Product Safety Assessment

**Nitric Acid**

Select a Topic:
- Names
- Product Overview
- Manufacture of Product
- Product Description
- Product Uses
- Exposure Potential
- Health Information
- Environmental Information
- Physical Hazard Information
- Regulatory Information
- Additional Information
- References

**Names**
- CAS No. 7697-37-2
- Azotic acid
- Nitric acid
- Nitrogenic acid
- Nitric Acid, 403
- Hydrogen nitrate
- Nitric acid 65%
- Aqua fortis

**Product Overview**
- Nitric acid is a colorless to yellow liquid with a strong, choking, acidic odor. Nitric acid for industrial use is typically 50-70% nitric acid in water.
- ANGUS® Chemical Company (a subsidiary of The Dow Chemical Company) produces a 61-65% nitric acid product in water primarily as a raw material for the production of nitroparaffins. Occasionally, ANGUS will sell nitric acid to a limited number of industrial customers. See Product Description.
- Nitric acid is a strong acid. The severity of effects of contact with nitric acid is dependent on its concentration, purity and the duration of contact. Nitric acid and its vapors cause severe burns to eyes, skin, respiratory tract, and gastrointestinal tract on contact. Both vapors and mists are harmful if inhaled and cause injury to the respiratory tract and lungs. See Health Information or Physical Hazard Information.
- Exposure to nitric acid could occur at a nitric acid manufacturing site, or at facilities that use nitric acid to manufacture other products. Additionally, nitric acid exposure could occur during laboratory work. Direct consumer exposure to industrial strength nitric acid is unlikely. However, the general population may be exposed to low levels of nitric acid from acid rain and fog, or to trace amounts in products of combustion. See Exposure Potential.
- Nitric acid is a corrosive acid and a strong oxidizer. It can react explosively on contact with powerful reducing agents. Nitric acid reacts with a wide range of materials, both organic and inorganic. The reactions with organics frequently result in the formation of gas which produces additional hazards in closed systems. Nitric acid is noncombustible, but increases the flammability of organics and materials that can be oxidized, increasing the intensity of fires or sometimes resulting in spontaneous combustion. It reacts with many metals to form explosive hydrogen gas. Unintended contact with other chemicals and combustible materials should be avoided. See Physical Hazard Information.

Back to top

® ANGUS Chemical Company is a subsidiary of The Dow Chemical Company
Manufacture of Product

- **Capacity** – ANGUS Chemical Company (ANGUS) has manufactured products from nitroalkanes and their derivatives for more than 70 years. Global nitric acid production in 2006 was estimated at about 51 million metric tons or 112.4 billion pounds.

- **Process** – Nitric acid is manufactured by the oxidation of ammonia by air or oxygen using a multi-step process with a catalyst based on the Ostwald reaction.

Product Description

Nitric acid is a colorless to yellow liquid with a characteristic strong, choking, acidic odor. It is one of the most common strong acids and is a strong oxidizing agent. It is completely soluble in water.

Nitric acid may be sold in a variety of different concentrations in water. Nitric acid for industrial use is typically 50-70% nitric acid in water. ANGUS produces a 61-65% nitric acid product in water primarily as a raw material for the production of nitroparaffins. ANGUS will occasionally sell nitric acid to a limited number of industrial customers.

Fuming nitric acid is a concentrated nitric acid containing nitrogen oxide and typically contains more than 85% nitric acid (white fuming nitric acid contains more than 97.5% and red fuming nitric acid contains more than 85%). Nitrogen dioxide and nitrogen oxide gases are emitted from concentrated nitric acid 85-100% concentrations). ANGUS does not produce or sell fuming nitric acid.

Product Uses

Nitric acid sold commercially is primarily used as a chemical intermediate in the synthesis of fertilizers, dyes and pharmaceuticals. It is also used in metallurgy, photoengraving, etching steel, metal ore flotation, laboratory work, and the production of urethane and rubber chemicals. Ammonium nitrite production accounts for 75% of the world nitric acid market. Two-thirds of the ammonium nitrate produced globally is used for fertilizer production while the remaining one-third is used for industrial applications. Other non-ammonium nitrate products are produced from nitric acid, including: adipic acid, nitrobenzene, and toluene diisocyanate.

Overall it is estimated that the fertilizer industry accounts for 55-60% of the global nitric acid market. Likewise, the majority of nitric acid produced in the United States is sold into the manufacture of ammonium nitrate fertilizer, accounting for consumption of 75% of the 6 million tons produced annually in the U.S.

ANGUS uses the vast majority of the nitric acid it produces as a raw material for its production of nitroparaffins.

Exposure Potential

Based on the uses for nitric acid, the public could be exposed through:

- **Workplace exposure** – Exposure can occur either in a nitric acid manufacturing facility or in educational, industrial or manufacturing facilities that use nitric acid as a laboratory chemical or as an intermediate. Those working with nitric acid in manufacturing operations could be exposed to liquid or vapor during maintenance, transfer, sampling, testing, disposal, or other procedures. Each manufacturing facility should maintain adequate ventilation and use engineering controls to maintain airborne levels below the relevant workplace exposure limits. Also employers should provide thorough employee training, appropriate work processes, and safety equipment to prevent exposure. See Health Information.
• **Consumer exposure to products containing nitric acid** – ANGUS does not sell nitric acid for consumer use and products containing high concentrations of nitric acid are not typically used by consumers. However, the general public may be exposed to trace amounts of nitric acid in acid rain and fog, or from products of combustion. See [Health Information](#).

