot be completely eliminated.

Keep away from combustible materials.

Filter the solutions only with glass wool, glass chips, or ceramic filters. Do not use any filtration materials made of paper which risks ignition after drying. Do not leave any cleaning rags lying in the open.

## 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.

An escape and rescue plan must be prepared when the location, scale, and use of the work-site so demand.

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".

Only employees are permitted to enter the work areas. Signposting to this effect must be displayed.

## PERSONAL PROTECTION

### Body protection

Depending on the risk, wear a sufficiently long apron and boots or a suitable chemical protection suit.

Wear flameproof protective clothing.

**Respiratory protection**

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

Respiratory protection: Special filter NO - P3, colour code blue-white.

These filters may only be used when in their original condition.

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 chemical safety goggles.

If the face is at risk a protective shield must also be worn.

If vapours or aerosols that may injure the eyes arise, then safety of the eyes can best be guaranteed by wearing a full mask.

**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.

Textile or leather gloves are completely unsuitable.

The following information refers to nitric-acid (10%):

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

Natural rubber/Natural latex - NR (0,5 mm) (use non-powdered and allergen free products)

Polychloroprene - CR (0,5 mm)

Nitrile rubber/Nitrile latex - NBR (0,35 mm)

Butyl rubber - Butyl (0,5 mm)

Fluoro carbon rubber - FKM (0,4 mm)

Polyvinyl chloride - PVC (0,5 mm)

The following information refers to nitric-acid (50%):

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

Natural rubber/Natural latex - NR (0,5 mm) (use non-powdered and allergen free products)

Polychloroprene - CR (0,5 mm)

Butyl rubber - Butyl (0,5 mm)

Fluoro carbon rubber - FKM (0,4 mm)

Polyvinyl chloride - PVC (0,5 mm)

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

Nitrile rubber/Nitrile latex - NBR

The following information refers to nitric-acid (65%):

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

Fluoro carbon rubber - FKM (0,4 mm)

Protective gloves of the following materials should not be worn longer than 2 hours continually (Permeation time  $\geq$  2 hours):

Polychloroprene - CR (0,5 mm)

Butyl rubber - Butyl (0,5 mm)

Polyvinyl chloride - PVC (0,5 mm)

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

Natural rubber/Natural latex - NR

Nitrile rubber/Nitrile latex - NBR

The following information refers to nitric-acid (100%):

For protection against spray or splash (brief contact), protective gloves of the following materials are suitable:

Fluoro carbon rubber - FKM (0,4 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

Butyl rubber - Butyl

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.

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.

### 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:

Inorganic acids and their anhydrides are, if necessary, first dilute or hydrolised by stirring cautiously in ice water. Then are neutralised with caustic lye; check pH value.

Place in collecting containers for salt solutions, adjust for a pH value of 6 - 8.

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 acids) and dispose of according to regulations.

Afterwards ventilate area and wash spill site.

Endangerment of water:

Distinct hazard to waters. Prevent penetration into water, drainage, sewer, or the ground. Inform the responsible authorities about penetration of larger quantities.

### FIRE FIGHTING MEASURES

#### Instructions

Substance is non-combustible, but has an oxidizing effect.

(Concentrations over 65%)

In case of ambient fire:

Cool surrounding containers with water spray.

If possible, take container out of dangerous zone.

Rise in pressure and risk of bursting when heating.

Shut off sources of ignition.

Contain vapours with water spray.

Contact with metals may lead to the formation of nitrous gases and hydrogen - risk of explosion!

### Special protective equipment

In the case of inclusion in an ambient fire hazardous substances can be released.

Nitrous gases (nitric oxides)

Wear self-contained breathing apparatus and special tightly sealed suit.

## REGULATIONS

[GHS Classification/Labelling](#) | [Workplace labelling](#) | [Water hazard class](#) | [Transport Regulations](#) | [Threshold limit values](#) | [EC-Threshold limit values](#) | [MAK recommendations](#) | [SevesoIII](#) | [Restriction of use](#) | [Technical rules](#) | [Regulations of accident insurers](#)

## EUROPEAN GHS CLASSIFICATION AND LABELLING

### Classification

Oxidising liquids, Category 2; H272

Corrosive to metals, Category 1; H290

Acute toxicity, Category 1, inhalation; H330

Skin corrosion, Category 1A; H314

Serious eye damage, Category 1; H318



**Signal Word** "Danger"

### Hazard Statement - H-phrases

H272: May intensify fire; oxidiser.

H290: May be corrosive to metals.

H330: Fatal if inhaled.

H314: Causes severe skin burns and eye damage.

### Supplemental Hazard Statement - EUH-phrases

EUH071: Corrosive to the respiratory tract.

### Precautionary Statement - P-phrases

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.  
P220: Keep away from clothing and other combustible materials.  
P280: Wear protective gloves/protective clothing/eye protection/face protection.  
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water or shower.  
P304+P340+P310: IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.  
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Manufacturer's specification by Merck  
The data apply to 100-% nitric acid

Reference: [01211](#)

State: 2021

Checked: 2022

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

Ox. Liq. 2; H272:  $C \geq 99 \%$   
Ox. Liq. 3; H272:  $65 \% \leq C < 99 \%$   
Skin Corr. 1A; H314:  $C \geq 20 \%$   
Skin Corr. 1B; H314:  $5 \% \leq C < 20 \%$

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.

