

Occupational Health Guideline for Propane

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: $\text{CH}_3\text{CH}_2\text{CH}_3$
- Synonyms: Dimethylmethane
- Appearance and odor: Colorless, odorless gas (a foul-smelling odorant is usually added).

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for propane is 1000 parts of propane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 1800 milligrams of propane per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Propane can affect the body if it is inhaled.

• Effects of overexposure

Overexposure to propane may cause dizziness, disorientation, and excitation. Greater exposure may cause unconsciousness and death. Contact with liquefied propane may cause a freezing injury or frostbite.

• 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 propane.

• Recommended medical surveillance

Routine medical examinations should be provided to each employee who is exposed to propane at potentially hazardous levels.

• Summary of toxicology

Propane, a gas at ordinary temperatures, is an asphyxiant in very high concentrations. Guinea pigs exposed to concentrations of up to 5.5% propane by volume (55,000 ppm) for 1 to 2 hours showed tremors after 5 minutes, then nausea, retching and stupefaction; all survived and at autopsy had no significant tissue damage. Brief exposures to 10,000 ppm caused no symptoms in human subjects; 100,000 ppm produced slight dizziness in a few minutes of exposure but was not noticeably irritating to the eyes, nose, or respiratory tract. In the very few reports of accidental overexposure, there was disorientation, excitation, excessive salivation, headache, and vomiting. Liquid propane may cause frostbite.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 44.1
2. Boiling point (760 mm Hg): -42.1 C (-43.7 F)
3. Specific gravity (water = 1): 0.5 (liquid)
4. Vapor density (air = 1 at boiling point of propane): 1.6
5. Melting point: -187.7 C (-305.8 F)
6. Vapor pressure at 20 C (68 F): 8.6 atm.
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• Reactivity

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

• Flammability

1. Flash point: Not applicable (gas)

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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Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

2. Autoignition temperature: 450 C (842 F)
3. Flammable limits in air, % by volume: Lower: 2.2; Upper: 9.5
4. Extinguishant: Stop flow of gas.

• **Warning properties**

1. Odor Threshold: Patty reports that the odor threshold of propane is 20,000 ppm.
2. Irritation Levels: According to Patty, exposure to concentrations as high as 100,000 ppm "is not noticeably irritating to the eyes, nose, or respiratory tract."
3. Evaluation of Warning Properties: Propane has poor warning properties. The odor threshold is 20 times the permissible exposure limit, and no noticeable irritation is produced at a concentration 100 times the permissible exposure limit.

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 utilizing a combustible gas meter. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure propane may be used. An analytical method for propane is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

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 the skin from becoming frozen from contact with liquid propane or from contact with vessels containing liquid propane.
- Any clothing which becomes wet with liquid propane should be removed immediately and not reworn until the propane has evaporated.
- Employees should be provided with and required to use splash-proof safety goggles where liquid propane may contact the eyes.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation from use as a component of liquid petroleum gas for commercial and industrial usage	General dilution ventilation
Use as feedstock in cracking process in production of ethylene and propylene and motor gasoline with high antiknock properties and stability	Process enclosure; general dilution ventilation
Use as a basic material in chemical synthesis for oxidation, alkylation, nitration, and chlorination	Process enclosure; general dilution ventilation
Use as a solvent and extractant in de-asphalting and degreasing of crude oils in production of lubricating oils, refining of fish and vegetable oils, extraction of oils from agricultural products, and segregate of specialty oils	Process enclosure; general dilution ventilation

Use as a refrigerant in chemical, petroleum refining, and gas processing operations, low-temperature crystallizers, and helium recovery from natural gas

Process enclosure; general dilution ventilation

Use as a fuel in welding and cutting operations; use in high-grade metallurgical work in which sulfur-free fuel is essential

General dilution ventilation

Use in oil wells to increase production of crude oil

Process enclosure

Use in desalination of water; use in hydrocarbon-fueled cells as source of power (experimental)

General dilution ventilation

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 liquefied propane gets into the eyes, flush eyes immediately with large amounts of water. Do not use hot water for eye flushing. Get medical attention immediately.

• Skin Exposure

If liquefied propane gets on the skin, immediately flush the contaminated skin with water. If liquefied propane soaks through the clothing, remove the clothing immediately and flush the skin with water. Do not use hot water for skin flushing. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of propane, 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.

• 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.

LEAK AND DISPOSAL PROCEDURES

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

• If propane is leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of leak.
3. Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair the leak or allow the cylinder to empty.

• Waste disposal method:

Propane may be disposed of by burning at a safe location or in a suitable combustion chamber.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "Propane," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

• Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.

• Underwriters' Laboratories: *Propane*.

RESPIRATORY PROTECTION FOR PROPANE

Condition	Minimum Respiratory Protection* Required Above 1000 ppm
Vapor Concentration	
10,000 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
20,000 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 20,000 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 escape self-contained breathing apparatus.

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