

# TOM CHESS T GROUP OF COMPANIES LTD

## Guidelines for Good Safety Practices in the LP Gas Industry



# POLICY STATEMENT

***“Safety is of primary importance. It is essential that we conduct our operations in such a way as to protect the safety and health of our employees, our contractors and all those affected by our activities”***

## Our goals are:

- To achieve no injury, lost work days or work related illnesses
- To fully respect safety and health in all of our management choices, plans and operations
- To comply with all applicable standards of the international oil industry, in addition to the laws and regulations of the states in which we are present

## These goals require that:

- Managers at all levels are responsible and accountable for health and safety matters and for ensuring compliance with this polycystatement
- All employees and contractors remain vigilant and responsible for their own safety, as well as the safety of the people around them

## To reach these goals we must:

- Develop and follow efficient safety procedures and standards
- Identify, evaluate and manage hazards and risks involved in our operations
- Ensure that our employees and contractors are properly trained to work safely and to ensure that they know how to act in an emergency
- Emphasize safety and health concern both on and off work sites
- Report all safety related incidents; investigate and analyze them to prevent recurrence
- Perform a regular audit of our compliance with our safety policy

***“These goals are fundamental to the wellbeing of all employees as well as the efficient operation of our Company. Helping to fulfill these goals is the responsibility of everyone who works at Tom Chess T Group of Companies Ltd ”***

**Thompson Douglas**

Executive Group Chairman/CEO

# Executive Summary

These Guidelines for Good Safety Practice in the LP Gas Industry have been developed by the Tom Chess T Group of Companies Ltd to provide employees, suppliers etc. with a tool for ensuring the marketplace, and more importantly the customer, is not compromised by unsafe practices.

The guidelines identifies Tom Chess T Group of Companies Ltd key stakeholders within the LP Gas industry and go on to describe their responsibilities to ensure a safe environment for LP Gas throughout the distribution chain; from the LP Gas producers at the refineries and gas fields, right through the distribution chain to the final application for the product.

Included within the stakeholders are the LP Gas equipment and appliance providers, together with the installers, the LP Gas suppliers and marketers, Authorities and Associations and of course the consumer.

The importance of a sound regulatory framework for the LP Gas industry and the impact that has on a safe environment is discussed.

The product itself is then described, highlighting the key physical properties and characteristics and how these affect the safe handling of LP Gas.

There is a need for full understanding of the distribution chain and controls to be ever present and exercised at every point to ensure safe operations and this is explained.

Trans-shipment terminals and the various methods of product movement throughout inland facilities are described together with the importance of understanding and managing the risks of storing and handling large quantities of LP Gas.

The importance of good safe practices when storing, handling and distributing bulk LP Gas and filling and handling cylinders is included in this guide.

The role of the consumer and the responsibilities expected in maintaining a safe environment for LP Gas is a key part of this guide.

The subject of managing safety and planning for emergencies is included in the final sections.

In the Appendices there are numerous references and links to Organizations, Institutions and Associations that have a key role in the subject of LP Gas safety.



# Introduction

The phrase liquefied petroleum gases (LP Gas) refers to a group of hydrocarbon-based gases derived from crude oil refining or natural gas fractionation. Propane and butane, and mixtures of the two, are its key constituents.

LP Gas can be liquefied (under moderate pressure or low temperature), which facilitates its transportation and distribution.

Although as a fossil fuel, LP Gas releases carbon dioxide into the atmosphere during combustion. However it burns more completely than other, notably solid, fuels and is thus more efficient and cleaner.

These properties of LP Gas have made it a convenient replacement for traditional cooking fuels (mainly, wood, coal and animal dung) and motor vehicle fuels in certain contexts.

Like all forms of energy LP Gas is potentially hazardous if mishandled or misused. The promotion of safety is one of the key aims of The Tom Chess T Group of Companies Ltd

These Guidelines are intended for Tom Chess T Group of Companies Ltd non experts who may have responsibility for or are otherwise concerned with good safe practice in relation to LP Gas handling, distribution and use.

They have been developed by Tom Chess T Group of Companies Ltd to form the central part of a Safety Promotion Project.

While safety is an important issue, it should also be emphasized that LP Gas is an excellent, versatile and often preferred fuel for many applications. It is also recognized as an environmentally friendly fuel with many social advantages.

As with all forms of energy LP Gas is potentially hazardous if mishandled or misused. Care in the handling and use of LP Gas will help to minimize the number of incidents, accidents and their consequences. This is the key driver in the Safety Promotion Project and with these Guidelines.

Within the LP Gas industry there is a wealth of knowledge and experience which is used to enhance safety and which is reflected in these Guidelines. It is the policy of TOM CHESS T GROUP OF COMPANIES LTD that the safety expertise available within the international LP Gas industry should be shared as widely as possible in the interest of employees, consumers and the community.

These Guidelines are intended for employees, suppliers and customers who must be concerned with good safety practice in relation to LP Gas handling, distribution and use.

The hazard commonly associated with LP Gas is an uncontrolled release followed by fire. These Guidelines address such a hazard but they also take a more comprehensive view of LP Gas safety.

The Guidelines follow the LP Gas distribution chain up to and including the point of use. Hazards are identified at each stage of the process and good safety practices are outlined. More detailed technical guidance references are provided in Appendix Three together with web links.



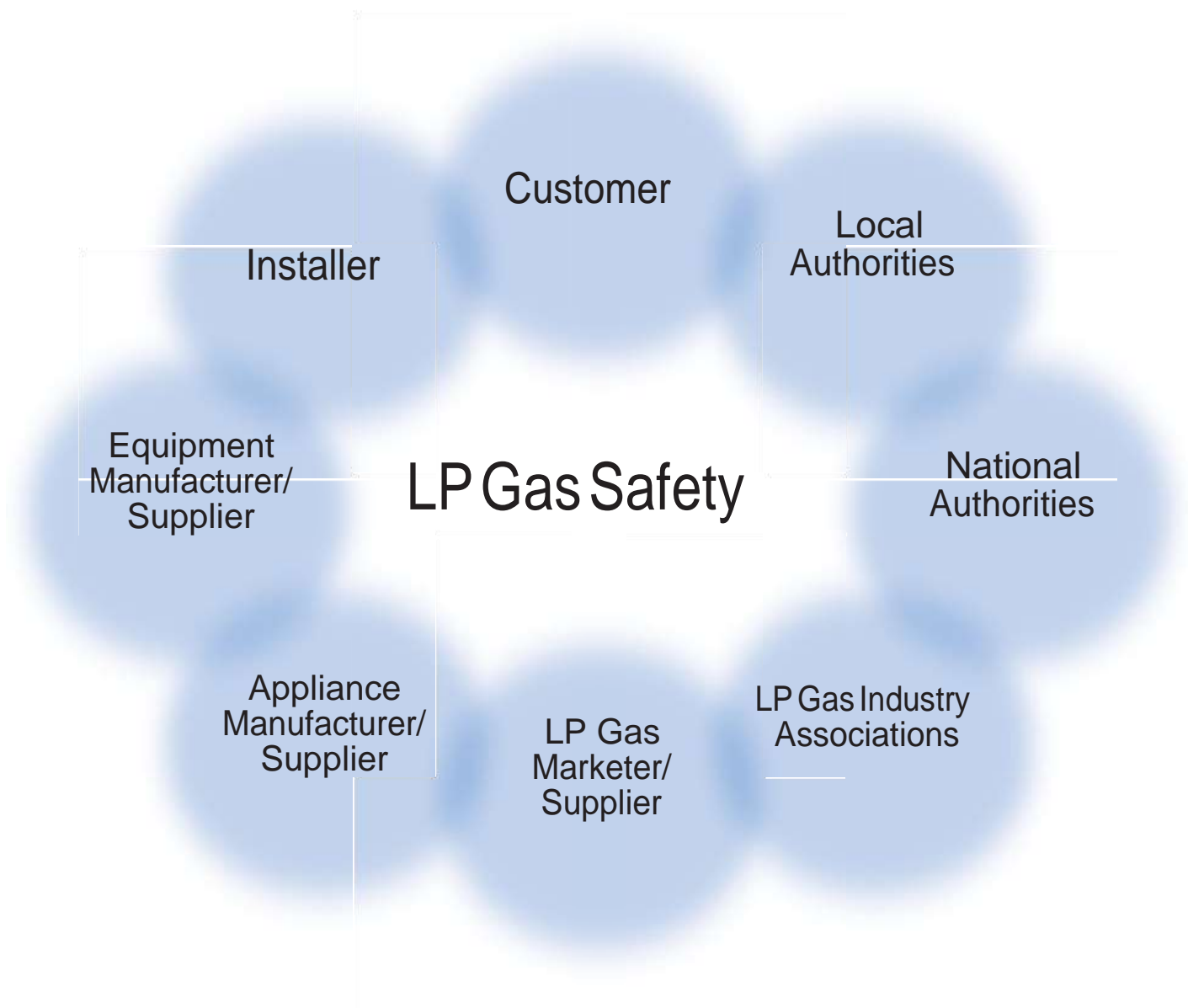
# Key Responsibilities

The principal participants in the LP Gas industry - marketers, equipment manufacturers, transporters and installers - all have responsibilities in the area of safety. They should collaborate to ensure the efficient discharge of their responsibilities; primarily they should comply with the law.

Users of LP Gas should consider adopting ISO 14000 standards on Environment, Health and Safety and OSHAS guidelines (on Occupational Safety and Health).

When appropriate, national and local authorities should take advantage of the expertise within the LP Gas industry to ensure an informed and uniform approach to good safety practice.

Consumers should adhere to the safety instructions which are provided for them. There are many stakeholders and all have a role to play.



## LP Gas Marketer/Supplier

The LP Gas marketer/supplier may be a producer, importer, a primary marketer or a distributor appointed by the marketer. It may be a state-owned or private-sector enterprise. Site safety of the operational premises shall be a key responsibility of the LP Gas marketer / supplier besides other responsibilities which cover all components of the distribution chain.

The marketer/supplier will be responsible for the quality of LP Gas supplied, i.e. for conformity with a declared standard or specification, and for quantity, i.e. for conformity with a declared volume or weight.

The marketer/supplier frequently retains ownership of the tanks and cylinders used to supply LP Gas. In this event conformity with prescribed or declared manufacturing standards with specified periodic inspection or re-qualification procedures must be maintained.

The marketer/supplier should be encouraged to work closely with manufacturers, suppliers and installers of LP Gas appliances and equipment as part of a coordinated industry approach to good safety practice. The marketer/supplier should influence appliance and equipment manufacturers and installers to adopt appropriate safety standards and practices and promote strict implementation of safety procedures in their mutual interest.

Tom Chess T Group of Companies Ltd is an LPG marketing company

## Appliance Manufacturer/Supplier

Manufacturers of LP Gas appliances usually distribute them through suppliers who may be sellers of household appliances and/or who may be LP Gas suppliers.

Virtually all commercial, household and leisure applications for LP Gas require an appliance. Some appliances are made specifically for LP Gas but many commercial and household appliances are manufactured primarily for use with natural gas. Natural Gas, whose basic constituent is methane gas, differs from LP Gas in physical characteristics since it is lighter than air and may be handled at much higher pressures depending upon its end-use.

Only LP Gas compatible appliances should be used with LP Gas. It is a key responsibility of the supplier to ensure that LP Gas appliances are capable of safe, efficient and convenient operation with the grades of LP Gas being sold in the market.

Suppliers should provide clear operating and safety instructions for the clients and user, including compatibility between burner and product (butane, propane or mixtures). If necessary, connections should be designed to avoid the use of incompatible appliances and products.

Suppliers of LP Gas and appliances should collaborate to ensure that consumers are offered a choice of appliances which are energy efficient and which can be operated safely in particular markets.