• **Environmental releases** – In the event of a small spill, the focus is on containing the spill to prevent contamination of soil, and surface or ground water. Evacuate the area. Personnel wearing full protective clothing should then isolate and contain the spill with dikes. DO NOT USE ABSORBENT MATERIALS such as: wood chips, sawdust, and cellulose-based, organic or polymeric absorbents. Carefully neutralize remaining acid on the ground with soda ash or other neutralizing materials. The reaction with soda ash or any other carbonate will release CO$_2$ gas and heat. Addition of water will also generate heat. Collect material in suitable and properly labeled containers. Flush the contaminated area with water. See [Environmental, Health and Physical Hazard Information](#).

• **Large release** – Industrial spills or releases are infrequent, and are generally contained. If a large spill does occur, evacuate personnel upwind and ventilate the area. Collect leaking and spilled liquid in appropriate sealable containers as completely as possible. Cautiously neutralize the remainder of the spilled material with soda ash powder or other neutralizing material. Only trained and properly protected personnel should be involved in clean-up operations. Keep out of sewers and other waterways.

• **In case of fire**, properly protected and trained fire fighting personnel should extinguish the fire with water, fog or fine spray. Adding water to nitric acid will generate heat, fumes, and may cause splattering, so use water cautiously. Nitric acid does not burn; if exposed to fire from another source, suitable extinguishing agent should be selected for that fire. Dry chemical extinguishing agents may react with product so must only be used with caution. Follow emergency procedures carefully. See [Environmental, Health and Physical Hazard Information](#).

For more information, see the relevant [Safety Data Sheet](#).

**Back to top**

**Health Information**

The effects of exposure to nitric acid depend upon the airborne or in-solution concentration and the duration of contact. Exposure effects can range from mild to severe, even producing death.

Ingestion of nitric acid is considered to be toxic. One teaspoon or 6 milliliters (0.2 ounces) of this material is corrosive to mucous membranes and/or fatal.

Inhalation of excessive nitric acid mist or vapor prompts coughing, gagging, chest pain, and difficulty breathing. In sufficiently high concentrations, a single, relatively short inhalation exposure can cause injury with fluid in the lungs. Symptoms may be delayed. Chronic exposure to lower concentrations of vapors can lead to bronchitis and chemical pneumonia. The vapor and mists of nitric acid may also cause erosion of teeth.

On the skin, nitric acid can produce severe penetrating burns, ulceration, yellow discoloration and corrosion. Nitric acid also causes severe irritation to eyes upon contact, and may result in permanent injury to eyes. Nitric acid vapor may also cause eye irritation with pain and redness.

For more information, see the [Safety Data Sheet](#).

**Back to top**

**Environmental Information**

Nitric acid is slightly toxic to aquatic organisms based on ecotoxicity testing. Nitric acid may decrease the pH of aquatic systems to less than pH 5 which may be toxic to aquatic species. The
bioconcentration potential of nitric acid is low and its potential for mobility in soil is very high. Nitric acid will not biodegrade readily in the environment, but will ionize in water and be readily neutralized by the natural buffering capacity (alkalinity) present in the soil and surface water. The nitrate ion will ultimately become an inorganic nutrient for plant species.

For more information, see the Safety Data Sheet.

**Physical Hazard Information**

Nitric acid is a strong oxidizer, even when fairly dilute and at ambient temperatures. It can react explosively on contact with powerful reducing agents. While nitric acid is noncombustible, it increases the flammability of organic and readily oxidizable materials in fire situations. Nitric acid also reacts with many metals to form explosive hydrogen gas.

Nitric acid reacts explosively with all metallic powders, carbides, hydrogen sulfide, and turpentine or other organics.

Nitric acid reacts violently with many common organic solvents and chemicals, such as ethanol, turpentine, bases, most metals, and many other materials. The reactions with organics frequently result in the formation of gas which produces additional hazards in closed systems. Contact with combustible materials such as wood chips, sawdust, cellulose and polymeric absorbents can cause a fire. Water added to nitric acid will generate heat, fumes, and splattering. If it is necessary to mix with water, nitric acid should be added slowly while stirring.

Store in a location where potential spills can be contained and in a location away from combustible or incompatible materials.

For more information, see the Safety Data Sheet.

**Regulatory Information**

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of nitric acid. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant Safety Data Sheet or Contact Us.

**Additional Information**

- European Chemical Substances Information System (ESIS) for CAS=7697-37-2, and IUCLID Chemical Data Sheet (containing specific study data) ([http://ecb.jrc.it/esis/](http://ecb.jrc.it/esis/))
Product Safety Assessment: Nitric Acid

- EPA AEGLS for Nitric Acid (http://www.epa.gov/oppt/aegl/pubs/tsd310.pdf)
- OSHA Chemical Sampling Information, for Nitric Acid (http://www.osha.gov/dts/chemicalsampling/data/CH_256600.html)
- Occupational Health Guideline for Nitric Acid, U.S. Department of Labor Occupational Safety and Health Administration (OSHA), September, 1978
- American Conference of Governmental Industrial Hygienists, “Nitric Acid”, Documentation of the Threshold Limit Values for Substances in Workroom Air (6th edition), Cincinnati
- OSHA/EPA Occupational Chemical Database Website, Nitric acid, search CAS=7697-37-2 (US OSHA and EPA database of information on more than 800 chemicals commonly found in the workplace (http://www.osha.gov/web/dep/chemicaldata/#target)
- Hazardous Substances Data Bank by the National Library of Medicine, Nitric acid, search CAS=7697-37-2 (http://toxnet.nlm.nih.gov)

For more business information about nitric acid, visit the ANGUS web site: www.dow.com/angus.

References

2. Nitric Acid Material Safety Data Sheet, ANGUS Chemical Company, Identification Number: 62496 /1031
4. Dow/ANGUS website: About Us (http://www.dow.com/angus/about/)
NOTICES:

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