Product Safety Assessment

Nitromethane

Names
- CAS No. 75-52-5
- Nitromethane
- Nitroalkane
- Nitro fuel
- Nitrocarbol
- Nitroparaffin

Product Overview
- ANGUS Chemical Company (a subsidiary of The Dow Chemical Company) has manufactured nitromethane products for over 50 years. ANGUS produces both pure nitromethane and a nitromethane mixture with furfural. See Product Description.
- Nitromethane is primarily used as a starting material in the synthesis of agricultural, biological and chemical products and intermediates. It can also be used as a fuel for hobby vehicles for which nitromethane is typically diluted with methanol by hobby fuel formulators. See Product Uses.
- Nitromethane can be handled safely as long as its hazardous properties are understood and unsafe conditions are avoided during its use. Nitromethane can detonate and cause serious harm to people and property under certain conditions. Nitromethane can detonate more easily when contaminated by acids, bases, amines or other “sensitizing” chemicals, or when handled at both increased pressure AND elevated temperatures. See Physical Hazard Information.
- Nitromethane is flammable and should be handled and stored in a dry well-ventilated area that is free of excessive heat and ignition sources. Even containers that appear empty may contain flammable vapors. See Physical Hazard Information.
- Pure nitromethane is low in toxicity by ingestion or absorption through the skin. With insufficient ventilation, vapor concentrations are attainable which could cause respiratory tract irritation and central nervous system effects such as headache, dizziness and drowsiness, unconsciousness, or even death, similar to effects of other organic solvents or chemicals. Nitromethane has caused cancer in laboratory animal studies. Mixtures of nitromethane with other solvents have additional hazards. See Health Information.
- Nitromethane exposure can occur by inhalation, through skin contact or accidental ingestion. See Exposure Potential.
- Only customers with robust safety and security programs are qualified to receive nitromethane produced by ANGUS. ANGUS requires a customer qualification approval prior to the first product shipment and periodic re-qualifications to address the safety and security of nitromethane throughout the product lifecycle.

Manufacture of Product
- Capacity – ANGUS is the only producer that manufactures nitromethane in the U.S.
- Process – Nitromethane produced by ANGUS is produced via nitration of propane.

Product Description
Nitromethane is a clear, mobile and colorless liquid at room temperature with a mild characteristic odor. See Physical Hazard Information.

Nitromethane mixes readily with alcohols and organic solvents and is somewhat soluble in water. It has a freezing point of –20°F (–29°C) and a boiling point of 214°F (101°C).
ANGUS Chemical Company currently sells the following grades of nitromethane:

- NM™ Nitromethane
- SYNTHATANE™ NM 100, Nitroalkane Intermediate
- Nitromethane Chloropicrin Grade
- NITROBOOST™ KIX 100
- NM Chloropicrin Grade WC

**Product Uses**

Nitromethane is primarily used as a chemical intermediate in the synthesis of biocides, chemicals, and agricultural products and intermediates. Nitromethane is also used as a fuel or fuel additive with methanol in hobby cars, boats and model engines. ANGUS no longer sells nitromethane into racing fuel applications. ANGUS uses some of its nitromethane volume internally to produce other products.

**Exposure Potential**

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

- **Workplace exposure** – Exposure can occur either in a nitromethane manufacturing facility or in industrial or manufacturing facilities that use nitromethane as an intermediate or solvent. Those working with nitromethane in manufacturing operations could be exposed to either liquid or vapor during maintenance, transfer, sampling, testing, disposal or other procedures. Each manufacturing facility should maintain adequate ventilation, have a thorough training program for employees, appropriate work processes, and safety equipment in place to limit unnecessary exposure. See Health Information.

- **Consumer exposure to products containing nitromethane** – Products containing nitromethane are not widely used by consumers. However, hobbyists could be exposed to incidental quantities of nitromethane liquid or vapor during fueling operations. The general population may also be exposed to nitromethane from combustion products in motor vehicle exhaust and cigarette smoke. Nitromethane has been detected in air, surface water and drinking water.¹ See Health Information.

- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface or ground water and to keep material from entering sewers. Nitromethane spills are also a potential vapor explosion hazard. Eliminate all nearby sources of ignition immediately and use non-sparking tools for cleanup. If available, use foam to smother or suppress vaporization. Consult the relevant Safety Data Sheet (SDS) for more information about protective equipment and procedures. See Environmental, Health and Physical Hazard Information.

- **Large release**²³ – Industrial spills or releases are infrequent and are generally contained. If a large spill does occur, evacuate the danger area! Consult an expert. Remove all ignition sources and use non-sparking tools for cleanup. Use only explosion-proof equipment; ground and bond all containers and handling equipment. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbant and remove to safe place. DO NOT absorb in saw-dust or other combustible absorbents. A harmful level of contamination in the air can be reached rather quickly upon evaporation of this material at ambient temperatures. A positive-pressure, self-contained breathing apparatus (SCBA) with a full-face mask is recommended. Collected material should be disposed of according to applicable governmental requirements. The public should be warned of downwind vapor explosion hazards. Vapors are heavier than air and may travel a long distance and accumulate in low lying areas. Keep out of sewers. Follow emergency procedures carefully. See Environmental, Health and Physical Hazard Information. See SDS for further information.

¹ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow
Health Information

**Pure Nitromethane**

Pure nitromethane has low acute toxicity if swallowed. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. Nitromethane is low in toxicity by absorption through the skin, and is only a mild irritant to the eyes. It is not likely to cause significant irritation to the skin.