Important but often overlooked LP Gas appliances include those produced by aerosol manufacturers that use LP Gas as a propellant and refrigeration and air conditioning equipment that uses LP Gas as the refrigerant.

## Equipment Manufacturer/Supplier

LP Gas equipment includes a variety of products associated with handling and use, such as storage tanks, cylinders, pressure regulators, gauges and controls. These include small volume/high value and mass-produced, high precision items.

Equipment may be installed in an LP Gas marketer's plant on a truck or pipeline at a consumer installation or at the immediate point of use. Manufacturers and suppliers should ensure that the equipment being used is suitable for the intended purpose and for the intended environment, including climatic conditions. They should prevent illegal use, e.g. product transfer by incompetent persons or via unapproved connections.

LP Gas marketers should take a direct informed interest in the equipment which they employ and recognize the relationship between quality and safety. Sub-standard equipment increases risk and has no place in the LP Gas industry. Enforcement may be by national type or product approval or by a voluntary code.

## Installer

The function of the installer is to put the LP Gas supply in place using appropriate equipment and having connected the supply to the appliance ensure the system is working correctly and in a safe environment, including access to proper ventilation.

While the LP Gas supplier will be responsible for any installed equipment which remains his property it is usually the installer who introduces the consumer to the safety features of the installation.

Key responsibilities of the installer include that:

- The work is in conformance with all relevant statutory requirements
- The installation is gas-tight and, as far as practicable, secure from damage or interference
- Adequate combustion air is available and that the products of combustion (or any product leaks) will be safely disposed of
- Controls and safety systems are functioning correctly
- The consumer understands the normal operation of the installation, its maintenance needs - including storage, safety procedures and precautions - the action to be taken in an emergency and has the emergency phone numbers

## Consumer

Because of the wide range of LP Gas applications and the variations in the scale of usage there are many categories of consumer. These range from households (often the largest single category) to industrial or chemical complexes where LP Gas may be only one of many hazardous products on site.

The consumer should be supplied with safety notices and instructions. Having been supplied, the consumer should heed them and avoid a cut-price or 'do-it-yourself' approach, to LP Gas installations. Some LP Gas applications, especially those in the leisure sector, lend themselves to self-assembly but most require the services of a competent installer.

When the consumer is expected to operate or maintain specific equipment such as vaporizers, they should be trained and approved as competent.

## LP Gas Industry Association

The key responsibility of a national or local LP Gas Industry Association such as **Nigeria LP Gas Association (NLPGA)** should be the promotion of good safety practice in the LP Gas industry. It should have a mission and structure to facilitate the progressive raising of technical and safety standards.

Membership of a LP Gas Industry Association is open to the appliance, equipment, transporter and installer sectors, as well as to LP Gas producers, suppliers and marketers.

**Nigeria LP Gas Association (NLPGA)** seeks to be consulted in the preparation of LP Gas related legislation and regulations, and if appropriate, act in a coordinating role.

# Regulatory Framework

LP Gas safety may be regulated directly or within the broader regulation of hazardous substances and activities. The regulatory system should promote safety in production, storage, handling, transportation and use.

The LP Gas industry should have a key role in the preparation of regulations through its national or other representative association.

## General

The Nigeria National Gas Policy, 2017 builds on the policy goals of the Federal Government for the gas sector as presented in the 7 Big Wins initiative ([www.7Bigwins.com](http://www.7Bigwins.com)) developed by the Ministry of Petroleum Resources and the National Economic Recovery & Growth Plan (ERGP2017 –2020).

The Policy articulates the vision of the Federal Government of Nigeria, sets goals, strategies and an implementation plan for the introduction of an appropriate institutional, legal, regulatory and commercial framework for the gas sector. It is intended to remove the barriers affecting investment and development of the sector. The policy will be reviewed and updated periodically to ensure consistency in Government policy objectives at all times.

## Background –

For approximately ten years until around 2014, Nigeria was exposed to a very benign international environment, with high gas prices, strong global demand for gas and LNG, and large flows of investment looking for opportunities in emerging markets for gas based industrialization (such as petrochemicals, methanol, fertilizers). Those benign times have now passed and the international business environment is now much tougher. International gas prices have fallen, huge new volumes of gas and LNG supplies are coming on stream globally, against reduced forecasts of market demand growth. Meanwhile, global investment flows are leaving emerging markets. Even within Africa, Nigeria is competing for investment with Southern and Eastern Africa.

## Gas Master Plan

The gas policy is based on a fundamental review of the policy positions of the Government over the last ten years in respect of Nigeria's gas resources. The previous policy positions emanated from the Gas Master Plan (GMP), which was designed to ensure the development of a full blown domestic market by 2015. However, the Plan has not delivered on all its set targets. For example, Nigeria still lacks critical gas infrastructure and continues to fall short of Domestic Gas Supply Obligations. Nigeria is experiencing a full-blown energy crisis in spite of its abundant gas resources. A new gas policy that is more effective and adjusted for the much harsher international business environment for gas is required to drive the reforms necessary to attract investment into the sector.

In these Guidelines our focus is only on the regulatory framework for safety.

In countries which have wide-ranging systems of regulation for public, employee and consumer safety, it is normal to find LP Gas included in schedules of hazardous substances. Typically, such systems provide for regulation of many substances, in storage, handling, transportation and use.

In the absence of such wide-ranging systems regulations may be introduced specifically for LP Gas or the LP Gas industry may be self-regulating. Self-regulation is usually on the basis of recognized technical standards and codes of practice which are accepted and overseen by an official inspectorate or authority.



# LP Gas Safety

LP Gas is potentially hazardous from the point of production until it has been safely used and the combustion products have been properly disposed of. The term LP Gas describes a range of products which have much in common but also have their differences which affect the approach to safety.

Safety comes from understanding the behavior of LP Gas and keeping it under control.

Every uncontrolled release is a hazardous event and should receive urgent attention. As pure LP Gas is odorless and invisible, a distinctive odour is usually added to warn of its presence. This allows even the smallest leak to be detected and receive the appropriate attention. However, as LP Gas is heavier than air an underground or low level leak might not be detected immediately.

LP Gas containers should be readily identifiable as such. Consumers should be given safety information and having been informed should exercise reasonable care in handling and use.

Good appliance and installation standards are essential for safety.

## General

The term LP Gas is an abbreviation for Liquefied Petroleum Gas and refers to hydrocarbon products, sometimes also described as light fractions. Butane and Propane are the predominant constituents of LP Gas.

In common with other forms of energy, LP Gas can be hazardous unless it is properly handled in a controlled manner. It is potentially hazardous from the time of production until it has been used and the products of combustion have been disposed of safely.

LP Gas has its own special hazardous characteristics. LP Gas safety comes from understanding these characteristics and behavior and from the exercise of control under both normal and abnormal conditions.

The behavior of LP Gas is predictable and the technology for control is well understood. Tom Chess T Group of Companies Ltd uses good technical and safety expertise in its supply and marketing. The application of this expertise becomes progressively more difficult as LP Gas is moved along the distribution chain and away from the direct control.

The hazards commonly associated with LP Gas are fire and explosion. Since uncontrolled releases of LP Gas can have serious consequences, the prime objective of a LP Gas safety programme is to prevent uncontrolled loss of containment. However there are other hazards inherent in handling, distribution and use which are addressed in these Guidelines.

Butane, Propane and Butane/Propane mixtures are handled and/or distributed separately and for safety, one product should not be mistaken for the other.

The consumer receives LP Gas at the end of the distribution chain. In practice this can mean transportation over long distances and probably one or more transshipments. LP Gas safety must take into account hazards associated with the mode and duration of transport including the risk of traffic accidents and delays and their possible consequences.

Most LP Gas is used by combustion in an appliance which is itself part of a consumer installation. Adequate combustion air and ventilation are essential for safety. The products of LP Gas combustion or product released as a result of leakage, should be vented to avoid a possible build-up of hazardous secondary products. The installer and the consumer have major roles in this aspect of LP Gas safety.

The vast range of LP Gas uses and of appliances as well as the variable scale of installations adds to the complexity of LP Gas safety. Introduction of new applications, especially when accompanied by changes in distribution practices present new hazards and may call for the introduction of additional safety practices. The safety procedures in Tom Chess T Group of Companies Ltd plant may not be adequate at an automotive re-fuelling station. The safety requirements of a household installation with several appliances, e.g. stove, water heater and space heaters will

differ from those of a consumer using a single appliance directly attached to a cylinder.

## Physical Properties

LP Gas is produced in oil refining and the processing of natural gas liquids. Commercial, or fuel grade, LP Gas mainly consists of Butane and Propane with small amounts of lighter and heavier fractions, such as Ethane and Pentane.

### Typical Properties of LP Gas

Property	Propane	n-Butane
Chemical Formula	C <sub>3</sub> H <sub>8</sub>	C <sub>4</sub> H <sub>10</sub>
Boiling point at 101.3 kPa (°C)	-42.1	-0.5
Liquid density at 15 °C (kg/m <sup>3</sup> )	506.0	583.0
Absolute vapour pressure at 40 °C (kPa)	1510	375
Flash Point (°C)	-104	-60
Upper flammable limit (% vol. in air)	9.5	8.5
Lower flammable limit (% vol. in air)	2.3	1.9
Vol. vapour per vol. liquid	269	235
Relative vapour density (air = 1)	1.55	2.07
Coefficient of expansion (liquid) per 1°C	0.0032	0.0023
Minimum air for combustion (m <sup>3</sup> /m <sup>3</sup> )	24	30
Kinematic Viscosity (centistokes) @ 20°C	0.20	0.30
Latent Heat of Vapourisation (kJ/kg) @ 20°C	352	368
Specific Heat (kJ/kg/°C) @ 20°C - liquid	2.554	2.361
Specific Heat (kJ/kg/°C) @ 20°C - vapour	1.047	1.495
Minimum ignition temperature (°C) in oxygen	470 - 575	380 - 550
Maximum Flame temperature (°C)	1980	1990
Octane number	>100	92
Specific Energy (gross) kJ/kg	49.83	49.40

It will be apparent from the above Table that there are significant differences in the physical properties of Butane and Propane. The values for LP Gas mixtures generally lie between these extremes depending on the ratio of Butane and Propane. However, quite small amounts of methane and ethane can have a significant effect on vapour pressure.

The differences in their physical properties mean that Butane and Propane behave differently under everyday conditions and more especially under extreme conditions. Such differences can be turned to advantages in certain applications. However, differences in boiling point, liquid density and vapour pressure between Butane and Propane are particularly important for safety and appliance performance.

Differences in the quantity of air required for complete combustion of Butane and Propane should be taken into account by appliance suppliers and installers. Failure to do so can affect both consumer safety and satisfaction.

Poor quality control in LP Gas refining and production processes can have an indirect bearing on safety as it may lead to hazards further along the distribution chain or at the point of use. Well-intentioned but inexperienced attempts to solve LP Gas quality problems at the point of use can be risky and are best prevented by appropriate controls during production. Authorities should ensure that relevant product standards are established and observed.

Because Butane and Propane have different physical properties it is important that the composition of LP Gas mixtures being distributed in a market be known to participants and kept within specified limits which are related to product specifications. There are LP Gas standards which have international recognition and one of which could be adopted, in the absence of a suitable national standard. See Appendix Three – List of References.

LP Gas is odourless in its natural state so a distinctive odour is usually added in order to warn of its presence. However, not all

Tom Chess T Group of Companies Ltd Guidelines for Good Safety Practices in the LP Gas industry

LP Gas is odourised in this way and additional hazards exist in the storage and distribution of unodourised LP Gas.

