

Occupational Health Guideline for Petroleum Distillates (Naphtha)

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_6H_{14} — C_7H_{16} — $C_{10}H_{22}$
- Synonyms: Petroleum naphtha; aliphatic petroleum naphtha; petroleum ether (95 to 115 C); naphtha, petroleum
- Appearance and odor: Colorless liquid with an odor like gasoline and kerosene.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for petroleum distillates is 500 parts of petroleum distillates per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 2000 milligrams of petroleum distillates per cubic meter of air (mg/m^3). NIOSH has recommended that the permissible exposure limit be reduced to $350 mg/m^3$ averaged over a work shift of up to 10 hours per day, 40 hours per week.

HEALTH HAZARD INFORMATION

• Routes of exposure

Petroleum distillates can affect the body if they are inhaled, come in contact with the eyes or skin, or are swallowed.

• Effects of overexposure

1. Short-term Exposure: Overexposure to petroleum distillates may cause dizziness, drowsiness, headache, and nausea. They may also cause irritation of the eyes, throat, and skin.

2. Long-term Exposure: Prolonged overexposure may cause drying and cracking of the skin.

3. 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 petroleum distillates.

• Recommended medical surveillance

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

—Skin disease: Petroleum distillates are skin defatting agents and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of these agents.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of petroleum distillates might cause exacerbation of symptoms due to their irritant properties.

—Liver disease: Although petroleum distillates are not known as liver toxins in humans, 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: Although petroleum distillates are not known as kidney toxins in humans, 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

The vapors of petroleum distillates are mild narcotics and mucous membrane irritants. There have been few toxicologic studies, either on animals or man. While 4000 to 7000 ppm are tolerated for 1 hour by human subjects, symptoms of narcosis, such as dizziness and drowsiness, occur at those concentrations. Continuing

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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exposure may produce signs of inebriation, followed by headache or nausea. Exposure at 10,000 to 20,000 ppm is regarded as immediately hazardous to life. The higher boiling fractions may produce irritation of the eyes, nose, and throat in addition to symptoms of mild narcosis. The liquid is a defatting agent, and repeated or prolonged skin contact results in drying and cracking of the skin. No chronic systemic effects have been reported from widespread industrial use. If benzene is present in the distillate, however, the hazard of both acute and chronic poisoning is increased; the presence of elevated phenol in the urine is indicative of benzene exposure.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 100 (approximately)
2. Boiling point (760 mm Hg): 30 to 127 C (86 to 260 F)
3. Specific gravity (water = 1): 0.74
4. Vapor density (air = 1 at boiling point of petroleum distillates): 3.4 (approximately)
5. Melting point: Data not available
6. Vapor pressure at 20 C (68 F): 40 mm Hg (approximately)
7. Solubility in water, g/100 g water at 20 C (68 F): 0.04 (approximately)
8. Evaporation rate (butyl acetate = 1): 10 (approximately)

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving petroleum distillates.
4. Special precautions: Petroleum distillates will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: -40 to 20 C (-40 to 68 F) (closed cup)
2. Autoignition temperature: 232 to 260 C (450 to 500 F)
3. Flammable limits in air, % by volume: Lower: 1; Upper: 6
4. Extinguishant: Foam, carbon dioxide, dry chemical

• Warning properties

1. Odor Threshold: The odor thresholds of the main constituents of petroleum naphtha (i. e., heptane, octane, pentane, etc.) are below the individual permissible exposure limits.
2. Eye Irritation Level: According to Gafafer, the naphthas irritate the conjunctiva. The American Petroleum Institute states that irritation of the conjunctiva may occur "when the eyes are exposed to high vapor concentrations (of petroleum naphtha) in air. The irritation is mild and transitory." No quantitative information is available concerning the threshold of eye irritation,

however.

3. Evaluation of Warning Properties: Since the odor of each of the main constituents of petroleum naphtha is detectable at concentrations below the respective permissible exposure limits, petroleum naphtha is treated as a material with adequate 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

Sampling and analyses may be performed by collection of petroleum distillates vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure petroleum distillates may be used. An analytical method for petroleum distillates is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 3, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00261-4).

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 petroleum distillates.

- Clothing wet with liquid petroleum distillates should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of petroleum distillates from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the petroleum distillates, the person performing the operation should be informed of petroleum distillates' hazardous properties.
- Any clothing which becomes wet with liquid petroleum distillates should be removed immediately and not reworn until the petroleum distillates are removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid petroleum distillates may contact the eyes.

SANITATION

- Skin that becomes wet with liquid petroleum distillates should be promptly washed or showered with soap or mild detergent and water to remove any petroleum distillates.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation during degreasing operations	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use as solvents in rubber industry during manufacture of water-proof cloth, shoe adhesives, and rubber tires	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use as extractants; use in preparation of paint, varnish, and lacquer as solvents, diluents, or thinners; use as solvents in pesticides	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use during dry cleaning operations	General dilution ventilation; 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 petroleum distillates get 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 these chemicals.

• Skin Exposure

If petroleum distillates get on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If petroleum distillates soak 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 petroleum distillates, 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

If petroleum distillates have been swallowed, do not induce vomiting. 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 petroleum distillates are 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. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be collected and atomized in a suitable combustion chamber. Petroleum distillates should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- Waste disposal method:

Petroleum distillates may be disposed of by atomizing in a suitable combustion chamber.

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RESPIRATORY PROTECTION FOR PETROLEUM DISTILLATES (NAPHTHA)

Condition	Minimum Respiratory Protection* Required Above 500 ppm
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
5000 ppm or less	A gas mask with a chin-style organic vapor canister.
10,000 ppm or less	A gas mask with a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 10,000 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 gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

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