



**LPG** *Association  
of New Zealand*

## **Best Practice Guide – Safe Handling of LPG**

A course to meet the handling and training requirements of the Health and Safety at Work (Hazardous Substances) Regulations 2017

# Contents

<b>Welcome</b> .....	<b>3</b>
<b>Part 1: LEGISLATION, PCBU and WORKER OBLIGATIONS</b> .....	<b>5</b>
OTHER IMPORTANT DEFINITIONS .....	5
LEGAL REQUIREMENTS .....	6
PCBU OBLIGATIONS .....	7
WORKER OBLIGATIONS .....	8
PART 1 QUESTIONS .....	9
ANSWERS .....	10
<b>Part 2: PROPERTIES AND HEALTH HAZARDS OF LPG</b> .....	<b>11</b>
PROPERTIES OF LPG .....	11
HAZARDS OF LPG .....	15
PART 2 QUESTIONS .....	17
ANSWERS .....	18
<b>Part 3: ACTIONS IN CASE OF EMERGENCY</b> .....	<b>19</b>
LPG EMERGENCIES .....	19
FIRST AID TREATMENT .....	20
PART 3 QUESTIONS .....	22
ANSWERS .....	23
<b>Part 4: SAFE HANDLING OF LPG AND LPG EQUIPMENT</b> .....	<b>24</b>
INTRODUCTION .....	24
LPG SYSTEMS AND EQUIPMENT .....	24
LPG USES AND OUTSIDE STORAGE .....	25
EXCHANGING CYLINDERS .....	26
LPG USES AND INSIDE STORAGE .....	28
SAFE DISPOSAL OR RECYCLING OF CYLINDERS .....	28
FILLING LPG CYLINDERS .....	29
SAMPLE TRAINING RECORD .....	30

## Welcome

This Safe Handling of LPG course has been developed by the LPG Association of New Zealand (LPGA). It sets out the training and handling requirements for workplaces with a hazardous substance location. LPG handler training should provide information, training, and instruction for workers to safely conduct and perform handling operations at the location the LPG is stored, manufactured or used.

The course describes what the PCBU and their workers are responsible for, as well as competency requirements, the properties and hazards of LPG, what to do in an emergency and how to keep yourself and others safe when handling and storing LPG.

### What is handling?



Handling of LPG includes cylinder(s) that have to be connected to or disconnected from a system.



The system can be a flexible connection, pigtail, or regulator, that in turn is connected to a manifold or an appliance.



The system also includes the connection and disconnection of a cylinder to run a forklift.

**Handling of LPG does not include:**

1. Taking a “swap” cylinder from a storage cage and providing to customer.
2. Turning the gas supply to a process or appliance either on or off.
3. The refuelling of a forklift with the cylinder still connected.
4. Fuelling of any vehicle at a gas station.
5. The transport of cylinders.
6. The loading or unloading of cylinders from a cylinder delivery vehicle.

## Part 1: LEGISLATION, PCBU and WORKER OBLIGATIONS

This part describes important definitions, legal requirements and a summary of your obligations and your workers obligations.

### OTHER IMPORTANT DEFINITIONS

<b>Business</b>	<b>An activity carried out with the intention of making a profit or gain.</b>
<b>HSWA</b>	Health and Safety at Work Act 2015
<b>PCBU</b>	A person conducting a business or undertaking
<b>Undertaking</b>	An activity that is non-commercial in nature (e.g. certain activities of a local authority or a not for profit group).
<b>Worker</b>	Means an individual who carries out work in any capacity for a PCBU, including work as– <ul style="list-style-type: none"><li>• an employee; or</li><li>• a contractor or subcontractor; or</li><li>• an employee of a contractor or subcontractor; or</li><li>• an employee of a labour hire company who has been assigned to work in the business or undertaking; or</li><li>• an outworker (including a homemaker); or</li><li>• an apprentice or a trainee; or</li><li>• a person gaining work experience or undertaking a work trial; or a person gaining work experience or undertaking a work trial; or</li><li>• a volunteer worker.</li></ul>
<b>Workplace</b>	A place where work is being carried out, or is customarily carried out, for a business or undertaking; and includes any place where a worker goes, or is likely to be, while at work.
<b>Hazardous Substance</b>	Refers to any product or chemical that has properties that are explosive, flammable, oxidising, toxic, corrosive, or toxic to the environment.

## LEGAL REQUIREMENTS

There are legal responsibilities for handling LPG. Some of these are set out below. You can find more information about your legal responsibilities at [www.legislation.govt.nz](http://www.legislation.govt.nz) or [www.worksafe.govt.nz](http://www.worksafe.govt.nz)

### 1. Health and Safety at Work Act 2015

Section 42 Duty of PCBU who supplies plant, substances, or structures.

For example, your gas supplier may own a bulk LPG tank and filling dispenser. As owners of that equipment, they act as a shared PCBU with the business that equipment is installed at.

