

# Occupational Health Guideline for LPG

## 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:  $C_2H_6$ —  $C_3H_8$ —  $C_4H_{10}$ —  $C_4H_{10}$  mixture
- Synonyms: Liquefied petroleum gas; bottled gas
- Appearance and odor: Colorless, odorless gas (a foul-smelling odorant is usually added).

## PERMISSIBLE EXPOSURE LIMIT (PEL)

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

## HEALTH HAZARD INFORMATION

### • Routes of exposure

LPG can affect the body if it is inhaled or if it comes in contact with the eyes or skin.

### • Effects of overexposure

Overexposure to LPG can cause lightheadedness and drowsiness. Greater exposure may also cause unconsciousness and death. Contact with the liquid may also cause frostbite and irritation.

### • 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 LPG.

### • Recommended medical surveillance

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

### • Summary of toxicology

LPG in gaseous form acts as a simple asphyxiant and a central nervous system depressant. In liquid form it may cause frostbite, as well as skin irritation. Toxicologic data are meager, and no chronic systemic effects have been reported from industrial exposure.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 42— 58 depending on relative amounts of ingredients
2. Boiling point (760 mm Hg):  $-40$  to  $-0.5$  C ( $-40$  to  $31$  F)
3. Specific gravity (water = 1): 0.5 to 0.58
4. Vapor density (air = 1 at boiling point of LPG): 1.6 to 2.0
5. Melting point: Data not available
6. Vapor pressure at 20 C (68 F): Propane: 8.6 atm.; Butane: 2.1 atm.
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Much greater than 1

### • 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 LPG.
4. Special precautions: LPG will attack some forms of plastics, rubber, and coatings.

### • Flammability

1. Flash point: Not applicable (gas)
2. Autoignition temperature: 405 to 450 C (761 to 842 F)
3. Flammable limits in air, % by volume: Lower: 1.9; Upper: 9.5 (estimated)
4. Extinguishant: Stop flow of gas

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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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- **Warning properties**

1. **Odor Threshold:** Propane is the main constituent of LPG, according to the *Documentation of TLVs*. The odor threshold of propane (20,000 ppm) is 20 times the permissible exposure limit (1000 ppm).

2. **Eye Irritation Level:** Since propane is the main constituent of LPG, and since the eye irritation threshold of propane is above its lower flammable limit, eye irritation does not restrict respirator selection either for propane or for LPG

3. **Evaluation of Warning Properties:** The odor threshold of propane is 20 times higher than its permissible exposure limit. On the basis of the judgment that propane does not have adequate warning properties, for the purposes of this guideline, LPG is also assumed not to have 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 utilizing a combustible gas meter. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure LPG may be used. An analytical method for LPG 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 LPG or from contact with vessels containing liquid LPG.

- Any clothing which becomes wet with liquid LPG should be removed immediately and not reworn until the LPG has evaporated.

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

## COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use in chemical industry as feedstock in catalytic cracking in manufacture of petrochemicals and polymers	Process enclosure; general dilution ventilation
Use as an internal combustion engine fuel	General dilution ventilation
Use in manufacture of synthetic rubber	Process enclosure; general dilution ventilation
Use as a fuel for industrial space and wall heating, air conditioning, and water heating	General dilution ventilation
Use as a fuel for drying agricultural products; use as a low sulfur fuel for cutting, soldering, and brazing	General dilution ventilation
Use as a fuel to augment public supply; to increase BTU content of manufactured gas	General dilution ventilation

Use as an aerosol propellant for shaving lather, window cleaners, starch sprays, room deoderants, insecticides, and pharmaceuticals

General dilution ventilation

Use as an agricultural tool in flame cultivation, non-selective cultivation, and weed control

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 liquid LPG gets into the eyes, flush the eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Do not use hot water for eye flushing. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

### • Skin Exposure

If liquid LPG gets on the skin, immediately flush the contaminated skin with water. If liquid LPG 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 LPG, 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 LPG 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:

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

## REFERENCES

• American Conference of Governmental Industrial Hygienists: "LPG," *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: *LPG*.

## RESPIRATORY PROTECTION FOR LPG

Condition	Minimum Respiratory Protection* Required Above 1000 ppm
Vapor Concentration 10,000 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
19,000 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 19,000 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.