Not all LP Gas is odourised as there are a few applications for LP Gas, like propellants, requiring unstenched product. Additional hazards exist in the storage and distribution of unodourised LP Gas and this requires extra care.

When selecting the type of odourant to use it is important to recognize their particular properties as some are toxic and require careful handling. Attention should also be given to their short life as the odour may fade over time.

## Inherent Hazards/Potential Risks

The principal potential hazard with LP Gas is fire and explosion. This derives from its inherent quality of high flammability and in extreme cases may combine with another condition, i.e. high pressure, and lead to the **BLEVE** (Boiling Liquid Expanding Vapour Explosion) phenomenon. This is a type of explosion that can occur when a vessel containing a pressurized liquid is ruptured due to high temperature and pressure. Such explosions can be extremely hazardous. There are also hazards incidental to the various modes of transport for distribution and use.

An additional potential hazard may arise at the point of use if ventilation is inadequate and the products of combustion are not dispersed into the atmosphere. Carbon monoxide may be produced and reach dangerous levels. LP Gas 'sniffing' i.e. the intentional inhalation of LP Gas vapours seeking a narcotic effect can result in injury or in some cases, death.

The risk associated with such hazards (with the exception of sniffing) can be controlled using available, proven technology, i.e. the safety equipment and procedures normally used by the LP Gas industry.

Liquid LP Gas will cause cold burns if it comes into contact with the skin. Propane, with its low boiling point is more hazardous in this respect than Butane which, in cold conditions, is slower to vaporize and disperse. The eyes and body must be protected when handling all liquefied products.

LP Gas vapour, being heavier than air, may, in the event of a leak, accumulate in confined spaces and low-lying areas. The means of ventilation and meteorological conditions will influence the movement and dispersion of the LP Gas vapour.

Any uncontrolled release of LP Gas is inherently hazardous. A liquid LP Gas leak is considered more hazardous in that it will expand to vapour form with volume in excess of 200 times that of the original liquid volume leak. Being heavier than air, vapour will tend to lie, or drift, close to the ground with a risk that it will find a source of ignition while it remains within its flammable limits. The physical properties are given in the table shown earlier in this section.

Liquid LP Gas has a high co-efficient of volumetric expansion and therefore cylinders and tanks should never be completely filled. They should be filled with ullage (the unfilled space in a container of liquid) to allow for liquid expansion caused by an increase in temperature. The degree of ullage necessary will depend on the operating conditions, especially the maximum expected operating temperature. This potential risk is further controlled by a combination of safety devices and procedures and especially by control during product transfer operations. This potential risk explains why cylinders and tanks should only be filled under the supervision of competent persons and why illegal filling is dangerous because of the risk of overfilling.

Because of its much higher vapour pressure, tanks and cylinders containing Propane need to be stronger than those for Butane, and both should be protected against excessive pressure. This potential risk is controlled by safety devices and by segregating the products or, where LP Gas mixture is handled, ensuring that the Propane content does not exceed a specified upper limit. In cold weather, a tank storing Butane may be subjected to negative pressure and must be capable of withstanding this.

During the process of distribution, LP Gas will normally be transported in one or more modes. There will be hazards associated with the transport mode and with the consequences of traffic accidents and incidents. The risks will vary from country to country and with the transport mode. The control of transport-related risks is discussed in Chapters 6 and 9.

The majority of consumers will use LP Gas as a fuel in an appliance. The installation comprising the LP Gas supply and connection to the appliance may be simple or complex, large or small. Hazard scenarios and risk at the point of use are discussed in Chapter 10.

The products of complete LP Gas combustion - mainly water and carbon dioxide - are not inherently hazardous.

Good installation practice specifies ventilation to supply the air required for combustion and to vent the products of combustion. This minimizes risk by preventing a build-up of carbon monoxide or a development of asphyxiating (i.e. oxygen-deficient) conditions.

LP Gas is a clear odourless liquid and is not readily visible in its gaseous phase. In the event of a leak it may be present, unseen, in hazardous concentrations. To minimize this risk, odorant with a distinctive, persistent and unpleasant smell is added to LP Gas prior to distribution. In special applications requiring odour-free LP Gas, such as aerosol propellant, or the chemical industry, alternative safety measures are adopted such as the use of gas detectors.

Accumulation of LP Gas vapour may result in the development of an oxygen-deficient atmosphere which carries a risk of asphyxiation. The visible cloud might be smaller or bigger than the actual gas cloud, depending on humidity in the air. An explosimeter should be used to approach a gas cloud. No one should enter a gas cloud as the possible introduction of an ignition source creates a hazardous zone and possible fatal area. No one should enter a vessel which has been used for LP Gas storage without supervision and only when all appropriate safety measures are in place and the area has been determined as gas free.



**Controlled release of LP Gas from a cylinder**

Minimizing risk in any operation must be one of the foremost goals. Guidelines such as these allow for the management of LP Gas operations, and for its use, well within the parameters for individual and societal risks acceptable in a modern, industrialized society.

## Basic Safety Principles

While flammability is the major safety concern with LP Gas it is not the only one. Good safety practice addresses the various hazards from production to consumption.

The term LP Gas embraces several products which while related have important physical differences which affect safety. If more than one type or grade of LP Gas is being handled each should be clearly identified and segregated. All should be within specification, especially with respect to maximum permitted vapour pressure.

Large LP Gas installations should not be constructed close to large or sensitive populations. Populations should be restricted close to locations approved for large LP Gas installations. In planning or evaluating proposals for the location of LP Gas facilities due account should be taken of the hazards created and of the risks associated with those hazards within and beyond the facility.

Space and separation distances are fundamental to safety at Tom Chess T Group of Companies Ltd facilities – large and small – and should be assessed for each location and observed.

Tom Chess T Group of Companies Ltd actively promotes a safety culture within their own businesses and at industry level.

Tom Chess T Group of Companies Ltd Personnel engaged in LP Gas operations receives formal training by competent persons for their normal activities and for emergencies. Tom Chess T Group of Companies Ltd facilities have emergency planning and response programmes appropriate to the hazards and risks which they represent.

These include correct handling procedures to avoid injury.

Fuel grade LP Gas should be adequately odourised prior to entering the distribution chain. When LP Gas is required to be odour-free adequate alternative safety measures should be employed. (See Appendix Three - References).

LP Gas cylinders and tanks should never be allowed to become liquid-full. Climatic conditions will influence the degree of ullage required but it is typical practice to fill to around 80% of the water capacity of the vessel. In some circumstances over fill devices may be required to provide protection. In other cases cylinders and tanks should only be filled under the supervision of competent personnel

Above a certain quantity LP Gas should be clearly identified during transportation, using classification numbers and appropriate warning signs. (See Appendix One).

Appliances and equipment for the handling, transportation and use of LP Gas should be fit-for-purpose, correctly installed and well-maintained. Sub-standard appliances, equipment and installations should be excluded if necessary by regulation.

Installers of appliances and equipment, and those responsible for service should be formally trained and should have reached a specified level of proficiency.

Cylinders for indoor use should preferably be filled with Butane or Butane-rich LP Gas mixtures although certain countries do permit the use of Propane cylinders indoors. Only those cylinders which are in use should be kept indoors. Whenever Butane and Propane are sold as separate products, cylinders should be readily distinguished and preferably fitted with different outlet valves so that they are not easily interchanged or used for natural gas appliances.

Consumer safety awareness campaigns are an essential part of Tom Chess T Group of Companies Ltd safety principles and it emphasizes:

- The quality/safety linkage for gas, appliances and equipment including safe practices
- The risks associated with inferior installation standards and/or practices
- The need for care and in particular for adequate ventilation
- How to recognize the smell of odourised LP Gas
- The action to take when gas is detected



## Product Classification and Labelling

In practice the products known collectively as LP Gas include n-Butane, iso-Butane, Propane and Propane/Propylene. They may be supplied separately or in varying mixtures and degrees of purity. All come within the designation 'Hazardous Substances' and are classified 'Highly flammable'.

LP Gas cylinders, storage tanks should be clearly identified by appropriate markings and warning signs, examples of which are to be found in Appendix One. These are recommended for use

Where Butane and Propane are sold as separate products, cylinders and tanks should be marked according to product. Containers of LP Gas which has not been odourised should be clearly marked and labeled.

The minimum safety information on a cylinder should state the product, the supplier's name or brand, the net fill amount, a flame symbol and the word 'Flammable', or its Local language equivalent. Information should be of sufficient size to be readily legible and in a colour contrasting with the rest of the cylinder.



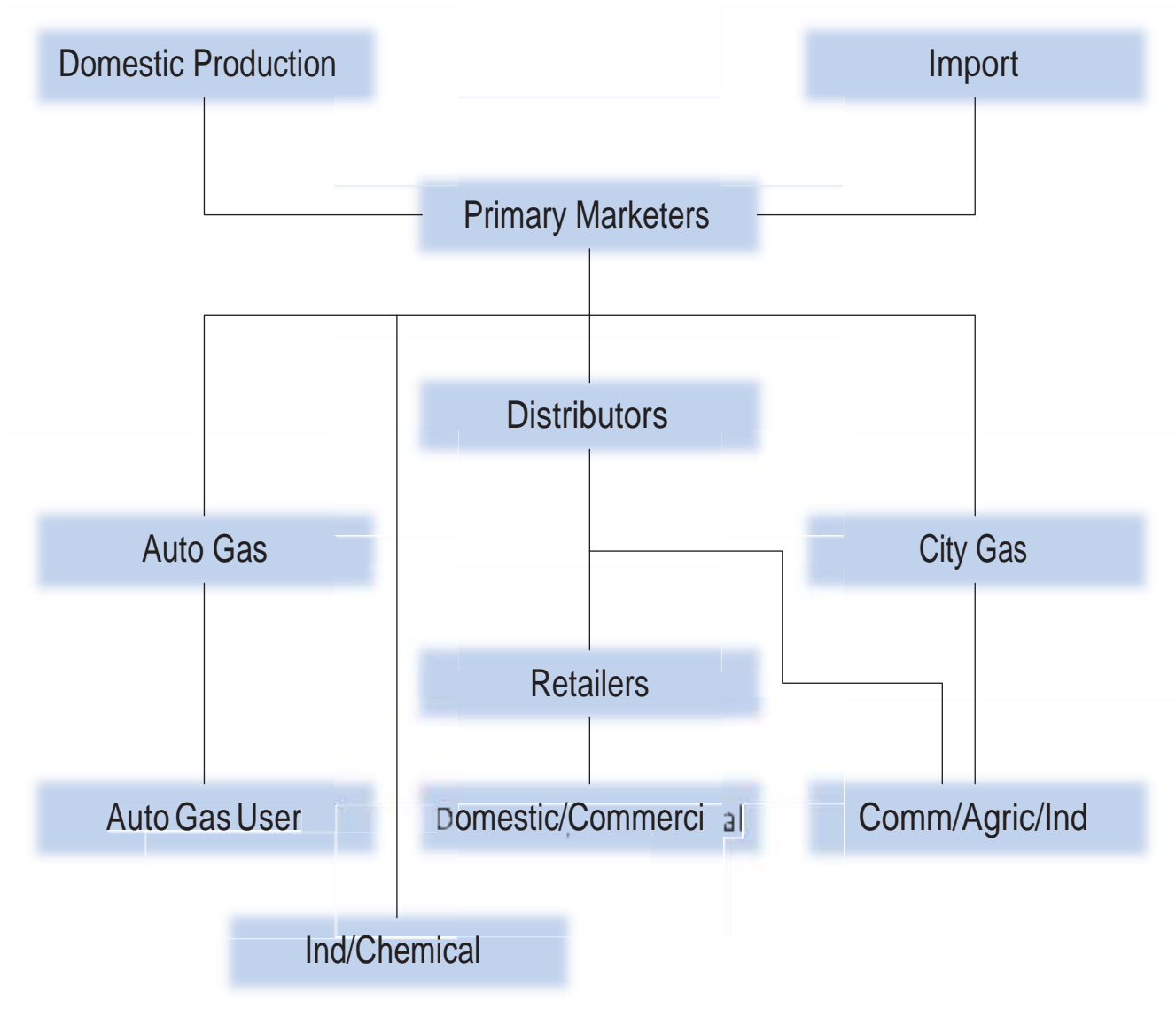
# LP Gas Distribution Chain

Tom Chess T Group of Companies Ltd distribution chain begins with a small number of large installations and ends with large numbers of consumers, some large but mostly small.