### 2. Health and Safety at Work (General Risk and Workplace Management) Regulations 2016

Regulation 9 Duty to provide information, supervision, training, and instruction.

For example, this training document addresses the intent of this regulation.

### 3. Health and Safety at Work (Hazardous Substance) Regulations 2017

Regulation 4.5 Duty of PCBU to provide information, training, and instruction as above.

Regulation 4.6 Duty of PCBU to provide supervision.

Regulation 10.26 Duty of PCBU to establish hazardous substance location.

Regulation 10.34 Requirement to have compliance certificate if class 2.1.1, 2.1.2, or 3.1 substance present at hazardous substance location.

In New Zealand the hazardous substance classification for LPG is:  
**Class 2.1.1A Extremely Flammable Gas**

Young people under 15 years old must not be present where you use, manufacture, or produce hazardous substances. However, young people can be present:

1. In areas where the public usually has access.
2. When the young person is under direct and active adult supervision suitable for the person's age and the risks.
3. In any areas used only for selling goods or services.

This means that young people can do school science experiments under adult supervision. They can also be present in the retail area of a factory as long as they stay only in the area where goods or services are sold.

## PCBU OBLIGATIONS

As a person conducting a business or undertaking (PCBU), you must ensure that:

1. Your workers know about the hazardous substances in their work area and the dangers they pose.
2. Your workers are given the information, training, and supervision they need to operate safely with and around hazardous substances. For example, you can provide them with the LPG safety data sheet.
3. You provide training and instruction to your workers about:
  - a. The properties and hazards of LPG.
  - b. How they safely use handle, store and dispose of LPG.
  - c. How they safely use machinery, tools, and equipment including Personal Protective Equipment (PPE) when handling LPG.
  - d. Any other duties or obligations that they may have.
  - e. What they need to do in an emergency.

Training may be achieved through inductions, emergency response procedures and safety data sheet information to cover the use and storage specific needs.

Where you are only storing and using the LPG and the gas supplier is handling the cylinder connections, training of your workers is not required.

Any of your staff that work near the storage of LPG cylinders or tanks (but do not handle any LPG cylinders) must be provided with the LPG safety data sheet.

4. Your workers complete a suitable period of practical experience in your workplace under direct supervision in the above items.
5. Records of the training are kept. The records must include:
  - a. Date of training.
  - b. Material covered.
  - c. Name of trainer or institution.
  - d. Results of training assessments.
  - e. Any other relevant information.

A sample training record is included at the rear of this book.

## Records to be provided to a Compliance Certifier during their site inspection

The information and records set out in the table below must be shown to a compliance certifier during their site assessment for a location compliance certificate.

<b>HSWA Regulation</b>	<b>Action by the certifier</b>	<b>Records you need to provide</b>
<b>4.5</b>	Verify there is a process for each worker to receive relevant information and training.	The training process used.
<b>4.5 (2)</b>	Verify the requirements for information provided to workers are met.	(a) The location of the safety data sheets available; and (b) A list of examples of any other relevant reference materials.
<b>4.5(3)(a)</b>	Verify the requirements for instruction and training provided to workers are met.	(a) Show that the information is included in the instructions and training; and (b) The type of instruction and training received (classroom, on-the-job) and the duration of the training, and (c) Copies of any training certificates.
<b>4.5(3)(b)</b>	Verify that there has been an appropriate period of practical experience under direct supervision.	Records of the type of task, duration, and nature of supervision.
<b>4.5(5)</b>	Verify that there is a record of training and instruction for each worker and that this record is available for inspection.	A record of the worker's instruction and training.
<b>4.5(6)</b>	Verify that where information, instruction and training was not required for a worker, you can demonstrate that the worker's previous experience is equivalent.	A sample of one of the records.

## WORKER OBLIGATIONS

1. Look after their own health and safety.
2. Make sure that what they do or do not do, does not affect the health and safety of other people.
3. Follow workplace health and safety policies and procedures.
4. Follow and carry out any reasonable instruction given by you (the PCBU), so you can comply with legal requirements.



## PART 1 QUESTIONS

1. Handling does NOT include:
  - a. Turning the gas supply to a process or appliance either on or off.
  - b. The refuelling of a forklift with the cylinder still connected to the vehicle.
  - c. The loading and unloading of a cylinder delivery vehicle.
  - d. All the above.
  
2. A worker is an individual who carries out work for a PCBU?
  - a. True
  - b. False
  
3. Pieces of legislation can be obtained from [www.legislation.govt.nz](http://www.legislation.govt.nz)?
  - a. True
  - b. False
  
4. It is the responsibility of the PCBU to ensure that any worker who handles LPG has been trained?
  - a. True
  - b. False
  
5. Workers who handle LPG must receive training and instruction which includes:
  - a. The properties and health hazards of LPG.
  - b. The procedures for safely using, handling, storing, and disposing of LPG.
  - c. How to safely use equipment such as PPE to manage LPG.
  - d. What to do in an emergency.
  - e. All the above.

