

Occupational Health Guideline for 1-Nitropropane

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2$
- Synonyms: None
- Appearance and odor: Colorless liquid with a mild, fruity odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 1-nitropropane is 25 parts of 1-nitropropane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 90 milligrams of 1-nitropropane per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has issued a Notice of Intended Changes of its recommended Threshold Limit Value for 1-nitropropane from 25 ppm to 15 ppm.

HEALTH HAZARD INFORMATION

• Routes of exposure

1-Nitropropane can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

• Effects of overexposure

1-Nitropropane causes irritation of the eyes and respiratory tract, headache, nausea, vomiting, and diarrhea.

• Reporting signs and symptoms

A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to 1-nitropropane.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to 1-nitropropane at potentially hazardous levels:

1. Initial Medical Screening: Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from 1-nitropropane exposure.

—Chronic respiratory disease: 1-Nitropropane causes respiratory irritation in animals. In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1-nitropropane might cause exacerbation of symptoms due to its irritant properties.

—Liver disease: 1-Nitropropane causes liver damage in animals. The importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

—Kidney disease: 1-Nitropropane causes kidney damage in animals. The importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

2. Periodic Medical Examination: Any employee developing the above-listed conditions should be referred for further medical examination.

• Summary of toxicology

1-Nitropropane vapor is an eye irritant and in animals causes mild respiratory irritation and severe liver damage. Rabbits died from exposure to 5,000 ppm for 3 hours, but 10,000 ppm for 1 hour was not lethal. Effects were conjunctival irritation, lacrimation, slow respiration with some rales, muscular incoordination, ataxia, and weakness. Autopsy of animals exposed to lethal concentrations revealed severe fatty infiltration of the liver and moderate kidney damage. Human volunteers exposed to over 100 ppm noted eye irritation. There are no reports of systemic effects in humans.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

1. Molecular weight: 89.1
2. Boiling point (760 mm Hg): 131.6 C (268 F)
3. Specific gravity (water = 1): 1.0
4. Vapor density (air = 1 at boiling point of 1-nitropropane): 3.1
5. Melting point: -108 C (-162 F)
6. Vapor pressure at 20 C (68 F): 7.5 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 1.4
8. Evaporation rate (butyl acetate = 1): 0.8

• **Reactivity**

1. Conditions contributing to instability: Overheat- ing in closed containers may cause violent explosion.

2. Incompatibilities: Even though no detonation of 1-nitropropane has been reported, contact with amines, strong acids, and alkalis may cause 1-nitropropane to become unstable. Contact with strong oxidizers may cause fires and explosions. Mixtures of 1-nitropropane and hydrocarbons (or other combustible materials) are highly flammable. Contact with some metal oxides may cause decomposition and development of pressure.

3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving 1-nitropropane.

4. Special precautions: Liquid 1-nitropropane will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Flash point: 35.6 C (96 F) (closed cup)
2. Autoignition temperature: 420.6 C (789 F)
3. Flammable limits in air, % by volume: Lower: 2.2; Upper: Data not available
4. Extinguishant: Dry chemical, alcohol foam, carbon dioxide

• **Warning properties**

1. Odor Threshold: The *AIHA Hygienic Guide* states that "the odor (of nitropropane) is detectable at 300 ppm but not at 80 ppm."

2. Eye Irritation Level: Grant states that "tests of nitropropane vapor on human volunteers have established that a sensation of eye irritation is noted at a concentration of 150 ppm in air."

3. Evaluation of Warning Properties: Since the odor and irritation thresholds of nitropropane are not within three times the permissible exposure limit, it is treated as a material with poor warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average

exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Method**

At the time of publication of this guideline, no measurement method for 1-nitropropane had been published by NIOSH.

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Clothing wet with liquid 1-nitropropane should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of 1-nitropropane from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 1-nitropropane, the person performing the operation should be informed of 1-nitropropane's hazardous properties.

• Any clothing which becomes wet with liquid 1-nitropropane should be removed immediately and not reworn until the 1-nitropropane is removed from the clothing.

• Employees should be provided with and required to use splash-proof safety goggles where liquid 1-nitropropane may contact the eyes.

SANITATION

• Employees who handle liquid 1-nitropropane should wash their hands thoroughly with soap or mild detergent and water before eating or smoking.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to 1-nitropropane may occur and control methods which may be effective in each case:

Operation	Controls
Use as a thinner and solvent for cellulose compounds, lacquers, and dopes; in vinyl resins for industrial coatings and printing inks; in synthetic finish removers; and for oil- and spirit-soluble dyes of molded plastics	Process enclosure; local exhaust ventilation; personal protective equipment
Use as an extraction solvent for purification, separation, recrystallization, and recovery for natural and synthetic resins, tars, coating materials, fats, and oils	Local exhaust ventilation; personal protective equipment
Use as a reaction medium in polymer technology, as a catalyst, initiator, and solvent	Local exhaust ventilation; personal protective equipment
Use in organic chemical synthesis for preparation of amines, nitrated alcohols, and acids, and chloronitroparaffins	Local exhaust ventilation; personal protective equipment
Use in manufacture of explosives	Process enclosure; local exhaust ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If liquid 1-nitropropane gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If liquid 1-nitropropane gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If liquid 1-nitropropane soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of 1-nitropropane, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

• Swallowing

When liquid 1-nitropropane has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

• Rescue

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

• If liquid 1-nitropropane is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities, absorb on paper towels and burn in a suitable combustion chamber which allows burning in an unconfined condition and is equipped with an appropriate effluent gas cleaning device. Large quantities can be collected, diluted in fuel oil, and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Liquid 1-nitropropane should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal method:

Liquid 1-nitropropane may be disposed of by diluting in fuel oil and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

REFERENCES

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RESPIRATORY PROTECTION FOR 1-NITROPROPANE

Condition	Minimum Respiratory Protection* Required Above 25 ppm
Vapor Concentration	
150 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
1250 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
2300 ppm or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 2300 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.