

ENVIRONMENTAL GUIDELINES

FOR

DEPOTS AND DISTRIBUTION OUTLETS

FOR

LIQUIFIED PETROLEUM GASES
(LPG)

PREPARED BY THE

DEPARTMENT OF THE ENVIRONMENT (DOE)

MINISTRY OF NATURAL RESOURCES AND THE ENVIRONMENT

AND THE

NATIONAL FIRE SERVICE (NFS)

ENVIRONMENTAL GUIDELINES FOR DEPOTS AND
DISTRIBUTION OUTLETS FOR COMPRESSED
INFLAMMABLE GASES

PURPOSE:

The purpose of this document is to propose measures that would prevent, control, and mitigate the environmental degradation that could arise from activities related to the establishment and operation of storage depots and major distribution outlets for compressed inflammable gases.

The guidelines herein proposed have been made based on the best available information. Therefore, the Department of the Environment reserves the right to make modifications to this document as more information becomes available.

Recognizing that there are many pitfalls to be avoided in initiating an activity of this nature, the proponent is required to adhere to the recommendations included in this Document of Guidelines. These guidelines aim at improving the consideration of the environmental aspects of all stages in the planning and execution of projects of this nature. Wanton disregard of the recommendations included herein could result in the proponent's permits being revoked.

Liquefied Petroleum Gases (e.g. butane, methane, propane, acetylene etc.) are classified as **HAZARDOUS MATERIALS** because of their extremely flammable properties and explosive potential when stored under pressure (see Appendix I for additional information on the properties, characteristics and hazards of liquid petroleum gases). The following considerations are taken into account in accordance with the hazardous properties of these compressed gases:

A. FIRE OR EXPLOSION

1. Extremely flammable.
2. May be ignited by heat, sparks, and flames.
3. Flammable vapor may rapidly spread away from leaks.
4. Vapor or gas explosion hazard indoors or outdoors.

B. HEALTH HAZARDS

1. Vapors may cause dizziness or suffocation
2. Contact can cause severe frostbite.
3. Fire may produce irritating or poisonous gases.

GENERAL GUIDELINES

BACKGROUND

This Section is designed to deal with the requirements and procedures needed when delivering filled cylinders to the households/businesses. This section will attempt to mitigate and minimize the safety issues that are inherent with this operation. The scenarios covered are as follows:

FIRE

DISCONNECTION AT CUSTOMER'S SITE

LEAKAGE

RECONNECTION

TRANSPORTING CYLINDERS

The risk of fire or leakage at the customer's site is always a factor due to the product(s) being handled. This section will put in place measures to reduce this risk to a minimum and to ensure, should an event occur, that there are resources available to deal with it speedily and at the same time safeguarding the customers and employees. This section aims to lay out the responses, since the faster a situation is brought under control, the quicker it can be dealt with. This response requires a dedicated effort on every one's part and especially on the employee(s) delivering the cylinder to the customer.

The Delivery Representative's Role

This section is designed so that the responsible person is the **DELIVERER (COMPANY)**. The risk of fire is always present, especially during disconnecting and reconnecting of cylinders; and during the loading, unloading and transporting of cylinders.

It is important that the delivery person is always alert for potential sources of ignition. Steps should be taken to extinguish ignition sources prior to moving or handling any cylinder, be it empty or full. An extinguisher should always be placed where it is easily available in case a fire should start. To minimize the risks of fire/explosion(s), the following procedures should be adopted when delivering and/or transporting cylinders.

1. Customer Delivery of Full/Empty Cylinders

- (i). All cylinders before being handled should be checked to ensure that they are correctly closed and that they are not leaking.
- (ii). The fire extinguisher provided should be placed readily available for use, down wind of the

loading.

- (iii). Cylinders should be stood upright and locked in place to ensure they cannot move and become damaged during transportation.
- (iv). Proper lifting techniques or mechanical lifting devices must be used to lift cylinders onto the vehicle. One person should not attempt to lift a full cylinder on his own.

2. Unloading and Disconnecting at the Customer's Site

- (i). When unloading a full cylinder at the customer's site the cylinder should not be dropped and/or rolled on the ground, but should be eased (mechanically/manually) unto the ground and moved using the cylinder trolley provided or carried by two (2) or more employees.
- (ii). After unloading the full cylinder, the delivery person will inspect the site of the empty cylinder that will be removed. An assessment for any sources of ignition (lighted stove, cigarettes, etc.) should be carried out and if any is/are apparent, then it should be requested from the customer that these be extinguished before proceeding to disconnect the empty cylinder.
- (iii). The extinguisher should be placed at a safe distance and the employee should try to create as much ventilation as possible by opening a door and/or window.
- (iv). The deliverer should ensure that the valve on the empty cylinder is closed and then with a proper sized spanner disconnect the cylinder.