Some consumers receive LP Gas in cylinders others receive it in bulk.

Safety should take account of the distribution system, the different types of consumer and the particular hazards at each stage of the chain.

The exercise of safety becomes more difficult as LP Gas moves through the distribution chain.



## General

The Distribution Chain describes the process by which LP Gas is moved from production or importation to the point of use.

LP Gas purchased ex-ship or ex-pipeline is considered to have entered the distribution chain at the point and time of custody transfer when ownership and responsibility normally passes to the primary marketer. At this early stage of the distribution process, Butane and Propane are often handled separately and the scale of operations tends to be at its largest.

LP Gas is normally stored, handled and transported under pressure and at ambient temperature during distribution. Marketers will seek competitive advantage through distribution efficiency which will include optimizing the scale and location of their distribution infrastructure. In practice this will include locating certain of their facilities close to consumption centers. This will necessitate marketers taking care of local interests.

LP Gas distribution may be in bulk or in cylinders depending on many considerations such as application, scale of usage and consumer preference. Automotive LP Gas should always be distributed in bulk. Tom Chess T Group of Companies Ltd distribution infrastructure will include bulk depots and cylinder filling plants

## Classification and Activities

In its basic Tom Chess T Group of Companies Ltd chain starts with purchasing a single grade of LP Gas, probably the producer's specification, and selling it to consumers within a limited geographical area. The chain becomes more complex as multiple supply sources and possibly choices of grades develop for example as the company begins to sell into an expanding geographical area and serve a broader range of LP Gas applications.

Multiple sources will normally enable the marketer to extend his supply options and possibly to shorten the primary transportation lines. The marketer will probably be drawn towards multi-depot operations and should then be prepared to deploy additional supervision in order to maintain safety standards.

Tom Chess T Group of Companies Ltd 's distribute directly to their consumers, large and small. The company sometimes uses their petrol stations as LP Gas outlets and also distribute through appointed agents, distributors or dealers. All must work to implement Tom Chess T Group of Companies Ltd LP Gas safety disciplines in distribution networks which may include some unresponsive or disinterested elements.

A developed Tom Chess T Group of Companies Ltd LP Gas distribution chain will have some (possibly all) of the components shown in the diagram on page 19. In addition it will include traders and transportation companies, shippers, pipeline operators, rail and road transport contractors.

## Implementation of Basic Safety Disciplines

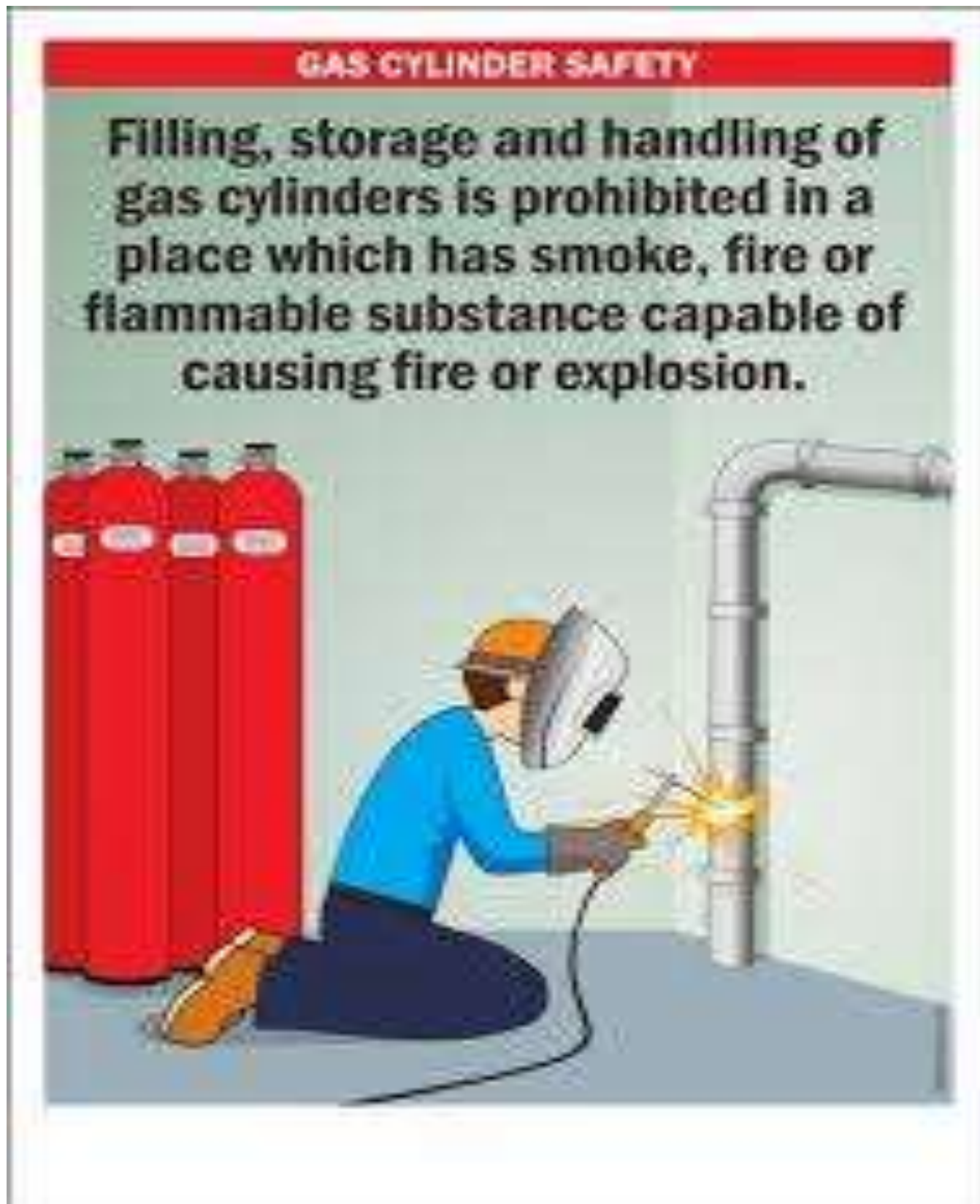
The effective implementation of Tom Chess T Group of Companies Ltd safety discipline should follow from the regulatory/enforcement system working constructively with industry, both directly and through its representative organizations. For the purpose of this document, 'industry' should include manufacturers of LP Gas-based aerosols, refrigeration and air-conditioning appliances' manufacturers and service providers, equipment vendors and installers, as well as LP Gas marketers.

Elsewhere in the Guidelines, we have noted that:

- LP Gas can be hazardous from production to the point of use
- Safety comes from understanding LP Gas and maintaining control
- Understanding and control should be present, and exercised, at every point of the distribution chain.

The logical starting points for the process of implementing safety discipline are knowledge and awareness. We have noted that good technical expertise is to be found in the LP Gas marketing companies and equipment manufacturers. The main burden of implementing knowledge-based safety and safety awareness should be borne by them and they should have recognition when it is done properly.

The majority of LP Gas-related incidents occur at, or close to, the point of use. Safety discipline must include the consumer who, having been made aware of certain hazards, should respond by exercising every reasonable care.





# Inland Transportation

LP Gas is moved in bulk in the initial stages of inland transportation by rail or road.

Some consumers receive their LP Gas in bulk. Others receive their LP Gas in cylinders. Small sized pressurized canisters are also used to supply LP Gas for the refrigeration and air conditioning appliances. Final delivery is usually by road.

Tom Chess T Group of Companies Ltd is extra vigilant when the risk of a traffic accident is high. Transport vehicles should be of a suitably high standard and operated by qualified drivers.

## General

Almost invariably LP Gas is moved in bulk in the initial stages of inland transportation. For many applications and especially for automotive and industrial use LP Gas is transported in bulk throughout the distribution process in Nigeria. For others, LP Gas may have started the journey in bulk but is finally delivered or collected in a cylinder.

There are hazards associated with the different modes of transportation but the risks will vary with local conditions. There will be times when the most economical method must be forgone in the interests of safety.

Tolerability of risk from traffic hazards varies. The LP Gas industry depends on transport to deliver its products and therefore should employ good safety practice in its inland transport operations. The industry should be extra vigilant where the external risk is known to be high.

## Distribution in Bulk and Cylinders

Distribution refers to the movement of LP Gas onward along the distribution chain from a bulk plant or cylinder filling plant. Distribution in cylinders usually means transportation by road and exposure to the road traffic hazards.

Tom Chess T Group of Companies Ltd Drivers are carefully selected and trained both in avoiding and in dealing with the consequences of accidents. Trucks regularly employed in the transport of LP Gas are designed, or adapted, to minimize the risks associated with the product and the mode of transportation. They are inspected before they enter service and are properly maintained

Tom Chess T Group of Companies Ltd distribution trucks display product identification plates and are equipped with suitable fire extinguishers.

Filled LP Gas cylinders which are intended to be utilized in the upright position are transported upright with the valves protected against any impact. Full and empty cylinders are segregated on the truck. Pallets or cylinders are restrained using straps or ropes (natural hemp not nylon) that are secured to properly designed anchorage points.



# Bulk Storage and Handling

The location of storage should be considered in conjunction with the nature and scale of the LP Gas operations and of external risks.

Safety systems and procedures should prevent uncontrolled releases of LP Gas and the over-filling of storage tanks.

Passive safety features and fail-safe safety systems should be incorporated into bulk storage and handling facilities.

## General

Tom Chess T Group of Companies Ltd LP Gas are stored on a large scale at an import or trans-shipment terminal on an intermediate scale at depots and cylinder filling plants.

From a safety standpoint, LP Gas storage should be considered in conjunction with the nature and scale of the associated on-site LP Gas handling operations. Apart from National Standards and Codes of practices, there are well established International Standards and Codes which, when effectively employed, will substantially reduce both hazard and risk.

A fire or explosion involving LP Gas in bulk storage is potentially a major incident and likely to have an impact beyond the operator's boundary fence. The development and operation of Tom Chess T Group of Companies Ltd facilities are subject to consultation at official and community level.

## Single/Multi-Grade Operation

For safety, the important considerations are that:

- Stored LP Gas does not develop a vapour pressure in excess of the permitted maximum for any part of its containment system
- There is no total dependency on the characteristic, unpleasant smell of stench product to warn of the presence of LP Gas. Other mitigating measures such as gas detectors should be installed. The storage and handling of unstench product will require these anyway

Tom Chess T Group of Companies Ltd Multi-grade facilities are equipped with the physical means of segregating the various grades of LP Gas and should have procedures to check and validate the effectiveness of such segregation.

Each LP Gas storage tank should be suitable for the grade of product to be stored in it at the expected temperature range and developing the highest vapour pressure.



**Above-ground cylindrical tanks for storage of LP Gas**

## Technical Options - Types of Storage

LP Gas is stored in bulk in:

- Cylindrical or spherical steel tanks which are above ground

The scale, location and method of operation of Tom Chess T Group of Companies Ltd storage facility ensures that environmental and safety issues are always be given due consideration.

## Technical Options - Product Transfer

LP Gas transfer is potentially hazardous - an activity where things can and sometimes do go wrong because of equipment or procedural failure.

