# Nitric acid

## General information

### Key Points

#### Fire
- Non-flammable under normal conditions, but may ignite other flammable materials
- Highly reactive
- Releases toxic and irritating fumes when heated
- In the event of fire involving nitric acid, use fine water spray and liquid-tight chemical protective suit with breathing apparatus
- Gas-tight protective suits with breathing apparatus are required for fuming nitric acid

#### Health
- Exposure can occur through ingestion, inhalation, or absorption through the skin or eyes
- Highly corrosive
- Short-term inhalation may result in a dry throat and nasal passages, cough, chest pain, shortness of breath, headache and difficulty breathing
- Long-term inhalation may lead to the development of lung diseases such as bronchitis and can cause tooth erosion
- Short-term ingestion can cause burns to the lips, tongue, mouth, throat and stomach. Swelling of the airways can cause difficulty breathing and swallowing.
- Skin exposure can result in severe burns, blisters and permanent scarring
- Exposure of the eyes can result in severe injury leading to permanent blindness
- Nitric acid or nitric acid solutions are not considered to cause cancer
- Nitric acid is not thought to cause damage to the unborn child

#### Environment
- Avoid release into the environment
- Inform Environment Agency of substantial release incidents

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Background

Nitric acid is a highly corrosive liquid which is colourless to yellow, with an acrid, choking odour.

Nitric acid can be produced by mixing nitrogen dioxide with water in the presence of oxygen. However, commercial production of nitric acid, known as the Ostwald process, commonly involves the oxidation of ammonia.

Nitric acid has widespread uses in industry, with over one million tons per year being produced in the UK alone. It is an important component for the manufacture of fertilisers, dyes and some pharmaceuticals. Nitric acid is also used for the production of semiconductors, in electroplating, etching and for the cleaning of many metals. Nitric acid can react violently when mixed with other organic compounds, and for this reason is a major component in some rocket fuels. It is also used in the manufacture of some explosives, such as nitroglycerin and trinitrotoluene (TNT).

Nitric acid does not commonly present in household products, therefore exposure of the general public is not common. However, the widespread industrial use of nitric acid, means that exposure may potentially occur in a variety of occupational settings.

Nitric acid does not accumulate in the environment and is rapidly neutralised in soil. However, nitric acid may be formed readily from nitrogen dioxide, which is a common air pollutant, in the atmosphere, and is one of the constituents of “acid-rain”.

Nitric acid is highly corrosive. Drinking a solution of nitric acid will result in burns to the mouth, throat and stomach and can, in some cases, cause death.

Inhalation of air containing high levels of nitric acid can cause dryness of the throat and nasal passages, cough, shortness of breath, difficulty breathing and chest pain. In some cases the inhalation of high concentrations of nitric acid can cause death. Repeated inhalation of air containing nitric acid over a long time can damage the lungs and erode the outer coating (enamel) from teeth. People with breathing problems such as asthma may be more sensitive to the damage caused by breathing air containing nitric acid.

Nitric acid is also capable of causing burns, blisters, ulcers and permanent scarring following skin contact. The depth of the burn depends upon the strength of the acid and the duration of contact. If nitric acid comes into contact with the eyes, the resulting burns can lead to permanent injury and blindness, depending on the length of exposure.

Children exposed to nitric acid will display similar effects to exposed adults. However, the effects seen in children may possibly be more severe.

Exposure of a pregnant mother to nitric acid is not likely to cause damage to the unborn child, as the acid is toxic only at the point of contact and is also rapidly broken down.

Solutions of nitric acid are not considered to be carcinogenic.
Production and Uses

Key Points

- Nitric acid is an important industrial chemical, with over 1 million tons being produced annually in the UK
- The main commercial use of nitric acid is in the production of nitrate-containing fertilisers
- Nitric acid is also used in the manufacture of dyes, fungicides, explosives and some pharmaceuticals

In the UK, over 1 million tons of nitric acid are produced annually. The Ostwald process is the main method used for the commercial production of nitric acid. In this process, ammonia is converted into nitric acid. This involves heating ammonia with oxygen to first form nitrogen dioxide. The nitrogen dioxide is then readily absorbed by water to produce dilute nitric acid. The acid can then be concentrated to the required strength by distillation.

The principle commercial use for nitric acid is in the production of nitrate-containing fertilisers. Nitric acid is also a common component used in the manufacture of dyes, pharmaceuticals, explosives and fungicides and is also used for water treatment, the manufacture of fibres and polymers, such as nylon and can be used for the reprocessing of spent nuclear fuels. As nitric acid reacts and corrodes most metals it is widely used for cleaning and plating metal surfaces.
Frequently Asked Questions

What is nitric acid?

Nitric acid is a clear liquid, which appears colourless to yellow. It has a choking odour and is highly corrosive. Nitric acid is used in many industries. For example, it is commonly used for the production of fertilisers, dyes, some pharmaceuticals, explosives and fungicides. It is also used to clean or etch metal.

How does nitric acid get into the environment?

Nitric acid may be present in the environment as a break-down product of nitrogen dioxide, which is a common pollutant released into the environment from commercial and industrial processes. Nitrogen dioxide in the environment, in the presence of water, can readily form nitric acid. It is also one of the components present in “acid-rain”, which can cause environmental damage.

How could I be exposed to nitric acid?

Nitric acid is not commonly present in household products, so the most likely place people might be exposed is in the workplace. Small amounts of nitric acid may also be breathed in from polluted air.

If there is nitric acid in the environment will I have any adverse health effects?

The presence of nitric acid in the environment does not always lead to exposure. Clearly, in order for it to cause any adverse health effects you must come into contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact. Following exposure to any chemical, the adverse health effects you may encounter depend on several factors, including the amount to which you are exposed (dose), the way you are exposed, the duration of exposure, the form of the chemical and if you were exposed to any other chemicals.

Strong solutions of nitric acid are highly corrosive and can cause burns to any part of the body it comes into contact with. More dilute solutions of nitric acid may cause irritation to the skin, eyes and throat.

Can nitric acid cause cancer?

Nitric acid and its solutions are not considered to be cancer causing substances.

Does nitric acid affect children or damage the unborn child?

Children will be affected by nitric acid in the same way as adults.

Nitric acid is not likely to cause damage to the unborn child if the mother is exposed, as nitric acid only causes toxicity at the point of contact and breaks down rapidly on contact with skin and other tissues.
What should I do if I am exposed to nitric acid?

It is very unlikely that the general population will be exposed to a level of nitric acid high enough to cause adverse health effects.