3. Reconnection and Loading at the Customer's Site

- (i). After safely removing the empty cylinder from the customer's site, the full cylinder should be carefully moved into place.
- (ii). After the full cylinder has been moved into place and reconnected, the valve connection should be thoroughly inspected and if necessary, Teflon tape should be applied to ensure a leak proof seal.
- (iii). After the reconnection has been made, the valve should be turned on and the tightness of the connection should be checked **WITH A SOAP/WATER SOLUTION**. If bubbles are seen, then this indicates that the joint is not tight enough and the valve should be closed and the joint reconnected. This should then again be tested until a proper connection is made.

4. Removal of Empty Cylinder

- (i). The empty cylinder should then be carefully removed from the location in the same manner as above and it must be ensured that the valve is tightly closed. The extinguisher should then be collected and replaced on the vehicle.

- (ii). Prior to moving off, the deliverer should check around the vehicle to ensure that all cylinders are properly secured.

5. Reporting

Any leak discovered should be dealt with immediately and then reported to the operations manager on return. If the leak cannot be contained, then the National Fire Service should be called by the quickest means possible and the people in the surrounding 100 yards be warned of the gas leak and told not to light stoves, etc. .

A. SITE LOCATION

1. Depots and major distribution outlets, in an attempt to avoid the possibilities of major disasters, must at all times consider non-residential areas for their location.
2. It is recommended that these sites be located a minimum of 100 yards from the nearest residence.
3. Main cylinders and storage area for smaller household cylinders should be located a minimum of fifty feet away from offices.
4. A security fence should be installed around the compound with additional restricted access to main storage area.

B. STORAGE

All containers containing liquified petroleum gases must be stored under appropriate conditions.

1. All storage containers should be stored under a roof and all housing structures must be well ventilated.
2. Storage structures should be carefully located to minimize the dangers that could arise from accidental FIRE OR EXPLOSION.
3. All materials must be stored in such a way that there is always sufficient space for fire-fighting access.
4. The storage structures should avoid having unnecessary electrical installations. All electrical wiring should be done using explosion-proof wiring.

C. SAFETY SIGNS AND EQUIPMENT

1. NO SMOKING signs should be posted around the security fence and in offices.
2. Smoking should be strictly prohibited within the compound.
3. Signs should also be placed over fire extinguishers.
4. HIGHLY FLAMMABLE signs must be placed on the security fence and on storage structures
5. Signs bearing safety reminders must also be placed at key locations.
6. Fire extinguishers must be located in easily accessible places and in adequate numbers.
7. Management must ensure that fire-fighting equipment is adequate and regularly serviced.

D. ENVIRONMENTAL CONTINGENCY PLANS

1. An Environmental Contingency Plan detailing response actions to deal with the events of incidents and accidents must be prepared and submitted to the Department of the Environment along with the proposal for the establishment of these facilities.
2. This Contingency Plan must contain the list of persons to contact, their telephone numbers and the sequence of reporting.
3. The Contingency Plan must be reviewed with staff to ensure their familiarity with reporting requirements and procedures.
4. The company should carry out drills to assess staff preparedness in the event of emergencies.

OPERATIONAL GUIDELINES

This section is for use and application of depot operators and staff. These operational guidelines are provided for the environmentally safe functioning of the facility and vehicles/equipment and for the control and prevention of accidents.

A. HOUSEKEEPING/FACILITY MAINTENANCE

Operators should make sure that their general housekeeping is of the highest standard to prevent fire hazards and environmental damage.

1. Institute an appropriate building and site maintenance programme.
2. Maintain a strict odor control policy (eg. leaking gases and vapors, toilets etc.)
3. Regularly inspect equipment (gauges, compressors, extinguishers etc.)
4. Prevent leakage of pumps, valves, taps and other equipment by regular inspection and repair.
5. Provide adequate waste bins of appropriate design.
6. If possible avoid delivery and filling of cylinders at peak traffic periods.

B. STOCK CONTROL

1. Strict stock control ("ins" and "outs") is required to provide 'up to date' information on leakage and other losses. Unnecessary damage to the environment can be prevented in this way.
2. Accurate records of accidents must be kept so that similar accidents can be prevented in the future.
3. An 'on site' environmental diary for recording accidents and incidents is recommended.
4. Depot operators should complete an accident report immediately after any incident,

which poses a threat to the environment and human life, and submit a duplicate of this report to the Department of the Environment.

