THE UNIVERSITY OF THE WEST INDIES

MONA CAMPUS

STANDARDS FOR THE SAFE USE AND MANAGEMENT OF LIQUEFIED PETROLEUM GAS (LPG) CONTAINERS

PREAMBLE

1. The main facility of the Mona Campus of the University of the West Indies sits on 653 acres of land at Mona in the parish of St. Andrew, Jamaica. The Campus has a peak population of over 20,000. The administrative, teaching and research facilities straddles both the compound of the University Hospital of the West Indies and the Mona Campus itself.
2. Additionally, the Mona Campus operates the Western Jamaica Campus located in Montego Bay St. James. That operation takes place in two locations; teaching facilities and student accommodation at 10 Queens Drive and student accommodation at Kent Avenue Montego Bay, St James. In Port Royal, Kingston and Discovery Bay, St Ann, the Campus also operates two Marine Laboratories.
3. The Campus has a mix of buildings ranging from single floor up to seven floors. The operations include the following;
    - Administrative offices
    - Conference rooms
    - Libraries
    - Teaching and Research laboratories.
    - Classrooms and Lecture Theaters
    - Student Housing accommodations
    - A Lodge and Conference Centre
    - Sporting facilities
    - Water extraction well
    - Cogenerating (Electricity/Air-conditioning) Plant
    - Single family dwelling
    - Food establishments
    - Private Beach

4. Liquid petroleum gas is used for a number of applications across the campus. These include but are not limited to the following;
    - Commercial
    - Industrial
    - Teaching and research
    - Domestic
5. Research done has shown that Jamaica appears to have no single standard for the location and safety of commercial LPG Cylinders. The National Environment and Planning Agency (NEPA) has some guidelines for the INSTALLATION of LPG FILLING PLANTS. The Bureau of Standards Jamaica (BSJ) has Standards for the QUALITY of the PRODUCT and that of the CONTAINERS. Marketing/Distribution companies have standards for the LOCATION and SAFETY of LPG containers above 45kgs (100lbs).
6. Based on the current and future use of LPG on the campus, it was deemed necessary to create Standards for the campus as we await a national initiative to create same.

HAZARDS

7. LIQUEFIED PETROLEUM GAS
    a. Liquefied petroleum gas (LPG) is a colourless odourless liquid which readily evaporates into a gas. Normally an odourant has been added to it to help detect leaks.
    b. LPG (either Butane or Propane), is generally stored and distributed as a liquid and it is widely used for process and space heating, cooking and automotive propulsion.
    c. It is classified as highly flammable. Where it contains more than 0.1%Butadiene, it is also classified as a carcinogen and mutagen. LPG is non-corrosive but can dissolve lubricants, certain plastics or synthetic rubbers.
8. DANGERS OF LIQUEFIED PETROLEUM GAS
    d. LPG may leak as a gas or a liquid. If the liquid leaks it will quickly evaporate and form a relatively large cloud of gas which will drop to the ground, as it is heavier than air. LPG vapours can run for long distances along the ground and can collect in drains or basements. When the gas meets a source of ignition it can burn or explode.
    e. Cylinders can explode if involved in a fire. LPG can cause cold burns to the skin and it can act as an asphyxiant at high concentrations.

SCOPE

9. These Guidelines cover outdoor and indoor LPG cylinder installations. It is intended for commercial, industrial, teaching and residential premises.

GUIDELINES

10. These Standards are guided by the Occupational Safety and Health Administration (OSHA) and the National Fire Protection Association (NFPA).

11. The Occupational Safety and Health Administration (OSHA) addresses the storage and handling of LPG in 29 Code of Federal Regulations (CFR) 1910.110. The National Fire Protection Association (NFPA) standard on LPG, NFPA 58 Liquefied Petroleum Gas Code, covers the storage, handling, transportation, and use of LPG. This Code was last revised in 2017.

