

# Occupational Health Guideline for Nitroethane

## 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:  $C_2H_5NO_2$
- Synonyms: None
- Appearance and odor: Colorless liquid with a mild, fruity odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for nitroethane is 100 parts of nitroethane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 310 milligrams of nitroethane per cubic meter of air ( $mg/m^3$ ).

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Nitroethane 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

In man, mild skin irritation has occurred from repeated exposure of the skin. Animal exposure to nitroethane has produced irritation of the respiratory tract with breathing difficulties which may be delayed in onset. Irritation of the eyes, anesthesia, and death have also occurred.

### • 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 nitroethane.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to nitroethane 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 nitroethane exposure.

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

—Liver disease: Nitroethane 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: Nitroethane 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.

—Skin disease: Nitroethane is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

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

### • Summary of toxicology

Nitroethane is a mild skin irritant. In animals, nitroethane vapor is narcotic and a pulmonary irritant and also causes liver damage. Rabbits died from exposure to 5000 ppm for 3 hours; exposure to 2500 ppm for 3 hours was not fatal. Effects were lacrimation, dyspnea, pulmonary rales, and, in a few animals, pulmonary edema. Twitching and jerking movements of the head and extremities were observed; convulsions were rare and of brief duration. Stupor or narcosis at high concentra-

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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.

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tions was rapidly reversible. Autopsy of animals exposed to lethal concentrations showed mild to severe liver damage and non-specific changes in the kidneys. No systemic effects have been reported in humans. The liquid is a mild skin irritant due to solvent action.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 75.1
2. Boiling point (760 mm Hg): 114 C (237 F)
3. Specific gravity (water = 1): 1.05
4. Vapor density (air = 1 at boiling point of nitroethane): 2.6
5. Melting point: -90 C (-130 F)
6. Vapor pressure at 20 C (68 F): 15.6 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 4.5
8. Evaporation rate (butyl acetate = 1): 1.2

### • Reactivity

1. Conditions contributing to instability: Overheating of closed containers may cause detonation.

2. Incompatibilities: Contact with amines, strong acids, and alkalis may sensitize nitroethane so that it will readily explode. Contact with strong oxidizers may cause fires and explosions. Mixtures of nitroethane 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 nitroethane.

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

### • Flammability

1. Flash point: 27.8 C (82 F) (closed cup)
2. Autoignition temperature: 414 C (778 F)
3. Flammable limits in air, % by volume: Lower: 3.4; Upper: Data not available

4. Extinguishant: Alcohol foam, carbon dioxide, dry chemical

### • Warning properties

1. Odor Threshold: Patty states that "the odors of nitroparaffins are easily detectable, and concentrations below 200 ppm are disagreeable to most observers. The odor and sensory symptoms are not dependable warning properties."

2. Eye Irritation Level: The AIHA *Hygienic Guide* states that the vapors of nitroethane "are noticeably irritating at concentrations above 100 ppm but cannot be relied upon for warning properties." At 500 ppm and above, strong eye (and respiratory tract) irritation has been observed in animals.

3. Evaluation of Warning Properties: Patty states that "the odor and sensory symptoms (of the nitroparaffins) are not dependable 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

An analytical method for nitroethane is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 6, 1980, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00369-6).

## 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

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid nitroethane.

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

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

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

## SANITATION

- Skin that becomes wet with liquid nitroethane should be promptly washed or showered with soap or mild detergent and water to remove any nitroethane.
- Employees who handle liquid nitroethane should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

## COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use as a solvent in coatings and adhesives on cellulose esters and synthetic resins	Process enclosure; local exhaust ventilation; personal protective equipment
Use as an intermediate in synthesis of organic dyes, insecticides, pesticides, nitroplasticizers, pharmaceuticals, and other organic chemicals	General dilution ventilation; process enclosure; local exhaust ventilation; personal protective equipment
Use as a propellant; as a reaction-media fluid; as an extraction solvent in petroleum fractionation; use as a recrystallization solvent	General dilution ventilation; 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 nitroethane 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 nitroethane gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If liquid nitroethane soaks through the clothing, remove the clothing promptly 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 nitroethane, 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 nitroethane 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 nitroethane 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 nitroethane should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

### • Waste disposal method:

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

## REFERENCES

- American Conference of Governmental Industrial Hygienists: "Nitroethane," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
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- Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.
- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.
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### RESPIRATORY PROTECTION FOR NITROETHANE

Condition	Minimum Respiratory Protection* Required Above 100 ppm
Vapor Concentration  1000 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood.  Any self-contained breathing apparatus with a full facepiece.
Greater than 1000 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.