C. TRAINING OF STAFF

1. Routine training of staff in Hazard Management and in First Aid procedures must be conducted on a regular basis.
2. A permanent record should be kept of the instructions received.
3. Working instructions and procedures, intended to prevent bad working practices, must be readily available to all staff and should include the following:-
 - (a) Instruction for the safe and correct operation of any equipment and storage of materials.
 - (b) Hygiene and safety instructions and procedures.
 - (c) Emergency instructions and procedures.
 - (d) Record keeping procedures.

D. CYLINDER DELIVERY VEHICLE AND EQUIPMENT

SAFETY PRECAUTIONS

When delivering cylinders to residential or industrial customers, the employees will be responsible for the cylinder delivery truck and for transporting filled cylinders safely and efficiently. The employees will be responsible to conduct regular inspection and maintenance of the truck, ensure that its equipment and the cylinder cargo are in good condition and that they meet the requirements/standards of the local authority.

The following safety precautions should be considered when transporting LPG Cylinders:

1. Keep a properly inspected fire extinguisher (minimum 20 ABC) within reach at all times.
2. If a cylinder begins to leak uncontrollably, it should be moved to an area that is free from sources of ignition and fire-fighting personnel should be notified immediately. The employee should stay at the scene to warn people away from the cylinder and protect it from sources of ignition until help arrives.
3. A cylinder delivery truck should never be left unattended in a congested area or within 50 feet of apartments, schools, hospitals and/or other public buildings.
4. If due to an emergency breakdown, the truck must be stopped on a highway, it should be

- pulled off the roadway as far as possible and emergency reflectors/indicators should be set out or turned on to warn oncoming traffic. Flares should not be used.
5. Before leaving the cab, the driver must ensure that the vehicle is in gear and the hand-brake is fully set. If necessary, chock blocks should be put in place to keep the truck from rolling.
 6. When working with cylinders and other heavy objects, the employee(s) should wear heavy work gloves and steel-toed shoes to protect their hands and feet.
 7. A cylinder should never be dropped, thrown and/or rolled on the ground and the cylinder valve should never be used as a handhold.

DELIVERY VEHICLE & EQUIPMENT INSPECTIONS

Before placing the cylinder delivery truck into service each day, it must be inspected carefully to ensure that it is safe to drive and to carry and deliver LP-gas. The use of a special inspection report form could greatly assist in conducting a complete inspection. If a form is available it should be followed carefully.

Some areas of particular importance are; the vehicle chassis and drive train, the emergency/hazard equipment and the cylinder loading and securing equipment.

➤ **INSPECTING THE VEHICLE CHASSIS AND DRIVE TRAIN**

The inspection of a cylinder delivery truck chassis and drive train includes pre-start checks, checks while the engine is running and post operational checks.

When the inspection have been completed, any necessary repairs/maintenance should be reported, especially if these would affect the safety of the delivery truck. If possible, all the faults/deficiencies should be repaired before loading the truck and having it placed in service. Simple defects such as a non-working windshield wiper could be a serious safety hazard if the truck is driven in the rain.

➤ **INSPECTING THE EMERGENCY/HAZARD EQUIPMENT**

A complete check of all the emergency/hazard equipment carried on the truck must be conducted. This inspection should include the fire extinguisher(s), reflectors, tool kits, etc. It must be ascertained that the fire extinguisher is properly inspected and is fully charged. If the truck is equipped with 4-way emergency flashers, check their operation.

It should be ensured that all necessary tools and equipment are on board the truck and any missing tools should be replaced.

➤ **INSPECTING THE CYLINDER LOADING AND SECURING EQUIPMENT**

All cylinder delivery trucks must have some provision for securing cylinders, to secure them so that they cannot move around while the truck is in motion. This will prevent the cylinders from being damaged and keeps the load from shifting and impairing the driver's ability to handle the vehicle while making sharp turns and quick stop. Some trucks are equipped with storage racks while others may have cable, chain or strap binders to hold the cylinders in place. The racks should be checked for structural weaknesses and/or the cables should be checked for any fraying or damages. Should any repairs be necessary, these should be reported and if possible repaired before the truck is loaded and used.

Some other trucks are equipped with unloading ramps, power lift gates, or other special equipment for loading and unloading cylinders, these should be checked carefully everyday and the manufacturer's literature for recommended maintenance and inspection procedures should be followed carefully.

➤ **INSPECTING THE CYLINDER CARGO**

After all necessary inspections of the delivery truck and equipment have been completed, the cylinders should then be loaded and SECURED. Before they are loaded, each cylinder should be inspected to ensure that it is properly marked, free from noticeable leaks and equipped with the proper valve protection.