GENERAL REQUIREMENTS

12. All LPG cylinder installations shall be located outdoors and on the ground levels for all commercial, industrial, residential and teaching facilities.
13. Locating LPG cylinders indoor is restricted to the ground floor of facilities. Where permitted; the units shall be a maximum of one (1) 11kg (25lbs) cylinder
14. Single family residential facilities may be permitted to have no more than two (2) 45kg (100lb) cylinders at any point in time. Where permitted, these units must be located outdoors.
15. For multi-person dwelling facilities such as the Halls of Residence, only Bulk Containers (i.e those above 45kg/100lbs), are to be installed, where required. Where permitted, these units shall be installed in keeping with these Standards.
16. LPG containers should be stored in the upright position

APPLICABILITY

17. Sections 9,10,11,and 13 above, deals with containers of 45kgs/100lbs and below, the remainder of the Standards are applicable to Bulk Containers; those above 45kgs (100lbs)

APPROVAL

18. All LPG container installations in teaching, residential and industrial premises, including their manifold/piping systems, shall be in keeping with these said Standards and subject to the approval of the Technical and Environmental Committee of the Grounds, Building and Premises Committee.
19. The information to be submitted for approval are;
    a. Location and site plans.
    b. Schematic diagrams of the LPG supply system showing regulator, emergency shut-off valve, remote cut-off device, pipe entry and any other related safety features.
    c. Plan and elevation views showing the following details:
        i. Location, quantity and capacity (in kg) of LPG cylinders
        ii. Locations of ancillary fixtures and fittings, e.g. regulators, emergency shut-off valve, change-over valves, remote cut-off device, knock-out pot, pipe entries, etc.
        iii. Housing for the LPG cylinders, e.g. cabinets, fencing, compartment wall, etc.
        iv. All openings (doors, air intakes, windows, drains, manholes, etc.) and exits adjacent to the LPG installation
        v. Location of hydrant, access way, access road, car parking area, building and boundary lines, source of ignition, etc.

vi. Fire safety provisions, e.g. fire hose reel, fire extinguisher, sprinkler protection (if any), gas leak detector (if any), any other related detection, alarm and/or suppressant systemc.

vii. For LPG cylinders installation involving mechanical ventilation system and/or fire suppression system, separate Mechanical Ventilation plan and/or Fire Protection plan shall be submitted for approval.

PLACEMENT

20. Units may be placed below or above ground with the following general/specific requirements;

f. General

i. The cylinder shall be placed on a firm, clean, dry and level base. They shall be sited at ground level and in a well-ventilated area where any gas leakage can safely and rapidly disperse.

ii. They shall not be placed close to any passageways or exits and shall not cause any obstruction or danger to the occupants during gas leakage or fire.

iii. Placement will be guided by *Table 1 at APPENDIX A.*

iv. Cylinders shall not be located within 3m of any fire exit route of a building having only one exit. If the 3m distance cannot be complied with, a 2-hour fire rated masonry wall shall be provided between the fire exit and the LPG installation so as to achieve the equivalent 3m horizontal distance. The masonry wall shall be at least 1.8m high.

v. The LPG cylinders shall be located at least 1.5m horizontally away from any openings (windows, doors, air vents, balanced-flue outlets, etc.) of the building having more than one exit. If the 1.5m distance cannot be complied, a 2-hour fire rated masonry wall must be provided between the openings and the installation so as to maintain a 1.5m horizontal distance. The masonry wall should be at least 1.8m high.

vi. A minimum distance of 3m must be maintained between the edge of a vehicle Parking Lot.

vii. LPG cylinders shall be located at least 5m horizontally from any mechanical air intake which is below any part of the manifold system and 1.5m from any mechanical intake which is above any part of the manifold system.

viii. LPG cylinders may be installed below windows or openings provided that there is a minimum distance of 150mm between the top of any cylinder or the manifold system and the bottom of the windows or openings.

ix. LPG cylinders of total capacity up to 600kg shall be located at least 1.5m from any uncovered opening that is below the level of the cylinders, such as drains, pits, openings to basements, etc. For LPG cylinders having total

capacity above 600kg, the distance from any uncovered opening shall be at least 3m.