Product temperatures should not be below the design and material specifications. When refrigerated LP Gas is to be transferred to non-refrigerated storage, an inline product heater may be employed. At coastal locations in warm or temperate climates, seawater may be used as the heating medium.

Tom Chess T Group of Companies Ltd most common bulk transfers are between depot tanks and road tankers. Road tankers are loaded by weight or by volume, singly or in groups. All such transfers must be monitored to ensure that maximum fill limits are not exceeded. It should be constantly borne in mind that cold LP Gas will expand as its temperature rises.

Articulated loading arms are preferred for in-depot transfers but flexible hoses are currently the only practical option for bulk delivery to consumers.

## Safety Systems for Operation

The first rule of safety is to avoid any uncontrolled leakage of LP Gas. All systems should be designed with this prime objective of containment in mind.

The traditional approach to safety is based on generous use of space and of water deluge systems for emergency response. Increasingly, this approach is giving way to the concept of passive safety (including the use of passive fire protection [PFP] in the form of coatings) and to fail-safe valving and control systems. The passive safety concept is evident in mounded and underground tanks. Passive fire protection can be used where ground conditions are not suitable for burying or mounding vessels. A modern valve control system will be capable of automatic and/or remote operation. It will ensure that main valves are closed unless they are required to be open and only while that requirement lasts and that they close in case of emergency or alarm.

High and low-level alarms fitted to plant storage tanks can be a useful defence against overfilling but they should not be seen as an alternative to proper supervision.

Many plant incidents take place outside normal working hours, often during maintenance operations. After hours security and supervision of maintenance work are crucial for safety. All critical works or works done in critical areas should be subject to a risk assessment and a permit to work

Static electricity discharge is a cause for concern and so steel structures and pipe work should be securely earthed. Road tankers should be bonded to earth before LP Gas transfers commence and remain so until the operation is complete and the hose is disconnected.

Road tankers admitted to the plant should be equipped to the standard specified in national regulations or in a reputable code, such as ADR. Vehicles should be immobilized during transfer operations and equipped to prevent untimely movement. Loading/unloading bays should be protected against impact. Both company-owned and contractors' vehicles should comply.

Fire-resistant coatings can provide a useful means of improving safety in vessels. They have the advantage that they can be applied to existing tanks to augment an existing safety system. However the selection and application of such coatings should be entrusted to specialists.

Sections of pipe work and storage systems that can be isolated with valves or blinds should be equipped with safety valves to protect against possible damage as liquid LP Gas expands with increases in temperature.

# Cylinder Filling and Handling

Cylinders should be filled with the intended product – Butane, Propane or specific LP Gas mixtures – and should never be over-filled.

Cylinders should be checked before and after filling to ensure that they are fit to fill, have been correctly filled, are gas tight and will be trouble-free in service.

A mishandled cylinder can cause injury and damage, or result in an uncontrolled release of LP Gas. Handling of LPGas cylinders should as far as practical be mechanized to prevent injury.

## General

Tom Chess T Group of Companies Ltd Cylinder filling plants vary in scale and sophistication from simple single-station operations filling small numbers of cylinders on demand, to high-technology plants serving hundreds of thousands of consumers.

LP Gas is sold by weight in cylinders and too often accuracy of filling means 'not being underweight' to both consumer and filler. It is not always appreciated that an overfilled cylinder, i.e. one which may become liquid-full, can be highly dangerous with small increases in temperature as liquid LP Gas expands ten times greater than water.

Ownership of cylinders can have an important bearing on safety. They should be manufactured and maintained in accordance with recognized technical standards. Tom Chess T Group of Companies Ltd ensures that non-compliant cylinders should not be re-filled although this can lead to difficulties when the consumer owns the cylinder and he may suspect a motive in a refusal to fill it. The consumer will have little appreciation of the safety checks which the professional re-filler carries out as a routine part of his work.

Cylinder maintenance and repair are potentially hazardous activities and when undertaken in a filling plant can become disruptive of cylinder filling operations. Maintenance and repair should be carefully planned in order to avoid such disruption.

Filling plants handling more than one grade of LP Gas should be designed and equipped accordingly. They should have the physical and procedural controls to ensure that one is not mistaken for another.

## Cylinder Filling and Checking

Cylinder filling operations should be carried out in accordance with a reputable technical standard or code such as ISO 10691

The initial check is to ensure that the cylinder is fit for refilling, i.e. that when filled it will not create a problem for either the refiller or the consumer. This initial check is also for compliance with any national or industry revalidation rules.

The cylinder valve is normally dual purpose in that it is used both for re-filling and to supply gas to the consumer. The condition and performance of the valve is crucial for safety.

National regulations may determine the permitted filling tolerances. While complying with these the refiller must ensure that the correct grade of LP Gas is filled and that the maximum permitted fill volume for the cylinder is not exceeded, i.e. that there is no risk of the cylinder becoming liquid-full

Post-filling checks are specified in the Code of Practice. The objective is to provide the consumer with a cylinder which has been correctly filled, will be trouble-free in use and meets all national or industry labelling requirements. The photo below shows LP Gas cylinders on an automatic filling carousel.



**An automated carousel for filling of LP Gas Cylinders**

Post-fill procedures should include leak-testing, check weighing and, in the absence of fixed protection (e.g. a shroud) the fitting of a suitable form of cylinder valve protection if this is not already provided for in the valve design. Increasingly LP Gas marketers are fixing a tamper-proof seal to the cylinder valve after re-filling to reassure consumers of the integrity.

Both full and empty LP Gas cylinders can cause serious injury during manual handling and, where possible, handling should be mechanized. Manual handling of cylinders should be done with proper personal protective equipment.

## Care and Maintenance of Cylinders

An LP Gas cylinder is a pressure vessel which may, during the process of distribution and end use, be subjected to rough treatment. Nevertheless its integrity is essential for safety and therefore it must be properly maintained

Where the LP Gas marketer retains ownership of cylinders - and the empties are returned for refilling - the marketer is also responsible for care and maintenance.

The consumer, as the owner of the cylinder, may assume – probably unwittingly – responsibility for maintenance. In this case, compliance with cylinder re-qualification requirements can be very difficult. The cost of re-qualification (to be borne by the owner-consumer) and problems of access to re-qualification facilities are likely to be contributing factors. The owner-consumer system also carries the risk of a do-it yourself approach to cylinder valve repair/replacement. It is imperative that legislation and regulations are consistent with the standards and codes of practice relating to cylinder re-qualification.

In the absence of national regulations, there are reputable standards, such as ISO 10464 which specify intervals for inspection and re-qualification. Cylinder filling standards such as ISO 10691 codes (e.g. COP 12) [refer: [www.iso.org](http://www.iso.org)] include acceptance/rejection criteria for damaged cylinders. The LP Gas marketer filling the cylinder must be responsible for checking for compliance with these criteria.

## Technical Options for Cylinder Filling

Although the leading equipment manufacturers also offer volumetric filling machines, most LP Gas cylinders are filled by weight, i.e. by reference to individual tare weights and a specified fill, or weight, of LP Gas. At high volume, the challenge

for the equipment manufacturer is to provide speed and accuracy for both filling and checking together with flexibility to deal with different types of cylinder and different grades of LP Gas. At low volume, accuracy of filling and checking are equally important for safety. Generally, a check weigh scale is needed for 'weights and measures' compliance with 100% check weighing becoming the norm.

Essentially, the technical options for cylinder filling are:

- A small number of high volume plants
- A larger number of low volume plants
- High automation/few employees and vice-versa.

Filling large numbers of cylinders manually is heavy, monotonous work and the risk of injury inherent in a labour intensive plant should be evaluated against that of a well-managed, automated plant. In Tom Chess T Group of Companies Ltd, the personnel handling cylinders manually should be trained to minimizing the risk of injuries to themselves and others. Management of safety should always be appropriate to the number, size and type of plants.

Advances in electronics, in metering and in data management systems have moved the technology of cylinder filling forward and have helped to Tom Chess T Group of Companies Ltd operations safer. However, any programme to automate should ensure that safety systems are updated as filling procedures change.

## Storage and Handling

LP Gas cylinders can cause serious injury during manual handling and, wherever possible, handling should be mechanized. Manual handling of cylinders should be done with proper personal protective equipment.

Conveyors and other parts of a mechanical handling system are earthed to discharge static electricity. As with all rotating machinery they can also lead to incidents and should be designed to avoid employees being trapped and stop when an employee is trapped.

Forklift trucks are invaluable cylinder handling aids. Tom Chess T Group of Companies Ltd ensures that they are equipped with spark-suppressing features (flameproof) and observe any hazardous zone restrictions within the filling plant or depot.

Training is provided for those involved in cylinder handling in order to minimize the risk of injury to employees and of damage to the cylinders.

The storage of cylinders is systematic with full and empty cylinders segregated and confined to designated areas.

Cylinders requiring maintenance, repair or fill correction are dealt with urgently by trained and properly supervised employees. Such cylinders are potentially hazardous and a backlog is never be allowed to accumulate within the cylinder filling area. Should cylinders be unserviceable, then recycling of the different metal components is to be encouraged.

## Safety Systems for Operation

A cylinder filling plant has many potential trouble spots which, in a large plant, may be some distance apart. Tom Chess T Group of Companies Ltd Plants are incorporated an emergency shutdown system to stop the flow of LP Gas, pumps and filling equipment. An alarm system capable of operation from key locations and of actuating emergency response measures is considered an essential part of the plant safety system.

Clear signage (including road marking) and effective gatehouse control over vehicle and individual access to the hazardous areas are also considered essential.

Many plant incidents take place outside normal working hours, often during maintenance operations. After-hours security and supervision of maintenance work are crucial for safety. All critical work or work done in critical areas should be subject to a risk assessment and a permit to work.

More detailed guidance of safety systems for operation can be found in COP 12 [refer: [www.lpga.co.uk](http://www.lpga.co.uk)].

# Distribution in Bulk

Bulk LP Gas distribution requires equipment and skills which differ from those required for cylinder distribution. The consumer's installation and the bulk delivery vehicle should be correctly designed, equipped and maintained. The driver/operator must be properly trained and equipped to handle both normal operations and emergencies.

## General

In the LP Gas industry, 'bulk distribution' generally refers to supply by road tanker into a fixed storage tank or tanks. LP Gas is sometimes distributed in bulk using demountable or containerized tanks but this is an exception not the rule. All accepted alternatives will be dealt with in these Guidelines.

Bulk distribution may be 'full-load', where the customer has sufficient storage to accept the contents of the supplying road tanker, or 'part-load', where the tanker's LP Gas cargo is shared among a number of customers. Full-load distribution may be by weight or by volume while part-load is often by volume, measured by a tanker-mounted metering system. The system should include a temperature correction feature to take account of changes in volume arising from changes in LP Gas temperature

The possibility of a release of product during transfer may involve both the delivery tanker and the fixed storage vessel.

Bulk distribution is popular with consumers as it often means a higher level of convenience than cylinders. Sometimes, because of the quantity involved, it is the only practical method of supply.

Bulk distribution and the bulk installation which is a necessary part of the system call for technical, operational and safety expertise which may not be available in a cylinder-only LP Gas market

Bulk distribution may have the effect of reducing the number of trucks employed in transporting LP Gas (when compared with cylinders) reducing the traffic accident hazard. On the other hand, the amount of LP Gas being carried on each truck will be greater with potentially more serious consequences in the event of a major traffic accident. Technical standards for tanker construction, on-board safety systems and driver skills should be of a suitably high order.

## Technical Options

The technical options for bulk distribution of LP Gas are:

- Demountable or containerized tanks
- Road tankers without LP Gas transfer equipment
- Road tankers with on-board LP Gas transfer equipment.