## ANSWERS

1. d.
2. a.
3. a.
4. a.
5. e.

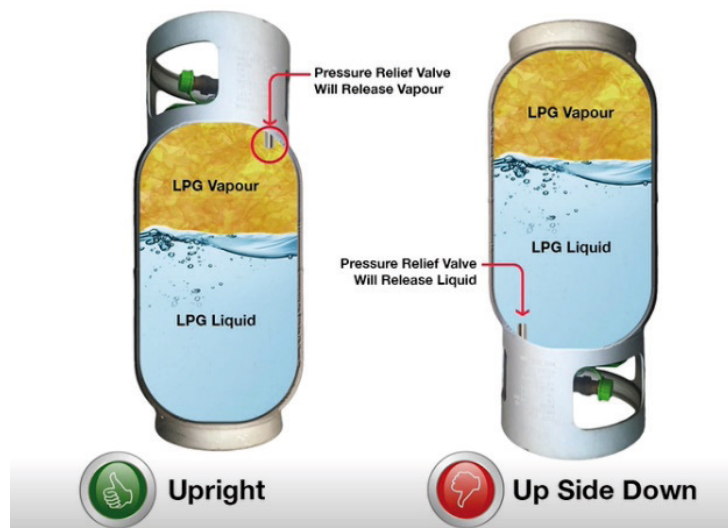
## Part 2: PROPERTIES AND HEALTH HAZARDS OF LPG

In order to handle LPG safely, it is important to understand the properties and hazards of LPG.

### What is LPG?

LPG stands for Liquefied Petroleum Gas. It is a mixture of the hydrocarbons propane (60%) and butane (40%). When liquid LPG is released to the air, it becomes a colourless and tasteless gas that smells strongly of rotten cabbage.

LPG is stored, handled, and transported as a liquid under pressure inside a cylinder or tank. LPG inside a cylinder is in two states of matter, liquid, and gas. The liquid portion is at the bottom of the cylinder, the gas is at the top.



## PROPERTIES OF LPG

### Toxicity

LPG is non-toxic but if you breathe it in you may feel lightheaded, sleepy, or become unconscious because of a lack of oxygen. Breathing in large volumes of gas can potentially cause death by asphyxiation.

### Odour

LPG is odourless. An odourant called ethyl mercaptan is added to LPG to make it easy to detect in the air.

### Flammability

LPG is extremely flammable. Leaks are hazardous as LPG can burn or explode when it meets any source of ignition like a naked flame, electrical spark, or a cigarette.

LPG, when mixed with air, has a flammable range. The flammable range is approximately 2% to 10% volume of LPG mixed with air. This means that if there is too little fuel (less than 2%), the LPG is too lean and will not burn. If there is too much fuel (more than 10%), the LPG is too rich and will not burn. This is particularly important when thinking about LPG leaks. You never know where or when the leaked LPG may fall within its flammability range. Any spark at that point could cause a fire or explosion.

### Ignition Temperature

The ignition temperature is the temperature that a flammable mixture of fuel and air must be heated to for it to ignite without an external source of ignition. The ignition temperature for LPG is about 410° to 500° centigrade. As a comparison the burning temperature of a match head is 1500°C while for a cigarette it is approximately 700°C.

### Boiling Point

The boiling point temperature of propane is -42°C and 0°C for butane. This is the temperature at which liquid LPG will change from a liquid to a gas when it is released to the air. If the liquid touches your skin or any equipment it will be snap frozen at that temperature causing cold burns and frosting and freezing of the equipment.

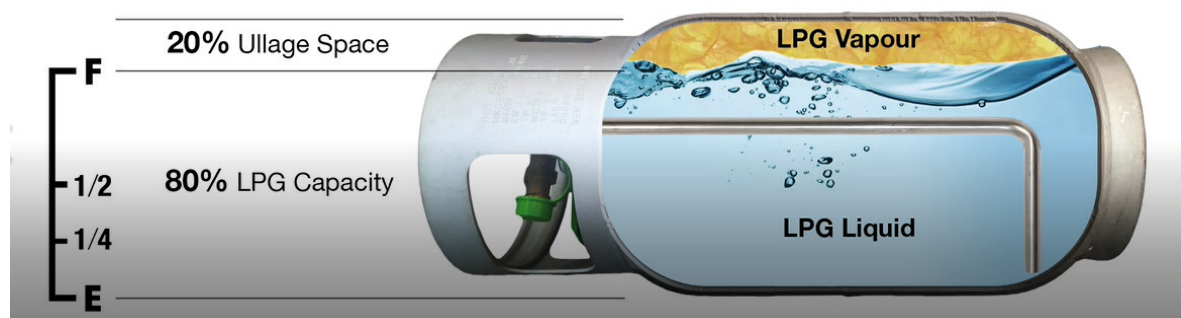
### Pressure

LPG absorbs heat from the air through the walls of the cylinder or tank. As the temperature of the cylinder or tank rises, the liquid LPG inside the cylinder or tank expands. This causes the pressure of the gas within the cylinder or tank to rise. The rate of expansion for liquid LPG is many times greater than for water.