x. LPG cylinders shall be located at least 3m away from any boundary and any Fire Engine access-way.
xi. LPG cylinders shall be located at least 10m away from any fire hydrant.
xii. The units should be sited in low/no pedestrian and vehicular traffic area
xiii. The area should be well ventilated
xiv. The vertical clearance from the top of the container to any overhead power distribution line of >/=600v, is 1.8m (6ft)
xv. Containers installed for use shall not be stacked one above the other
xvi. Readily ignitable material such as weeds and long dry grass shall be removed within 3m (10ft) of any container.
xvii. The minimum separation between liquefied petroleum gas containers and flammable liquid tanks shall be 6m (20ft), and the minimum separation between a container and the centerline of the dike shall be 3m (10ft). The foregoing provision shall not apply when LPG containers of 473L (125 gals) or less capacity are installed adjacent to Class III flammable liquid tanks of 1040L (275gals) or less capacity.

b. Below Ground
   i. Vehicles will not be permitted to move over the area holding such container. The containers are to be adequately protected against vehicular damage
   ii. No building shall be built above a buried container
   iii. The portion of the container below the surface and for a vertical distance not less than 8cm (3") above the surface of the ground is protected to resist corrosion, and the container is protected against settling and corrosion as required for fully buried containers.
   iv. Containers buried underground shall be placed so that the top of the container is not less than 15cm (6") below grade.
   v. It will not be necessary to cover the portion of the container to which manhole and other connections are affixed
   vi. When necessary to prevent floating, containers shall be securely anchored or weighted.

c. Above Ground
   i. The cylinder shall be placed on a firm/solid concrete/masonry foundation.
   ii. The containers are to be adequately protected against vehicular damage
   iii. Cylinders must be securely attached to the base to prevent /minimize movement if disturbed by forces of nature or motorized unit.

iv. Containers must have secure anchorage or adequate pier height shall be provided against possible container flotation wherever sufficiently high floodwater might occur.
v. Suitable means shall be taken to prevent the accumulation of flammable liquids under adjacent liquefied petroleum gas containers, such as by dyking, diversion curbs, or grading.
vi. When dykes are used with flammable liquid tanks, no liquefied petroleum gas containers shall be located within the dyked area.
vii. When permanently installed containers are interconnected, provision shall be made to compensate for expansion, contraction, vibration, and settling of containers, and interconnecting piping. Where flexible connections are used, they shall be of an approved type and shall be designed for a bursting pressure of not less than five times the vapor pressure of the product at 37ºC (100º F). The use of nonmetallic hose is prohibited for permanently interconnecting such containers.

RESTAURANT EXEMPTION

21. The clause on placements, specific to restaurants, is attached as APPENDIX B

CONDITIONS FOR INDOOR STORAGE/USE OF LPG IN EATING OUTLETS

22. Conditions for the indoor storage /use of LPG in food establishments are attached as APPENDIX C.

SIGNAGE

23. Signage shall be place as shown below
    a. "NO SMOKING"
    b. "NO NAKED LIGHT/FLAME"
    c. The makings above should conform to the following;
        i. A minimum of 7.6cm(3") high and 2.5cm(1")wide
        ii. Written with Red (British Standard BS381 538 - Post Office Red)
    d. Name and address of the supplier of the container, or with the trade name of the container.
    e. All safety marking must be clearly visible to the public.

TRANSPORTATION AND DELIVERY

24. In order to mitigate any risk and to reduce exposure from the movement and delivery of LPG on the Campus, the following protocols must be observed;
    a. The Campus recommends the delivery of bulk above 45kgs (100 lbs) LPG on weekends (Saturdays and Sundays) and during reduced business hours; from 6:00 to 10:00 pm on week days.
    b. The receiving entity must inform the Director of Security no less than three (3) hours before the arrival of the delivery.
    c. The Director of Security will be responsible for making the necessary arrangement for its access and egress of the Campus.
    d. The receiving entity must ensure that the appropriate signs are posted when deliver is being done and that access the area is restricted.

PROTECTION

25. Where it is possible that vehicles could come in contact with the LPG Containers, vehicle restraint barriers should be erected.
    a. The barriers must be made a suitable material and constructed in such a manner to prevent vehicles from coming in contact with the container
    b. The said barriers should be painted in black (British Standard BS 4800 18 A 14-Black) and yellow (British Standard BS 4800 10 E 51-Yellow) The colours should be applied alternately (from the base of the barrier). The bars of colouring should be of no less than 10cm (4") wide).
    c. Access to the area containing the container should be restricted to only authorized persons.
    d. LPG cylinders located in places accessible to the public shall be protected and locked against tampering and accidental damage by fencing of height not less than 1.8m (6') or a suitable housing or a cabinet made of non-combustible material.
    e. There shall not be any corrosive, toxic or oxidizing materials located within 6m (20') from the cylinder installation.