Demountable tanks may be relatively small capacity (i.e. 1 tonne and upwards) and are sometimes used to distribute chemical grade LP Gas or where physical access to the consumer is difficult or where the quantity for distribution does not justify the expense of a road tanker. Containerized tanks are mounted within a standard ISO container frame (see fig. 9.1 on following page). Both demountable and containerized tanks require specialized handling equipment and are probably at highest risk during handling operations.



### LPG ISO Container

Road tankers without LP Gas transfer equipment are generally used for full-load deliveries and are unloaded using a fixed pump or compressor at the receiving location. These are rated as low-risk operations because transfers are usually made in controlled environments.

Road tankers with transfer equipment, usually a pump driven by the truck's engine and an in-line flow meter, are an essential part of bulk LP Gas distribution. Making frequent deliveries through a flexible hose requires more elaborate safety equipment. A comprehensive hose inspection/renewal programme should be implemented. One-man operation is normal but this demands consistent and comprehensive training of the driver/operator but only by a properly trained driver-operator.

## Bulk Supply and Delivery

Tanks used on Tom Chess T Group of Companies Ltd road tankers are specially designed and constructed for this duty as are skid-mounted and containerized tanks. A tank intended for static storage should not be used for deliveries.

Tank nozzles and valves are fitted internally, recessed into the tank shell or positioned so as to minimize the risk of impact damage and to prevent unauthorized access

Road tankers may be loaded by volume or by weight but should always retain a safety margin, or ullage, to protect against the tank becoming liquid-full of LP Gas.

The time of delivery, i.e. connection, pumping and disconnection, is normally the time of highest risk requiring the full attention of the driver - operator as well as due care on the part of the consumer.

## Safety Systems for Operation

The bulk distribution system requires the driver-operator to spend some time at the tank and some at his tanker during delivery. Ideally, there should be a clear line of sight and unimpeded access between them. Where sight or access are impeded, the driver-operator should be able to shut off the road tanker's engine and close the liquid outlet valve while stationed at the consumer's storage tank and monitoring the filling process. The truck should be safely parked and signaled to avoid traffic accidents and allow easy departure in case of emergency. The transfer area should be free from ignition sources.

The vehicle should be equipped with a number of externally-mounted shutdown devices to enable the driver to stop pumping operations quickly and to secure the vehicle in an emergency. It is normal to fit a remote shutdown switch or button on the end of the delivery hose so that the driver can halt pumping without the need to return to the vehicle. Sometimes, a 'dead man's handle' is incorporated so that pumping can continue only in response to a positive action of the driver. In some areas a radio frequency device with a transmitter is used to remotely shut off the



engine and the liquid outlet of the road tanker.

# Consumer Installation and Usage

Technical and safety standards should be established, maintained and enforced for LP Gas appliances and appliances and for consumer installations, including refrigeration and air conditioning appliances.

Only qualified installers and servicemen should be permitted to undertake Tom Chess T Group of Companies Ltd installation work.

Consumers should be informed about potential hazards in using LP Gas and about the safety features of appliances and their installation.

Consumers should exercise due care in the use of LP Gas.

## General

The versatility of LP Gas and its range of applications are reflected in the diversity of installation. These include leisure or household applications employing less than a kilogram of LP Gas to industrial installations supported by hundreds of tonnes of LP Gas in on-site storage.

For the purposes of these Guidelines, the installation comprises of a LP Gas supply vessel (cylinder or tank), connected to one or more appliances or to a dispenser. The connection may be direct from vessel to appliance through a flexible hose or through lengths of pipe work to a multiplicity of appliances. Transport applications for LP Gas, including automotive LP Gas and forklift trucks, also fall within this overall classification.

The LP Gas supplier may also be the supplier and/or installer of the appliance. More often however these activities are separate and the LP Gas supplier may not know exactly where and how the product is being used.

Consumer safety depends on the performance of the installer as well as the standard achieved by the supplier of the LP Gas and of the appliance. It also requires an appreciation on the part of the consumer of the importance of such performance and a willingness to demand and pay for it.

Most accidents, including fatalities, occur at or near the point of use. Prompted by these authorities are increasingly regulating the activities of installers and setting appropriate standards for installations.

## Role and Duty of Tom Chess T Group of Companies Ltd Installer

It is the role of the installer to bring together the LP Gas supply and the LP Gas consuming appliance and having connected them ensure that the system is working correctly.

The role of the installer is crucial for LP Gas safety and therefore should have achieved and maintained a specified level of proficiency i.e. be qualified by training and experience.

The installer has a duty to ensure that his work conforms to all statutory or code requirements and to draw attention to any defect in the LP Gas supply or in the appliance which he is instructed to install.

The installer should instruct the consumer in the correct use of the LP Gas installation with regard to safety features, including the provision of adequate ventilation, servicing/maintenance needs and any action to be taken by the consumer in the event of difficulty.

## Appliance Installation, Inspection, Servicing

The LP Gas supplier and the appliance manufacturer may not know where the appliance is installed but they nevertheless have a key role in its safety. They should exercise this role by promoting good installation standards and insisting on qualified installers.

A formal system of information exchange between LP Gas producers and marketers, appliance manufacturers and [Tom Chess T Group of Companies Ltd Guidelines for Good Safety Practices in the LP Gas industry](#)

installers can be a highly effective safety measure.

LP Gas delivery personnel should be instructed to inspect the external installation at each visit to their consumers and to report any defects. Marketers must be prepared to follow up such reports promptly.

Delivery personnel responding to 'out of gas' calls should additionally check the operation of controls and any pilot lights in the internal installation and if necessary attach a written warning not to turn on the LP Gas supply until a qualified person has tested the system for safety.

Servicing is especially important for appliances which are used seasonally or which may have remained unused for a long time. LP Gas producers and marketers should actively promote an internal inspection and servicing programme for their consumers in association with qualified installers. It may be counter-productive to announce a programme unless it is adequately resourced and managed.

Builders and consumers should be made aware of the need to have LP Gas installations inspected when carrying out construction or alteration work which could affect safe operation, paying particular attention to ventilation and the removal of the products of combustion.

Inspectors should pay special attention to the number of spare LP Gas cylinders at consumers' installations and the storage arrangements for them. Spare cylinders, full or empty, are potentially hazardous and their numbers should be kept to the minimum required for continuity of supply.

Operating, service and safety instruction literature should be kept up-to-date and widely disseminated usually in a multimedia format.

## Domestic and Commercial Applications

The diversity of LP Gas applications means that sometimes LP Gas is only one of several hazardous substances present. In others, such as aerosols and refrigerant applications, the consumer may be unaware of the presence of LP Gas.

The use of LP Gas cylinders indoors is normal, accepted practice in some countries. LP Gas safety programmes should emphasize the need for care, especially when exchanging LP Gas cylinders indoors.

Water heaters are frequently involved in domestic incidents with LP Gas, notably carbon monoxide poisoning. Because they are high-output appliances and are often installed in small bathrooms adequate ventilation to remove combustion products is especially important for consumer safety. Flues should be checked regularly for obstructions, e.g. snow and nests.

LP Gas is an indispensable part of commercial cooking but there is a tendency to place cylinders in out of the way places where they may constitute an unseen hazard. Cylinders should never be installed or stored in basements, at exits, or in congested or poorly ventilated places.

An efficient delivery service can contribute to safety by removing the need to hoard cylinders in unsafe conditions.

Providing the correct grade of LP Gas and of equipment can be an effective safety measure by deterring dangerous practices. A high-off take application which may be difficult to fuel using Butane is more likely to be trouble-free with Propane, due the latter's higher vapour pressure over a wide temperature range.



## Consumer Safety Awareness

LP Gas is sold on the basis of benefits, i.e. that it is better than competing fuels for certain applications. It is also hazardous and most LP Gas-related incidents occur at or close to the point of use. In effort to win and retain consumers the marketer seeks to create safety awareness without undermining his product.

The LP Gas industry must address the safety issue directly and enlist the support of national regulatory authorities and consumer organizations to create safety awareness. Together, they should publicize the steps which consumers should take, and those to avoid, in the interest of safety, e.g. by providing Material/Safety Data Sheets.

As consumer safety depends on the appliance and the installation as well as the LP Gas supply, authorities should set standards for all three components and make consumers aware of them. An example is the CE mark which is mandatory on appliances sold in EU member states.

Cylinder labels, marketing letters, point-of-sale notices can all be effective in raising consumer safety awareness. To maintain awareness, messages and presentations should be refreshed from time to time. Brief, timely campaigns are especially useful for seasonal users.

The use of detectors and alarms should not be discouraged but neither should consumers become over-dependent on them. Such devices can be particularly useful in warning against a build-up of CO and for the safety of consumers with an impaired sense of smell.

# LPG

## SAFETY TIP

Always be careful

### BEFORE USE

- ✓ Keep the cylinder away from other sources of heat
- ✓ Never keep kerosene or other stoves on the floor where an LPG cylinder is in use.



The diagram illustrates an unsafe practice. It shows a large LPG cylinder standing on the floor. To its left is a small kerosene stove, and to its right is another kerosene stove with a flame. A large 'X' is placed over the scene, indicating that placing a kerosene stove on the floor near an LPG cylinder is dangerous.

# Managing Safety

In Tom Chess T Group of Companies Ltd , the most senior management accept responsibility for safety and should ensure that the resources are available for the safety management programme.

Safety management should be knowledge - based and should operate within a formal structure of policy and action plans.

Safety programmes should be regularly updated on the basis of systematic reviews and advances in technology.

Accident experience can be instructive and should be shared for the benefit of all.

## General

LP Gas is potentially hazardous from the time of production until it has been used and the products of combustion have been safely disposed of. The management of safety is correspondingly wide-ranging.

Management of the hazards associated with LP Gas starts with an understanding of the product and with the exercise of control under all conditions. In the event of a fire affecting LP Gas in storage, particular care is required to prevent the development of conditions which could lead to a BLEVE. If, under abnormal conditions, control is lost then the management task is to regain it with the minimum loss. LP Gas in isolation is not hazardous but even a small leakage must be dealt with immediately.

Tom Chess T Group of Companies Ltd safety management programme also addresses hazards incidental to the manner in which LP Gas is distributed and used.

At the beginning of the distribution chain LP Gas is usually stored and handled in sufficient quantity to constitute a major industrial hazard and is regulated accordingly. Further along the distribution chain LP Gas will pass through less skilled hands but the safety management task remains.

At the point of use LP Gas may be a culprit or an innocent party to an incident arising from deliberate misuse of the product or through a faulty appliance or installation. Such exposures further complicate the management task.

## Safety Management Programme

Tom Chess T Group of Companies Ltd Safety Management Programme (or System) is aimed at taking an active role to manage the safety within the business.

The Safety Management Programme addresses issues such as the business and system resources, plant design and layout, the environment, on site and off site risks, recruitment and training of personnel, managing change within the business, dealing with emergencies (including links with emergency services departments), the capacity to deal with events etc.

When properly implemented, The Safety Management Programme should significantly reduce the incident potential and the number and severity of accidents.

## Management Commitment and Leadership

Effective safety management requires a clear commitment from proprietors, and their appointed top managers, to put safety among their key concerns and priorities.

Tom Chess T Group of Companies Ltd top management demonstrates that commitment through unequivocal leadership, sanctioning and implementing the actions are required for a safety programme appropriate to the company's role in the LP Gas industry.

## Policy, Objectives, Action Plans, Resources

Tom Chess T Group of Companies Ltd publishes a safety policy, explaining its objectives and action plans to their employees and business partners.

Tom Chess T Group of Companies Ltd uses clear, written definitions of the role of managers at all levels. Individual responsibilities and objectives should be specified in respect of the safety programme.