Therefore, LPG cylinders must only be filled to 80% of their capacity, with a 20% space left at the top of the cylinder to allow for the liquid to expand. This space is called Ullage.

If there is no space (Ullage) for expansion, liquid LPG can be forced through the safety relief valve if the outside temperature increases. If the cylinder is being transported in a vehicle or is in use by the customer, this can result in fire and explosion.

### LPG Capacity & Ullage Space



Example of Forklift Cylinder

### **LPG leak expansion**

When released to air, LPG liquid vaporises and expands 250 times. This means that every 1 litre of liquid released will become 250 litres of gas. This must be remembered, as a liquid LPG leak will produce a very large amount of gas and therefore potentially, a major hazard.

### **LPG specific gravity**

LPG gas is heavier than air and will settle in low places if allowed. Propane is 1.5 times heavier than air and butane is twice as heavy. Being heavier than air, the gas will cling to the ground and will enter trenches, drains and other low areas.

### **LPG leak dispersion**

Liquid LPG will change to gas and disperse much faster on a hot sunny day than on a cold, rainy, overcast, or snowy day. In still atmospheres it will not disperse easily and can travel for long distances from the point of release. LPG gas, however, is readily dispersed by wind or a water spray.

### **Release of LPG Gas to the Air**

An LPG gas release from a cylinder to the air is not easily seen and can spread out as an invisible gas cloud. Under certain conditions when close to the gas cloud, you may see a shimmer (like heat waves rising from a hot pavement). You may also hear the hissing sound of gas escaping, be able to smell the gas, or see bubbles forming around the ullage valve.

You may also see a white cloud form at the point of discharge. This is caused by liquid LPG vaporising and thereby expanding and cooling so rapidly that it condenses the moisture in the air. The outer edge of this white cloud is flammable and will flash back to the point of discharge if brought in contact with a source of ignition.

## How do the Properties Affect the Safe Handling of LPG?

Property	Safe Handling Practice
<b>LPG is non-toxic but is an asphyxiant.</b>	Breathing in large volumes of LPG can potentially cause death by asphyxiation. Keep up wind of any gas leaks.
<b>LPG is extremely flammable. It can ignite when mixed in air to a ratio of between 2-10%.</b>	Any release of LPG can create a flammable mixture. Keep all sources of ignition away from LPG filling or storage areas.
<b>If liquid is released to the atmosphere it absorbs heat and become a gas. It will quickly reduce surface temperatures to below freezing.</b>	Wear protective gloves and safety glasses to prevent cold burns to any exposed skin and to protect the eyes.
<b>Liquid LPG has a low viscosity and is contained under pressure.</b>	Check joints and connections with soapy water solution. Do not check for leaks with open flames.
<b>As the temperature inside the container increases, the pressure in the container also increases.</b>	Containers must be stored in cool, well ventilated areas away from sources of external ignition and heat.
<b>As the temperature of the surrounding air increases, the liquid in the container expands.</b>	All LPG containers must have an ullage space to allow for this liquid expansion. Containers must only be filled to 80% of their capacity. Do not over fill them.
<b>As LPG boils at very low temperatures, frosting can occur on the filling equipment and cylinder valves. Under extreme conditions, this can prevent closing of valves.</b>	Bleeding off (releasing) liquid e.g. from the ullage valve must be kept to a minimum to prevent frosting and icing of equipment.
<b>If liquid LPG is released to the atmosphere it expands approximately 250 times as it turns to gas.</b>	A small liquid leak can produce a large amount of flammable gas.
<b>LPG gas is heavier than air and will settle in low places.</b>	LPG can generate a flammable atmosphere or asphyxiant hazard in low lying areas such as drains and trenches. Use a water spray to disperse gas.

## HAZARDS OF LPG

You are now going to look at the potential hazards associated with the use of LPG. We will look at:

- What can go wrong (*Hazard*)
- Why things go wrong
- How problems can be prevented (*Control Measures*).

You now know that LPG is stored under pressure as a liquid. Any fault or damage to the cylinder or storage vessel can lead to an escape or leakage of gas.

**Ignition of any gas leak causing fire and explosion is the greatest hazard.**

A summary of the hazards and potential risks of working with LPG are covered in the table below.

Personal Protective Equipment (PPE) must always be worn when handling LPG. PPE includes protective gloves, safety glasses, covered footwear and long-sleeved clothing.