ACCESS

26. Suitable roadways or means of access for extinguishing equipment such as wheeled extinguishers or fire department apparatus shall be provided.

FIRE SAFETY

27. The required fire safety systems should be in place. These include but are not limited to the following;
    a. Appropriate AB extinguisher must be located no more than 15m (50') from the storage location.
    b. For kitchen provided with fixed fire suppression system, activation of the system shall automatically shut off the supply of LPG to the kitchen.
    c. Remote Emergency shut-off valve shall be located at least 3m (10') away from the edge of the installation. It shall be clearly marked and placed at a suitable height for easy access during emergencies.
    d. There shall be no ignition source within 3m (10') from the cylinder installation.
    e. Each facility shall have a designated Safety Officer. Personnel operating within the respective facilities served by the containers should be sufficiently trained, oriented and be able to perform basic fire prevention and suppression activities.

VALVES

28. Valves, fittings, and accessories connected directly to the container including primary shutoff valves, must be of material and design suitable for LPG service.
29. An Emergency Shut-off Valve is to be located as close to the container as is practicable.

PIPING

30. Piping shall be in accordance with APPENDIX D

TUBING

31. Tubing shall be in accordance with APPENDIX E

Sources

1. *The Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.110.*
2. *The National Fire Protection Association (NFPA) Code 58 (Revised 2017).*
3. *The Factories Act (1943)*
4. *The Factories Regulation (1961).*
5. *The Factories (Amendment) Act (2009)*
6. *The Bureau of Standards Jamaica (JS 41:2014 and JS 25:2010)*
7. *Draft Occupational Safety and Health Act (Jamaica)*
8. *Petroleum Quality Control Act (1990.2001)*
9. *National Environment and Planning Agency –Standards for Business Developers (Vol. 6)*
10. *American National Standards Institute*
11. *American Petroleum Institute*

TABLE 1[1]

WATER CAPACITY PER CONTAINER	MINIMUM DISTANCE		
	CONTAINERS		BETWEEN ABOVE GROUND CONTAINERS
	UNDER GROUND	ABOVE GROUND	
Less than 473 litres/125 gals	*None*	*None*	*None.*
473 litres/125 gals to 946 litres/250 gals	*3 metres/10 feet*	*3 metres/10 feet*	*1 metre/3 feet*
947 litres /251gals to 1893litres/500 gals	*3 metres/10 feet*	*3 metres/10 feet*	*1 metre/3 feet*
1894 litres/501gals to 7571 litres/2,000 gals	*8 metres/25 feet*	*8 metres/25 feet*	*1.5 metres/ 5 feet*
7572 litres/2,001 gals to 113,562 litres/30,000 gals	*15 metres/50 feet*	*15 metres/50 feet*	-
113,563litres/30,001 gals to 264,979 litres/70,000 gals	*15 metres/50 feet*	*23 metres/75 feet*	-
264,980 litres/70,001 gals/ to 340,687 litres/90,000 gals	*15 metres/50 feet*	*30 metres/100 feet*	-

[1] NFPA 58 (2017)

APPENDIX B

RESTAURANT EXEMPTION

1. *The "restaurant exemption," clause provides a special case that allows the installation of one LPG container of 1200 gal (4.5 m3) or less to be 10 ft (3 m) from a building, rather than the 25 ft (7.6 m) required in Table 1.*
2. *The 10 ft (3 m) spacing of one container with 1200 gal (4.5 m3) or less water capacity is allowed only if one such container is installed and there are no other LP-Gas containers of more than 125 gal (0.5 m3) water capacity within 25 ft (7.6 m).*
3. *The provision was created because of the limited space often found in commercial areas, and it has continued to be used because fire records do not indicate a problem with the reduced distance.*
4. *Note that the 25 ft (7.6 m) separation distance to other LP-Gas containers is applicable in all cases, even if two different users would like to install containers less than 25 ft (7.6 m) apart.*