### Acute toxicity estimates (ATE)

Inhalation: 2,65 mg/l (vapours)

The ATE value applies to nitric acid  $\leq 70 \%$

Reference: [07515](#)

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

### Prohibition label



No open flame; fire, open ignition sources and smoking prohibited



No admittance for unauthorized persons





No eating and  
drinking

### Warning label



Caution - toxic  
material



Caution - corrosive  
material



Caution - oxidizing material

### Precept label



Use safety goggles



Wear safety  
gloves

### GERMAN WATER HAZARD CLASS

Substance No: 414

WGK 1 - low hazard to waters

Nitric acid solution (except fuming)

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

Substance No: 415

WGK 2 - distinct hazard to waters

Nitric acid solution (fuming)

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

### TRANSPORT REGULATIONS

UN Number: 2032  
Shipping name: Nitric acid, red fuming  
Hazard Identification Number: 856  
Class: 8 (Corrosive Substances)  
Packing Group: I (high danger)  
Danger Label: 8/5.1/6.1



[Classification code:](#) COT

Tunnel restrictions:

Transports in tanks: passage forbidden through tunnels of category C, D und E.  
Other transports: passage forbidden through tunnels of category D and E.

Reference: [07902](#)

UN Number: 2031  
Shipping name: Nitric acid, with more than 70 % and less than 95 % pure acid  
Hazard Identification Number: 885  
Class: 8 (Corrosive Substances)  
Packing Group: I (high danger)  
Danger Label: 8/5.1

Shipping name: Nitric acid, with more than 65 % and less than 70 % pure acid  
Hazard Identification Number: 85  
Class: 8 (Corrosive Substances)  
Packing Group: II (medium danger)  
Danger Label: 8/5.1



[Classification code:](#) C01

Tunnel restrictions:

Passage forbidden through tunnels of category E.

Reference: [07902](#)

UN Number: 2031  
Shipping name: Nitric acid, with less than 65 % pure acid  
Hazard Identification Number: 80  
Class: 8 (Corrosive Substances)  
Packing Group: II (medium danger)  
Danger Label: 8



Classification code: C1

Tunnel restrictions:

Passage forbidden through tunnels of category E.

Reference: [07902](#)

#### **TRGS 900 - GERMAN OCCUPATIONAL EXPOSURE LIMIT VALUES**

For nitric acid, no occupational exposure limit value is specified as a time-weighted average (TWA). Reasons for the deduction of an occupational exposure limit value are not given.

Attention: The value specified in [TRGS 900](#) in column "Occupational exposure limit" is a short-time value:

Short-time value 15 minutes: 1 ml/m<sup>3</sup>

Short-time value 15 minutes: 2,6 mg/m<sup>3</sup>

The operational monitoring should occur by averaging the technical measurement over 15 minutes, e.g. by collecting the sample over a period of 15 minutes.

Source: EU

Scope:

Nitric acid

#### **EC OCCUPATIONAL EXPOSURE LIMIT VALUES**

Directive 2006/15/EC

**Recommended indicative occupational exposure limit value** for the European Union

A national occupational exposure limit value has to be set.

Short term limit value: 2,6 mg/m<sup>3</sup> (1 ppm)

#### **RECOMMENDATIONS OF MAK-COMMISSION**

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

II b) substances, for which (still) no MAK-values can be established

#### **DIRECTIVE 2012/18/EU (Seveso III)**

**The substance is subject to the hazard categories of the Hazardous Incident Ordinance:**

H1      Acute toxic Category 1, all exposure routes

P8 Oxidising liquids or solids, Category 1, 2 or 3

### Quantity thresholds for determination of operation scopes:

Annex I Part 1 Section: H1

Acute toxic

Qualifying quantity for the application of

Lower-tier requirements: 5 t

Upper-tier requirements: 20 t

### Quantity thresholds for determination of operation scopes:

Annex I Part 1 Section: P8

Oxidising liquids or solids

Qualifying quantity for the application of

Lower-tier requirements: 50 t

Upper-tier requirements: 200 t

## 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 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.

## **REGULATION (EU) 2019/1148 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the marketing and use of explosives precursors**

The regulation shall apply from 1 February 2021.

The substance are not to be available to members of the general public, whether on their own or in mixtures that include this substance, unless the concentration is equal to or lower than the limit values set out in column 2. Suspicious transactions, loss and thefts of significant quantities are to be reported within 24 hours.

Further information can be taken from the regulation.

**Limit value: 3 % w/w**

**Upper limit value for the purpose of licensing under Article 5(3): 10 % w/w**

## **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 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**

### [DGUV Regel 112-190](#)

Benutzung von Atemschutzgeräten, Ausgabe November 2021  
(in German only)

## **LINKS**

[International Limit Values](#)

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

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

[DGUV Information 213-098: List of substances - lesson in schools \(in German only\)](#)

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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: 02001

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Angabe des Bearbeiters

Indication of the editor

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