### Summary of the Hazards and Potential Risks of storing LPG

Hazard	Why things go wrong	Control Measures
<b>Fire and Explosion</b> <b>This is the greatest hazard when working with LPG</b>	LPG is extremely flammable. If a LPG container or vessel under pressure is exposed to high temperatures it may rupture and cause an explosion. This explosion is called a BLEVE (Boiling Liquid Expanding Vapour Explosion). These types of explosions are very rare but can be extremely hazardous.	Store containers in cool, well ventilated area away from potential sources of ignition.
<b>Lack of Ventilation in storage area</b>	Breathing in or sniffing LPG vapour may lead to unconsciousness and in some cases, death.	Ensure LPG storage and filling areas are well ventilated. Avoid breathing in or sniffing vapour.
<b>Gas Leaks (Minor)</b>	LPG gas is heavier than air and will gather on the ground e.g. drains and in confined spaces.  The amount of ventilation and the weather conditions will determine how quickly LPG gas will disperse.	Ensure LPG storage and filling areas are well ventilated.

Hazard	Why things go wrong	Control Measures
<b>Uncontrolled Gas Leaks or Release (Major Leaks)</b>	<p>An uncontrolled gas release or leak is very hazardous as Liquid LPG expands 250 times when it is released. Large gas clouds will form and gather in low lying areas.</p> <p>Contact with an ignition source may cause fire and, potentially explosion.</p>	<p>Store LPG away from ignition sources in a well-ventilated area.</p> <p>Leak test connection points.</p>
<b>Invisible Gas Clouds</b>	<p>Release of LPG gas may displace oxygen in the air, creating a risk of asphyxiation (suffocation).</p> <p>The visible cloud might be smaller or bigger than the actual gas cloud, depending on humidity in the air.</p>	<p>Use a gas detector to approach a gas cloud. Do not enter the cloud as any ignition sources near or in the cloud may cause fire or explosion.</p> <p>Do not enter a vessel or tank which has been used for LPG storage without supervision and only when all appropriate safety measures are in place and the area has been determined as gas free.</p>
<b>Over Filled Cylinders or Tanks</b>	<p>If the temperature of LPG inside the cylinder or tank increases, the liquid expands causing the gas pressure of the cylinder to rise.</p> <p>If there is no room for the gas to expand the cylinder or tank may rupture or leak.</p>	<p>Fill cylinders and tanks to 80% of their capacity.</p> <p>The remaining 20% space (Ullage Space) is left unfilled to allow for the LPG to expand.</p>
<b>Cold Burns</b>	<p>Liquid LPG will cause cold burns if it touches your skin or gets in your eyes.</p>	<p>Wear cryogenic gloves, safety glasses and protective clothing that covers your body.</p>
<b>LPG gas is odourless and colourless</b>	<p>If a gas leak occurs, you are unable to see or smell the LPG gas cloud.</p> <p>An odourant is added to LPG liquid to give it a strong smell of rotten cabbage.</p> <p>In some industries, aerosol propellant or chemical industries, the odourant may not be added.</p>	<p>An odourant is added to Liquid LPG to give it an unpleasant smell.</p> <p>Gas detectors may be used.</p>



## PART 2 QUESTIONS

1. What is added to LPG to help you to detect gas in the air?
  - a. Water
  - b. Coloured dye
  - c. Additional LPG vapour
  - d. An odourant
  
2. What will happen to liquid LPG in a cylinder or tank if the temperature increases?
  - a. Expands
  - b. Contracts
  - c. Vaporises
  - d. Disperses
  
3. To allow liquid to expand, LPG cylinders are filled to what capacity?
  - a. 25%
  - b. 40%
  - c. 65%
  - d. 80%
  
4. LPG liquid released into air will expand how many times its original volume?
  - a. 2
  - b. 10
  - c. 250
  - d. 350
  
5. The proper mixture of LPG gas, air and what else is needed for LPG to burn?
  - a. Nitrogen
  - b. Humidity
  - c. Odourant
  - d. An ignition source
  
6. Gloves and other PPE are required when handling LPG connections because of what?
  - a. Possible cold burns
  - b. The rate that liquid vapourises to gas when released
  - c. Expansion properties
  - d. Toxicity
  
7. What is the greatest hazard of working with LPG?
  - a. Minor gas leak
  - b. Fire and Explosion
  - c. Cold burns to the skin or eyes
  - d. Over filled cylinders

## ANSWERS

1. d.
2. a.
3. d.
4. c.
5. d.
6. a.
7. b.

## Part 3: ACTIONS IN CASE OF EMERGENCY

### Basic Principles

The primary objective in emergency response is to prevent harm to you, your workers and the public. You can minimise the risk of minor incidents becoming major incidents by being prepared and knowing how to handle emergency situations.

WorkSafe NZ have produced a generic emergency response plan for hazardous substances. The plan can be found on their website [www.worksafe.govt.nz](http://www.worksafe.govt.nz)

### Basic Guidelines on Handling LPG Emergencies are as follows:

1. Assess the situation and organise appropriate response.
2. Remove ignition sources.
3. all **111** for fire and emergency services.
4. Treat any injuries.
5. Make sure everyone is safe. Carry out a roll call.