➤ **HAZARDOUS MATERIAL MARKINGS**

Every cylinder, whether it is full or empty (contains vapor only) must have markings indicating its hazard class and product shipping name. If these markings are absent or illegible, these should be replaced before loading of the cylinder(s).

➤ **VALVE PROTECTION**

No cylinder should be transported without adequate protection for its valve(s). In the case of exchange cylinders, they should be checked to ensure that the protective cap is installed and fully seated on the cylinder boss. On lift truck cylinders, it must be ascertained that the protective neck ring is intact and that the filler and safety valves have plastic caps to protect them against dirt and debris. These should be replaced if missing and any seriously damaged cylinders must be reported.

➤ **LOADING AND SECURING CYLINDER CARGO**

When cylinders are being placed on a delivery truck, the load should be distributed as evenly as possible. An attempt should be made as much as possible to keep the majority of the load between the front and rear axles and that it is evenly distributed from front to back and side to side. It must be emphasized that an unbalanced load can cause the truck to turn over or handle poorly in an emergency situation.

ALL CYLINDERS MUST BE PLACED IN AN UPRIGHT POSITION AND FIRMLY

SECURED.

APPENDIX I

PROPERTIES, CHARACTERISTICS AND HAZARDS OF LPG

Properties of LPG

The two liquified petroleum gases in general use are commercial butane and commercial propane. At present, Belize uses a mixture of approximately 30% propane and 70%. Their main physical properties are:

		Butane	Propane
Relative density (to water) of liquid at 15.6°C		0.57 - 0.580	.50 - 0.51
Liters/Ton of liquid at 15.6°C		1723 - 1760	1957 - 2091
Relative Density (to air) of vapor at 15.6°C and 1015.9 mbar		1.90 - 2.10	1.40 - 1.55
Ratio of gas to liquid volume at 15.6°C and 1015.0 mbar		.233	.274
Vapor Pressure at 20°C	bar	2.5	9
	psig	40	130
Vapor Pressure at 50°C	bar	7	19.6
	psig	100	283
Lower Limit of Flammability	%	1.8	2.2
Upper Limit of Flammability	%	9.0	10.0

LPG is a generic term used to describe liquifiable gases consisting predominantly of C-3 and C-4 hydrocarbons. The term includes commercial butane, propane and mixtures of both. These hydrocarbons exist as gases at normal temperatures but can be liquified under moderate pressure. If the pressure is subsequently released, the hydrocarbons again become gaseous.

CHARACTERISTICS AND HAZARDS:

LPG is colorless and it's density (weight) as a liquid is approximately half that of water. If LPG is spilt on water, it will float on the surface before vaporizing. The liquid has approximately 1/250 of the gas volume.

The gas or vapor is at least 1 2 times as dense as air and does not disperse easliy. It will tend to sink to the lowest possible level and may accumulate in pit drains or other depressions. In still air conditions, any accumulation will take time to disperse.

LPG forms flammable mixtures in air in concentrations of between approximately 2% and 10%. It can, therefore, be a fire and explosion hazard if stores or used incorrectly. Outside this range, any mixture is either weak or too rich to propagate flames. Within this range, there is risk of fire or explosion. Small quantities of the liquified gas can give rise to large volumes of vapor/air mixture

and thus cause a considerable hazard.

A suitable, properly calibrated combustible gas indicator (explosimeter) may be used for testing the concentration of LPG in air. On no account is a naked flame or light to be used to detect a leak. If the LPG escapes into a confined space and is ignited, an explosion could result. If an LPG vessel (container) is involved in a fire, it may overheat and rupture violently, giving an intensely hot fireball and may project pieces of the container considerable distances.

Vapor/air mixtures from leakage or other causes may be ignited some distance from the point of escape and the flame travel back to the source.

At very high concentrations, when mixed with air, LPG vapor is anaesthetic and subsequently may cause suffocation by diluting or decreasing the available oxygen.

LPG can cause severe cold burns owing to its rapid vaporization and the consequent lowering of temperature. Protective clothing such as gloves should be worn.

LPG is normally odorized before distribution by the addition of an odorant such as ethyl mercaptan so that it has a characteristic smell which can easily be recognized. This enables the detection by smell of the gas concentrate down to one fifth of the lower flammable limit (approximately 0.4% of the gas in air). Significant leaks may also be detected by a hissing sound or by icing in the area of the leak. Small leaks may be detected by brushing the suspected area with a detergent/water mixture where bubbles will form the leak. ***ON NO ACCOUNT SHOULD A NAKED FLAME OR OTHER SOURCE OF IGNITION BE USED TO DETECT A LEAK.***

A container which had held LPG and is empty may still contain LPG in vapor form and is potentially dangerous. In this state, the internal pressure is approximately