Excessive exposure to concentrated nitromethane vapors can result in irritation to the upper respiratory tract and lungs. With insufficient ventilation, nitromethane can create vapor concentrations that could cause central nervous system effects such as headache, dizziness, drowsiness, unconsciousness, or even death, similar to effects of other common organic solvent chemicals. Excessive nitromethane exposure may also cause methemoglobinemia, which impairs the blood’s ability to transport oxygen.

A two-year chronic inhalation study in male and female rats, by the White Sands Research Center, New Mexico, showed no pharmacologic effects or effects on tumor incidence from exposure to 100 or 200 parts per million (ppm) of nitromethane vapors. A two-year chronic inhalation study in rats conducted by the U.S. National Toxicology Program (NTP) at doses of 94, 188 or 375 ppm, reported evidence of carcinogenic activity in female rats, male and female mice (not in male rats) and, as a result, nitromethane is listed as a potential carcinogen to humans in Group 2B by the International Agency for Research on Cancer (IARC) and in Group A3 by American Conference of Governmental Industrial Hygienists (ACGIH).

No mutagenic activity has been detected in either *in vivo* or *in vitro* studies. The non-mutagenicity of nitromethane and the absence of a carcinogenic response in animals exposed to lower concentrations of 100-200 ppm nitromethane support the premise of a threshold below which nitromethane would not be expected to produce tumors.

Environmental Information

Nitromethane is practically non-toxic to aquatic organisms. Testing has shown that the bioconcentration potential of nitromethane is low and its potential for mobility in soil is very high. This material is not considered readily biodegradable; however, these results do not necessarily mean that the material is not biodegradable under environmental conditions. Degradation is expected in the atmospheric environment within months to years.

Physical Hazard Information

Nitromethane can be handled safely provided that its hazardous properties are understood and unsafe conditions are avoided in its use. Only customers with robust safety and security programs are qualified to purchase nitromethane produced by ANGUS. ANGUS requires a customer qualification process prior to the first product shipment and periodic requalifications to address the safety and security of nitromethane throughout the product lifecycle.

**Detonation**

Nitromethane can be detonated when it is:

- Exposed to a very severe shock (when nitromethane is unconfined at room temperature)
- Experiencing severe and very rapid compression under adiabatic conditions
- Heated under confinement to near its critical temperature
Nitromethane is “sensitized” and more easily detonated when it is mixed with a few percent of certain compounds such as amines, acids and bases.

Raising the temperature of liquid nitromethane also increases the sensitivity of the material to detonation. It is therefore advisable to handle/store nitromethane at or below room temperature if possible. Shock sensitivity is controlled by selecting proper materials of construction and avoiding contact with incompatible materials. Because of this hazard, strict adherence to proper storage and handling equipment design and procedures is necessary.

- Do not heat liquid under confinement.
- Do not confine liquid in heavy-walled containers, such as in pipes between closed valves.
- Avoid contact with metals such as brass, copper, copper alloys, lead and its alloys.
- Avoid unintended contact with acids, bases, amines, aldehydes, alkenes, reducing agents and strong oxidizing agents.
- Avoid contact with absorbent materials such as clay-based absorbents and activated carbon.

For certain applications, such as with hobby fuels and synthesis activities, methanol and other solvents are added to nitromethane products to make them less likely to detonate.

**Fire Considerations**

Nitromethane is a flammable liquid with a closed cup flash point of 96°F (36°C). Nitromethane vapor has a lower explosive limit of 7.3% by volume at atmospheric pressure and at 91°F (33°C). It does not form explosive mixtures with air at room temperature and below, when unconfined.

Because nitromethane burns slowly with an almost invisible, colorless flame, fires may be difficult to detect by sight. Unlike most hydrocarbon fuels, nitromethane fires are readily extinguished by water applied gently. DO NOT USE dry-chemical extinguishers that contain sodium or potassium bicarbonate as they can appear to extinguish the fire when first applied, but then reignite the fire. Instead, use carbon dioxide, foam or ABC (ammonium phosphate containing) dry-chemical class extinguishers.

Review the [ANGUS Nitromethane Technical Bulletin](http://www.dow.com/angus/prod/literature.htm#N) to review the hazards of nitromethane and ways to avoid them. Additional physical property information for nitromethane is available on the [SDS](http://www.dow.com/webapps/msds/msdssearch.aspx).

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**Regulatory Information**

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of nitromethane. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant [SDS, Technical Data Sheet](http://www.dow.com/webapps/msds/msdssearch.aspx) or [Contact Us](http://www.dow.com/angus/contact/index.htm).

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**Additional Information**

- Contact Us ([http://www.dow.com/angus/contact/index.htm](http://www.dow.com/angus/contact/index.htm))
World Health Organization (WHO) Chemical Cards, International Program on Chemical Safety (IPCS) – Nitromethane
(http://www.ilo.org/public/english/protection/safework/cis/products/icsc/dtasht/_icsc05/icsc0522.htm)

International Agency for Research on Cancer (IARC) Summary – Nitromethane
(http://www.inchem.org/documents/iarc/vol77/77-15.html)

European Chemicals Bureau, ESIS, look for CAS 75-52-5 (http://esis.jrc.ec.europa.eu/)

Scorecard Chemical Profiles – Nitromethane

For more business information about nitromethane, visit the ANGUS website (http://www.dow.com/angus/).

References

2 ANGUS Chemical Company Technical Data Sheet: Nitromethane, Form No. 319-00012
3 NM™ Nitromethane, Material Safety Data Sheet, No. 41044
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