### LPG EMERGENCIES

#### Handling a Leak Inside a Building

1. Activate the nearest fire call point and evacuate all people (staff, general public, etc.) to your site's safe location, upwind of the leak.
2. Ask someone to call **111** for fire and emergency services once they are outside and upwind from the leak. Do not use a mobile phone near a leak. Keep people and vehicles away.
3. Remove ignition sources. Do not start or move any vehicles as these are an ignition source.
4. lose any valves upstream of the leak (**if safe to do so**). Do not switch any electrical switch on or off as this may cause a spark.
5. Wait for further instructions from emergency services. They will let you know when it is safe to re-enter.
6. Once the leak has been contained and the cylinder is cool, mark it as faulty and call your gas supplier.

#### Handling a Leak Outside a Building

1. Activate the nearest fire call point and evacuate all people (staff, general public, etc.) to your site's safe location, upwind of the leak.

2. Ask someone to call **111** for fire and emergency services once they are outside and upwind from the leak. Do not use a mobile phone near a leak. Keep people and vehicles away.
3. Remove ignition sources. Do not start or move any vehicles as these are an ignition source.
4. Close any valves upstream of the leak (**if safe to do so**). Do not switch any electrical switch either on or off as this may cause a spark.
5. **Only if it is safe to do so:** Close the cylinder valve and move it to a well-ventilated area with valve facing downwind. Pour water over the cylinder or wrap it with a wet cloth to cool the cylinder down. This will decrease the amount of gas escaping. Spray the vapour with water to disperse it, **otherwise:**
6. Stay upwind of the leak.
7. Wait for further instructions from emergency services. They will let you know when it is safe to re-enter the area.
8. Once the leak has been contained and the cylinder is cool, mark it as faulty and call your gas supplier.

## Handling a Fire

**Use of dry chemical fire extinguishers and any firefighting measures may only be carried out if you have had appropriate training.**

1. The most effective way to handle a LPG fire is to shut off the LPG supply. Close the cylinder valve and any valves upstream of the fire (**only if it is safe to do so**). If it is not safe to do this:
2. Activate the nearest fire call point and evacuate all people (staff, general public, etc.) to your site's safe location, upwind of the fire.
3. Ask someone to call **111** for fire and emergency services once they are outside and upwind from the fire. Do not use a mobile phone near a fire. Keep people and vehicles away.
4. Remove ignition sources. Do not switch any electrical switch either on or off as this may cause a spark.
5. Keep all nearby equipment, especially storage tanks, cool with water from fixed sprays or monitors, **only if safe to do so**.

## FIRST AID TREATMENT

If liquid LPG or gas vapour contacts your skin or eyes or you breathe it in, or you swallow it you must seek medical help immediately.

## Cold burns

Cold burns may occur if liquid LPG touches your skin or eyes. The liquid LPG causes snap freezing of the affected area, causing an injury that is like a heat burn. If you touch equipment that is at below zero temperatures, your skin may stick to it and tear when you try to remove it.

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### Treatment

#### Cold burns to the skin or limbs

Wash skin with water. Do not remove any clothing splashed by LPG until the LPG has been washed off.

Loosen any clothing that is not frozen but may restrict blood circulation or breathing. Move the injured person to a warm area as soon as possible.

Warm the injured area up to body temperature as *fast as you can*. Do not allow to thaw slowly.

Bathe the injured area with warm water (not hot) preferably 33-35°C and immerse if possible. Use tap water only if warm water is not available.

***Do not apply heat or cold directly to the cold burn e.g. heat lamps, hot water, or ice***

Gently cover or drape the injured area with dry, sterile dressings. Do not cover or wrap it too tightly or it will restrict blood flow to the area.

#### Liquid LPG splashes to the eyes

Flush eyes with water continuously for 15 minutes. Use warm water if available.

Give warm liquids. Do not give alcohol.

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## Asphyxiation (Suffocation)

Although LPG is non-toxic, swallowing or breathing in LPG vapour can lead to breathing difficulties, light headedness, seizures, unconsciousness and possibly death.

The signs and symptoms of asphyxiation can vary from one person to another, depending on their level of exposure. It may be mild in some and severe in others. Signs and symptoms may include:

- vomiting and diarrhoea
- burning feeling in your throat or mouth
- fever
- headache
- skin irritation
- irregular or rapid heartbeat
- pain in your arms or legs or
- uncoordinated body movement.