Tom Chess T Group of Companies Ltd Safety policy is credibility with specific action plans and the resources required for implementation.

## Laws, Standards and Codes

Laws provide the legal basis for regulations intended to safeguard the safety of the general public and consumers. There may be a law specifically enacted for LP Gas but the product is sometimes brought within the scope of broader legislation.

The public interest requires a measure of safety regulation over hazardous substances, including LP Gas. Tom Chess T Group of Companies Ltd co-operates with government authorities by making their expertise available to ensure that safety regulations are soundly based.

LP Gas standards and codes embody the technical expertise of a mature industry which constantly seeks to improve its safety image and performance. There are many such standards and codes listed in Appendix Three together with web site references. Consideration should be given to adopting standards and codes which have achieved international recognition rather than undertake the necessarily laborious work of preparing, or up-dating, national standards.

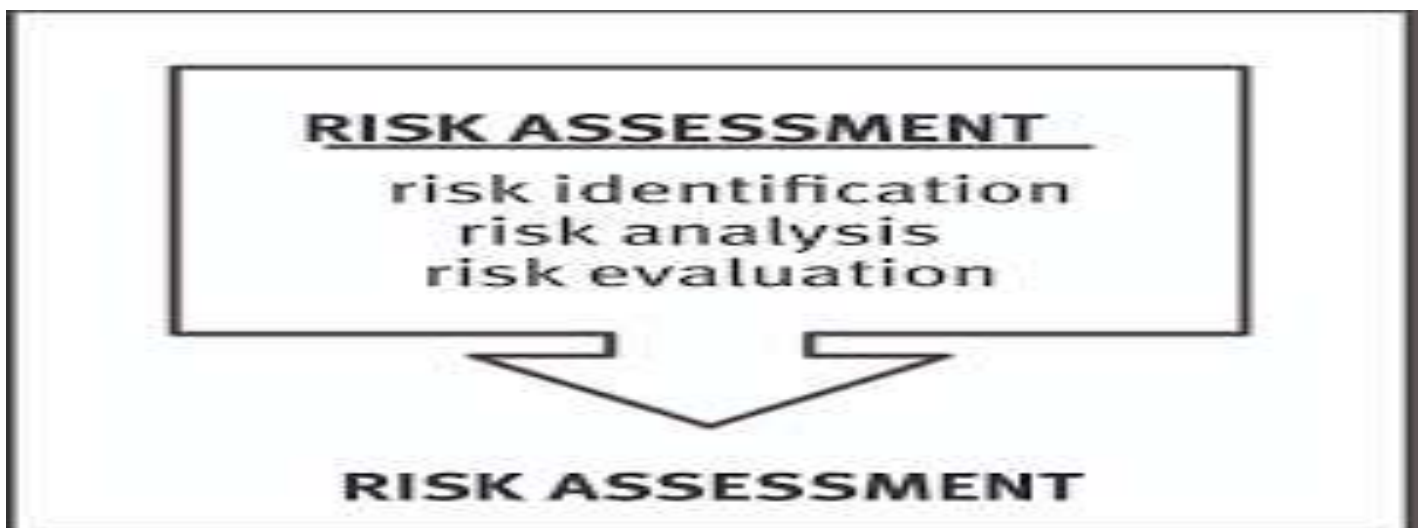
## Hazard Identification, Evaluation, Quantification, Mitigation

It is recognized that in a modern industrial society certain hazards are present and unavoidable as part of basic wants and needs. This has prompted ideas of hazard evaluation and the tolerability of risk.

The LP Gas industry has taken the initiative in LP Gas related hazard identification, evaluation and quantification, using its expertise to encourage a science-based approach by the authorities responsible for safety regulation.

Contacts between the Tom Chess T Group of Companies Ltd and the Authorities are not confined to times of difficulty. The immediate aftermath of some tragic event or incident is probably not the best time to introduce, or to amend, safety regulations.

Tom Chess T Group of Companies Ltd team - marketers, equipment and appliance manufacturers - work constantly and constructively on safety management issues through improvements in technical standards, safety features and procedures.



## Systematic Review, Corrective Action

Having published our safety policies and set safety objectives, our suppliers and marketers should put in place a system of reviews to monitor progress towards achieving those objectives. The review should be seen as a high-level activity receiving top management's attention. Operating companies should develop and update a corrective action and safety improvement plan.

The review should monitor all points of the marketer's distribution chain and provide information feedback to appliance and equipment vendors and installers.

Where a licensing system operates, evidence of systematic safety review process should be a factor in the periodic re-licensing of LP Gas facilities.

There are often useful lessons to be learned from post-incident investigations and such experience should be shared.



# Emergency Planning and Response

Planning for emergencies should be an integral part of a safety management programme that also takes into account the national and local emergency requirements that may exist in the particular country, particularly any legal ones.

Planning and response should encompass every stage of the distribution chain as well as LP Gas in storage and in use.

An emergency at an LP Gas plant may have an impact beyond its boundary fence and the APELL (Awareness and Preparedness for Emergencies at a Local Level) process should be employed for preparedness at local level.



APELL is a programme developed by UNEP in conjunction with governments and industry with the purpose of minimizing the occurrence and harmful effects of technological accidents and environmental emergencies.

## General

Emergency planning and response is one component of an overall safety management programme. The concept and procedures have been integrated into regulations for the control of major industrial hazards, prompted by initiatives which specify 'planning for emergencies' as part of the safety management system.

In these Guidelines, emergency planning and response process for LP Gas plants of a size to be classified as 'major hazards' and LP Gas in bulk transport will be discussed.

## The APELL Process

APELL is the acronym for **Awareness and Preparedness for Emergencies at Local Level**, a process developed by the UNEP Industry and Environment Office in co-operation with industry and governments. With its emphasis on preparedness at local level, the APELL process recognizes that the extent of an industrial accident's impact depends heavily on the immediate response to an emergency at the plant site and in its immediate vicinity.

Alongside this emphasis on local preparedness APELL recognizes the role of government authorities in formulating regulations and in providing the resources which local communities need. APELL neither replaces nor interferes with established emergency response provisions but seeks to increase awareness of such provisions and activities.

At local level there are three very important partners who must be involved if APELL is to be successful; local authorities, industry and local community/interest groups.

Tom Chess T Group of Companies Ltd acknowledges the need and the right of the local community to be informed about and to participate at all times in response planning for hazardous installations.

## Emergency Plan, Procedures

Expert hazard evaluation and quantification should form the basis of the emergency plan by:

- Identifying the on-site and off-site hazards
- Assessing the ability for the emergency plans to mitigate the impact of the accident or incident
- Quantifying the on-site and off-site impact of credible accident scenarios

Whether required to do so by regulation or not, Tom Chess T Group of Companies Ltd provides the initial hazard evaluation and quantification. They share this hazard information with the partners described in the APELL process and be prepared to provide independent verification if required.

The development of the emergency response plan should conform to any national or local regulatory requirements and ideally the procedures specified in the APELL process.



The emergency plan provides for an escalating sequence of events and emergency procedures tiered accordingly.

## Fire-fighting Principles, Procedures

The most effective way to fight an LP Gas fire is to shut off the LP Gas supply. If this cannot be done, it may be safer to allow the fire to burn itself out, i.e. to burn until the LP Gas supply to it has been exhausted, unless the continuing fire will result in an escalation of the emergency. The photograph below shows an ignited LP Gas flame in controlled conditions.



**An ignited LP Gas Flame in controlled conditions**

Dry powder or carbon dioxide fire extinguishers are effective against LP Gas fires.

Water is effective in cooling LP Gas vessels during a fire and in helping to keep the temperature of tanks and their contents below critical levels. Water spray can be useful in protecting fire-fighters attempting to close LP Gas supply valves in heat-affected areas and in dispersing LP Gas vapour.

Emergency response teams drawn from the plant staff should represent the first line of defense and should be trained for quick decisive action to contain emergencies before they develop and be trained to assist emergency personnel as any escalation of the emergency demands.

Emergency response to a fire on or close enough to threaten an LP Gas road tanker depends critically on the driver-operator. Therefore the quality of the equipment and training in its use are crucial to recovering control and mitigating the impact of the emergency situation.

## Internal, External Responses

Most in-plant emergencies begin in a small way or as a result of failure to deal promptly and effectively with a minor incident. Tom Chess T Group of Companies Ltd recognizes the value of rapid response by trained teams confident in their ability to deal with emergencies. Good equipment, a team spirit and regular training are essential for the commitment and confidence which ensures an effective internal response.

External response may be from local authority emergency services or from a mutual assistance group set up to respond to emergencies.

The effectiveness of both internal and external response depends initially on the seriousness of the event and then on resources, preparedness and timing. Fire drills and rehearsals for emergencies are an essential part of safety

management and should be practiced regularly. External response will be most effective when the team is totally familiar with the plant, its hazards and its defenses.

Internal and external communications are important factors in determining the effectiveness of emergency response. The slightest delay in reacting to an emergency can make the difference between success and failure. No one should be criticized for over-reacting to an emergency.

## Investigation, Corrective Action, Follow-up

The purpose of post-incident investigation is to determine the causes, both immediate and underlying, in order that lessons can be learned and corrective action taken. The investigating team should include an independent expert and should report to the owners, or to senior management. The licensing authority may wish to participate or to make an independent investigation.

An investigation may disclose the need for corrective action in respect of plant layout, equipment, systems, procedures or personnel. While the team should guard against developing an unrealistic 'wish list' senior management should be prepared to sanction their recommendations.

Senior management should be prepared to discipline anyone who causes or contributes to an incident by disregarding safety rules and procedures. They should also recognize those who respond well in an emergency.

Follow-up should include information feedback to the APELL partners. If relevant information has to be withheld or delayed for legal or other good reason this should be made clear to the partners.

If equipment or system defects contributed to an incident then equipment suppliers, installers and other plants known to be similarly equipped should be alerted.

Following a serious incident, plant management should set about maintaining and improving relationships with employees and the community and recognize that this may take time.



## Appendix One

# Product Classification and Labelling

## Hazard Warning Notices and Signs (UN)

Depending on the mixture, there are three UN classification numbers to be considered for LP Gas:

- Butane or Butane mixtures – UN 1011
- Propane or Propane mixtures – UN 1978 Or a common classification:
- Petroleum Gas, Liquefied or Liquefied Petroleum Gas – UN 1965

All these gases fall under the Hazard Classification (Transport): Class 2 Division 1, indicated as 2.1 and have to be marked with the label 2.1 'Flammable Gas'.

The colour of the placard or label is red.