APPENDIX C

CONDITIONS FOR INDOOR STORAGE/USE OF LPG IN FOOD ESTABLISHMENTS

Below are the conditions for storage/ LPG in food establishments

a. *Definition: Food Establishments are defined as any facility where food is prepared for human consumption.*
b. *General Requirements: All eating outlets shall not use or store LPG cylinders within building unless the following conditions are fulfilled;*
    i. *The eating outlet is located on or above ground level.*
    ii. *It is naturally ventilated.*
c. *The maximum allowable quantity of LPG shall be limited to two (2) x 11kg (25lbs) cylinders (including standby cylinder) per food stall; and The total capacity for each facility (such as a Food Court) shall not be more than 200 kg. (440lbs)*
d. *The Fire Safety Requirements shall be ;*
    i. *The eating outlet shall be separated by fire-resistant walls (1-hour fire resisting for sprinkler protected building and 2-hour for non-sprinkler protected building) from other areas.*
    ii. *Stalls within food court or coffee-shop shall be separated from each other with 1-hour fire-resisting side-walls.*
    iii. *Each cylinder shall be connected to cooking hob/stove with the approved flexible hose.*
    iv. *The LPG cylinders shall not be connected together with manifold system.*
    v. *LPG Cabinet shall be housed in a 2.5mm thick steel cabinet. There shall be not more than 2 x 15 kg cylinders in each cabinet.*
    vi. *The cabinet shall be placed directly on a firm floor.*
    vii. *The cabinet shall be adequately ventilated with openings at the bottom of the cabinet.*
    viii. *The cabinet should always be kept free of any combustible materials.*
    ix. *The Gas-Leak Detection System shall be provided. The system shall be linked to shut off the LPG supply automatically and activate local alert alarm. The gas-leak detector shall be located at low level and near to the possible leak areas such as the connecting hoses, LPG cylinder cabinets, etc.*
    x. *If kitchen automatic fire suppression system is provided, it shall also be linked to shut-off the LPG supply automatically.*

PIPING

Pipe shall be wrought iron or steel (black or galvanized), brass, copper, or aluminum alloy. Aluminum alloy pipe shall be at least in accordance with the specifications for Aluminum Alloy Pipe, American National Standards Institute (ANSI) H38.7-1969 (ASTM, B241-69).

a. *Aluminum Alloy pipe shall be protected against external corrosion when it is in contact with dissimilar metals other than galvanized steel, or its location is subject to repeated wetting by such liquids as water (except rain water), detergents, sewage, or leaking from other piping, or it passes through flooring, plaster, masonry, or insulation.*
b. *Galvanized sheet steel or pipe, galvanized inside and out, may be considered suitable protection.*
c. *The maximum nominal pipe size for aluminum pipe shall be 2cm (3/4") and shall not be used for pressures exceeding 20 p.s.i.g.*
d. *Aluminum alloy pipe shall not be installed within 15cm (6") of the ground.*
e. *Containers shall be set upon firm foundation or otherwise firmly secured; the possible effect on the outlet piping of settling shall be guarded against by a flexible connection or special fitting.*
f. *The liquid LPG pipelines in "Yellow" (BS 4800 08 C 35-Yellow) with the marking of the word "LPG" at intervals of not more than 3m (10').*

APPENDIX E

TUBING

Tubing shall be seamless and of copper, brass, steel, or aluminum alloy. Copper tubing shall be of type K or L or equivalent as covered in the Specification for Seamless Copper Water Tube, ANSI H23.1-1970 (ASTM B88-69). Aluminum alloy tubing shall be of Type A or B or equivalent as covered in Specification ASTM B210-68.

a. *Aluminum alloy tubing shall be protected against external corrosion when it is in contact with dissimilar metals other than galvanized steel, or its location is subject to repeated wetting by liquids such as water (except rainwater), detergents, sewage, or leakage from other piping, or it passes through flooring, plaster, masonry, or insulation.*
b. *Galvanized sheet steel or pipe, galvanized inside and out, may be considered suitable protection. The maximum outside diameter for aluminum alloy tubing shall be 2cm (3/4") and shall not be used for pressures exceeding 20 p.s.i.g.*
c. *Aluminum alloy tubing shall not be installed within 15cm (6") of the ground.*