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## If you or one of your workers: Treatment

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<b>Breathes in LPG Vapour</b>	Immediately move away from the vapour cloud and into the fresh air. Keep at rest.  Call 111 for medical help or ask someone to do this for you if you need assistance.
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<b>Has Difficulty Breathing</b>	Immediately move away from the vapour cloud and into the fresh air. Keep at rest.  Call 111 for medical help or ask someone to do this for you if you need assistance.  Start CPR if needed.
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<b>Has Swallowed LPG</b>	Immediately move away into fresh air. Keep at rest.  Call 111 for medical help or ask someone to do this for you if you need assistance.
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## PART 3 QUESTIONS

1. What is the first thing you do if you discover a gas leak? *(Circle all that apply)*
  - a. Ignore it
  - b. Activate the nearest fire call point and evacuate people
  - c. Turn off all electrical equipment
  - d. All the above
  - e. Isolate the source of the leak
2. You should always stay **upwind** / **downwind** from a leak? *(Circle the correct answer)*
3. When should you close valves on leaking or burning cylinders?
  - a. Always
  - b. Only when it is not safe to do so
  - c. Only when it is safe to do so
  - d. Never
4. Which of the following should you not do when treating a cold burn?
  - a. Wash skin with warm water
  - b. Immediately remove clothing splashed by LPG
  - c. Warm the injured area up to body temperature as quickly as possible
  - d. Seek medical attention
5. If you breathe in LPG vapour, you should move immediately into the fresh air?  
  
True / False *(Circle the correct answer)*

## ANSWERS

1. b. and e.
2. upwind
3. c.
4. b.
5. True

## Part 4: SAFE HANDLING OF LPG AND LPG EQUIPMENT

### INTRODUCTION

LPG is transported by ship, road or rail tankers to storage locations e.g. terminals or depots. LPG is delivered in road tankers to industrial customers or, it is delivered in cylinders to smaller businesses and homes.

#### LPG as a source of fuel is used for:

- Heating e.g. hot water, gas heaters
- Cooking or BBQ
- Refrigeration
- Aerosol Propellant.

### LPG SYSTEMS AND EQUIPMENT

LPG can be stored in a range of different sized containers, from a small cartridge, containing a few hundred grams, up to a bulk tank or vessel storing more than 100 tonnes.

**For domestic use, cylinder capacity (size) range from 4kg to 90kg.**

**For commercial and industrial use, cylinder capacity will range from 15kg to 222kg.**

Most cylinders are made of steel and can last for up to 50 years. Cylinders must be checked every 10 years by a certified cylinder testing station to make sure they are safe to use and fit for purpose.

LPG cylinders are usually stored in an upright position. The most common exception to that are forklift cylinders which are positioned horizontally when mounted on a forklift.

**A basic LPG system generally consists of the LPG container (cylinder or tank), piping or tubing, a regulator, and an appliance.**





**The container** stores LPG under pressure in liquid form and generates vapour when pressure is released. LPG containers can either be cylinder(s) or bulk tank(s) depending on the customer.

**The piping or tubing** moves the vapour from the container to the appliance where it is ignited to create the flame for heating.

1. Pipes must never be stepped on or used to hang equipment or other objects that may create undue force on it.
2. Use soapy water to check for leaks on the piping system. Apply on all joints and hoses and check for bubbles which indicate a source of leak. Never use naked flames.

**A regulator** is used to control the vapour pressure and to maintain a consistent and even gas supply to appliances.

**A vapouriser** may be used produce vapour when a container cannot create enough vapour for an appliance to work. It turns liquid LPG from the container into a vapour using electricity, circulating hot water supplied from a boiler or water heater, or using a LPG flame.

**Installations and servicing of vapourises must be carried out by suitably qualified or authorised, experienced persons.**

**Main Service Valves, or Appliance Gas Service Valves** should always be closed when the appliance is not being used. When LPG will not be used for an extended period, the main gas valve and LPG container valves should be shutoff.

## LPG USES AND OUTSIDE STORAGE

**Read the sections that are relevant to your business.**

### Storing and Handling Cylinders

Cylinders should always be stored in the upright position. Never shake the cylinder or turn it upside down to draw out residual LPG.

Whenever possible, cylinders should be moved by rolling them on their base rings or by using manual handling equipment such as a cylinder trolley. Do not drop cylinders or allow them to hit forcefully into or against objects.

### Cylinder Installations and Storage

The requirements for the storage and installation of cylinders are set out in the Health and Safety at Work (Hazardous Substances) Regulations 2017. The basic requirements are:

- a. Should be outdoors and in a well-ventilated area
- b. Cylinders must be on a level, firm base, non-combustible, clean, dry and not resting on soil
- c. Away from entrance and exit of buildings

- d. At least 1.0 m away from any openings i.e. drains, gully traps, culverts, etc.
- e. At least 1.5 m from any ignition source i.e. air conditioners, heat pumps
- f. Must be accessible for the delivery driver to change the cylinders
- g. Must not be stored together with oxygen and other flammable material i.e. petrol, etc.
- h. Should be protected from vehicular collision or damage
- i. Secured against earthquakes i.e. with chains.

The connecting hoses (pigtailed) should be inspected and leak checked at least annually and replaced if there are any signs of damage or leaks.

All appliances and installations must be designed and approved for LPG use. Modifications to and installation of LPG equipment must comply with industry gas regulations and only be carried out by a qualified person such as a gas fitter.