## Appendix Two

# Glossary of Terms

Appliance	LP Gas consuming device e.g. stove, water heater, space heater
BLEVE	Boiling Liquid Expanding Vapour Explosion
Bulk Supply	LP Gas supply to a consumer's tank
CFCs	Chlorofluorocarbons
Cylinder	Portable LP Gas container
Cylinder Supply	LP Gas supply in cylinders
Equipment	Device(s) connecting and/or controlling LP Gas supply from a tank/cylinder to Appliances. Type of LP Gas, e.g. chemical, commercial, high purity. Proportion of Butane/Propane in LP Gas mixture, e.g. Butane rich mixture
Hazard	A threat which could cause an accident. (Definition in APELL process)
Passive Safety	Safety not dependent on active safety systems
Requalification	Periodic inspection/testing to ensure that LP Gas cylinders and tanks remain fit For service Probability of an accident occurring within a certain time, together with consequences for people, property and the environment (Definition in APELL process)
Tank	LP Gas container for bulk supply and transportation



## Appendix Three

# List of References

### General

European Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances (also known as the Seveso II Directive)  
*European Union*

Product Dossier 92/102: Liquefied Petroleum Gas.  
*CONCAWE* [refer: [www.concawe.be](http://www.concawe.be)]

LPG Safety: Quantified Risk Assessment for LPG Operations  
*European LPG Association (AEGPL)* [refer: [www.aegpl.com](http://www.aegpl.com)]

APELL - Awareness and Preparedness for Emergencies at Local Level:  
A Process for Response to Technological Accidents  
*UNEP* [refer: [www.unep.org](http://www.unep.org)]

HAZOP (A Hazard and Operability Study (HAZOP) is a systematic method for examining complex facilities or processes to find actual or potentially hazardous procedures and operations so that they may be eliminated or mitigated).  
[Refer: [www.hse.gov.uk/comah/sragtech/techmeasplantmod.htm](http://www.hse.gov.uk/comah/sragtech/techmeasplantmod.htm)]

### Technical

ISO 9162: Standard for LPG  
*International Standards Organization* [refer: [www.iso.org](http://www.iso.org)] K 2644-87:

Standard for LPG  
*Japanese Institute of Standards* [refer: [www.jisc.go.jp/www.jsa.or.jp](http://www.jisc.go.jp/www.jsa.or.jp)]

Standard 2140: Liquefied Petroleum Gas Specification and Test Methods  
*Gas Processors Association, US* [refer: [www.gasprocessors.com](http://www.gasprocessors.com)]

IS 4576: Indian Standard for LPG  
*Indian Standards Association* [refer: [www.bis.org.in](http://www.bis.org.in)]

BS 4250: Standard for Commercial Butane and Propane  
*British Standards Institute, UK* [refer: [www.bsi-global.com](http://www.bsi-global.com)]

Standard D-1835 Specification for Liquefied Petroleum (LP) Gases  
*American Society for Testing and Materials (ASTM), US* [refer: [www.astm.org](http://www.astm.org)]

Standard 54, National Fuel Gas Code  
*National Fire Protection Association, U* [refer: [www.nfpa.org](http://www.nfpa.org)]

Technical Report No. 3: Storage of Hazardous Materials  
*UNEP IE/PAC* [refer: [www.unep.org](http://www.unep.org)]

Liquefied Gas Handling Principles on Ships and in Terminals  
*Society of International Gas Tanker and Terminal Operators* [refer: [www.sigtto.org](http://www.sigtto.org)]

Guidance Notes GS 40: The Loading and Unloading of Bulk Flammable Liquids and Gases at Harbors' and Inland Waterways <i>Health and Safety Executive, UK</i>	[refer: <a href="http://www.hse.gov.uk">www.hse.gov.uk</a> ]
Safe Transport, Handling and Storage of Dangerous Substances in Port Areas <i>International Maritime Organization</i>	[refer: <a href="http://www.imo.org">www.imo.org</a> ]
Ship-to-Ship Transfer Guide (Liquefied Gases) <i>ICS, OCIMF, SIGGTO</i>	[refer: <a href="http://www.sigtto.org">www.sigtto.org</a> ]
Publication 2218 <span style="margin-left: 150px;"><i>API</i></span>	[refer: <a href="http://www.api.org">www.api.org</a> ]
Underground and Mounded Vessels Standards <i>EEMUA standard 190</i>	[refer: <a href="http://www.eemua.co.uk">www.eemua.co.uk</a> and <a href="http://www.eemua.org">www.eemua.org</a> ]
Safety Guide for Terminals Handling Ships Carrying Liquefied Gases in Bulk. OCIMF T14 <i>NFPA 307</i>	[refer: <a href="http://www.nfpa.org">www.nfpa.org</a> ]
Standard for the Construction and Fire Protection of Marine Terminals, Piers and Wharves <i>National Fire Protection Association, US</i>	[refer: <a href="http://www.nfpa.org">www.nfpa.org</a> ]
NFPA 58 Liquefied Petroleum Gas Code <i>National Fire Protection Association, US</i>	[refer: <a href="http://www.nfpa.org">www.nfpa.org</a> ]
COP 1 the Storage of LPG at Fixed Installations <i>UK (LPGA)</i>	[refer: <a href="http://www.lpga.co.uk">www.lpga.co.uk</a> ]
Model Code of Safe Practice No. 9 - Liquefied Petroleum Gas Volume 1, Large Bulk Pressurized Storage and Refrigerated Storage <i>Energy Institute, UK</i> Guide to Propane Transportation.  <i>National Propane Gas Association, US</i>	[refer: <a href="http://www.energyinst.org.uk">www.energyinst.org.uk</a> ]  [refer: <a href="http://www.npga.org">www.npga.org</a> ]
COP 2 Safe Handling and Transport in Bulk in Road Tankers and Tank Containers <i>LP Gas Association, UK</i>	[refer: <a href="http://www.lpga.co.uk">www.lpga.co.uk</a> ]
AS 2809: Road Tank Vehicles for Dangerous Goods Part 1: General and Part 3: LPG Road Tankers	
ASME section VIII: Rules for the Construction of Pressure Vessels <i>American Society of Mechanical Engineers, US</i>	[refer: <a href="http://www.asme.org">www.asme.org</a> ]
PD 5500: Specification for Unfired Fusion Welded Pressure Vessels <i>British Standards Institute, UK</i>	[refer: <a href="http://www.bsi-global.com">www.bsi-global.com</a> ]
Title 49 CFR Parts 171 - 190 Transportable LPG Cylinders <i>Department of Transportation, US</i>	[refer: <a href="http://www.dot.gov">www.dot.gov</a> ]
EN 1142: European Standard for LPG Cylinders <i>CEN</i>	[refer: <a href="http://www.cen.eu">www.cen.eu</a> ]
UN/ECE Regulation 67 European Standards for requirements for automotive LP Gas equipment fitted on vehicles	[Refer: <a href="http://www.unece.org">www.unece.org</a> ]
BS 5045 (or the equivalent EN Standard): Welded Cylinders up to 130 Litres Water Capacity <i>British Standard Institute, UK</i>	[refer: <a href="http://www.bsi-global.com">www.bsi-global.com</a> ]
Directive 84/527/EC: Welded Unalloyed Steel Gas Cylinders	[refer: <a href="http://www.unece.org">www.unece.org</a> ]
BS 5355 (and EN 13099): Filling Ratios and Developed Pressures for Liquefiable and Permanent Gases <i>British Standards Institute, UK</i>	[refer: <a href="http://www.bsi-global.com">www.bsi-global.com</a> ]
COP 7: Storage of Full and Empty Cylinders <i>LP Gas Association UK</i>	[refer: <a href="http://www.lpga.co.uk">www.lpga.co.uk</a> ]

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49 CFR Parts 107-180 Hazardous Material Regulations, Requalification of DOT cylinders  
Department of Transportation, US [refer: [www.dot.gov](http://www.dot.gov)]

49 CFR Parts 350-399 Motor Carrier Safety Regulations  
Department of Transportation, US [refer: [www.dot.gov](http://www.dot.gov)]

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National Propane Gas Association, US [refer: [www.npga.org](http://www.npga.org)]

COP 1 Installation and Maintenance of Bulk LPG Storage at Consumers' Premises  
LP Gas Association, UK [refer: [www.lpga.co.uk](http://www.lpga.co.uk)]

The Gas Safety (Installation and Use) Regulations (latest edition)  
Health and Safety Executive, UK [refer: [www.hse.gov.uk](http://www.hse.gov.uk)]

Aerosol Conversion Technology Handbook  
UNEPIE [refer: [www.unep.fr](http://www.unep.fr)]

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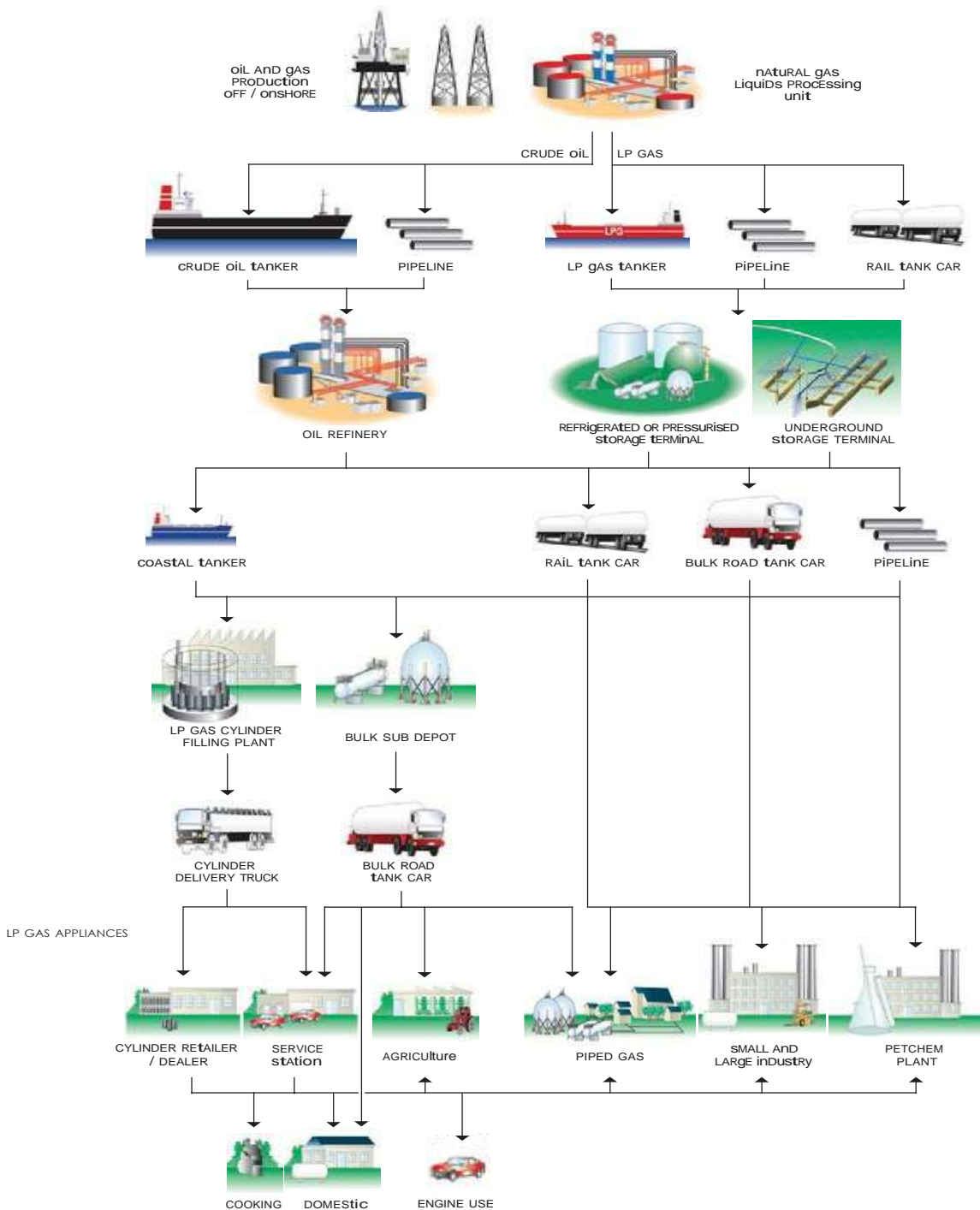
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# Appendix Four

## LP Gas Distribution Chain



### EQUIPMENT MANUFACTURES

Companies around the world provide filling, storage, controlling and safety equipment as well as services to the LP Gas industry and end users.





**APPROVAL PAGE**

**LPG SAFETY PRACTICE DOCUMENT**

	<b>NAME</b>	<b>FUNCTION</b>	<b>DATE</b>	<b>SIGN</b>
<b>CHECKED BY</b>				
<b>APPROVED BY</b>				