## **EXCHANGING CYLINDERS**

Wear Personal Protective Equipment (PPE) and remove all sources of ignition before you exchange a cylinder.

Extreme care needs to be taken when connecting LPG cylinders to ensure they do not leak. Cylinders should be handled and used in an upright position.

### **Exchanging Vapour or Liquid Cylinders**

1. Switch the regulator over to the full cylinder. Close the valve on the empty cylinder then disconnect from the pigtail.
2. Check the pigtail for wear and tear, replace O ring or pigtail if required.
3. Check the valve on the replacement cylinder is closed. Connect the replacement cylinder with the relief valve pointing away from the building.
4. Slowly open the valve until it is fully open then back off for half a turn.
5. Leak test all the connection points with a soapy solution (5mL detergent per 100mL water). If there is a leak, you will see bubbles form, frosting or you may be able to smell gas.

**Do not use a torch or flame to look for a leak as this may cause a spark and ignite the gas.**

**If you detect a leak:**

1. Close the cylinder valves. Disconnect the pigtail, clean the connections, reconnect and repeat the leak test.

**If the leak continues:**

1. Close the valve on the leaking cylinder and contact your gas supplier.

**Exchanging Forklift Cylinders**

Park the forklift away from ignition sources. Switch off the engine.

1. Check the valve is closed before you disconnect the empty cylinder. Any fuel left in the hose and fitting may spray on your hands or face.
2. Disconnect the forklift hose, undo the cylinder clamps, and remove the empty cylinder. Store the cylinder in an **upright** position – do not lay it on its side. Check the forklift hose and fitting for signs of damage.
3. Check the full cylinder. Look at the valve threads and O rings, frost build-up, dents, gouges, heavy rust. Do not use the cylinder if it is damaged. Replace O rings if needed.
4. Lift the cylinder onto the forklift. Place the cylinder onto the locating slot (if fitted) or turn the relief valve to point between the 12 o'clock and 1 o'clock position. This ensures the hose and fittings can be connected correctly and so that all the gas in the cylinder can be used.
5. Check all valves are closed. Attach the cylinder clamps then connect the forklift hose to the service valve. The connection should be tight to stop any LPG leaks occurring.
6. Slowly open the valve. Leak test all the connection points with a soapy solution (5mL detergent per 100mL water). If there is a leak, you will see bubbles form, frosting, or you may be able to smell gas.

**Do not use a torch or flame to look for a leak as this may cause a spark and ignite the gas.**

**If you detect a leak:**

1. Close the cylinder valves. Disconnects the hose and fittings, clean the connection, reconnect, and repeat the leak test.

**If the leak continues:**

1. Close the valve on the leaking cylinder and contact your gas supplier. Ventilate the area.

## LPG USES AND INSIDE STORAGE

### Using Cylinders Indoors

These situations include houses, flats and apartments, hotels and restaurants, and some commercial businesses. Refer to the following table for storage limits.

#### How much LPG can you store inside a building?

Location	Maximum Size of Cylinder	Maximum Quantity of LPG
<b>Residential:</b> A detached house or single storey attached dwellings, and Multi-storey attached dwellings, up to 3 storeys.	10kg	20 kg per dwelling
<b>Residential:</b> Multi-storey attached dwellings over 3 storeys.	10kg	10kg per dwelling
<b>Hotels, bars, restaurants, public buildings, places of worship, shops, offices, and laboratories not attached to a dwelling.</b>	10kg	10 kg per 10 square metres of the indoor floor area, up to a maximum total quantity of 100kg.
<b>Hotels, bars, restaurants, public buildings, places of worship, shops, offices, and laboratories that are attached to a dwelling.</b>	10kg	20kg per premise
<b>Factories and warehouses</b>	45kg	45 kg per 50 square metres of the indoor floor area, up to a maximum total quantity of 180 kg per occupancy.

The maximum quantity includes **both the LPG in use and any stored LPG (such as a replacement cylinder)**. Examples are shown below:

### SAFE DISPOSAL OR RECYCLING OF CYLINDERS

If a discarded cylinder releases LPG into the air, it may find an ignition source and pose a risk to people, animals, and the environment. Explosions and fires have occurred when cylinders of LPG have been disposed of incorrectly.

LPG cylinders are not safe to be recycled or disposed of unless they have had the gas removed from them (degassed), the valves removed (de-valved) and have been punctured to show that they are 'gas free'. They must not be disposed of in general rubbish collections.

Contact your local council body if you need to dispose of any cylinders.

## **FILLING LPG CYLINDERS**

This is a specialised topic with a training system operated by the LPG Association under license from WorkSafe NZ. You must not fill LPG Cylinders unless you hold an approved filler compliance certificate. This can be issued by an LPG Association Approved Site Trainer, see **[www.gasnz.org.nz](http://www.gasnz.org.nz)** for more information.



