

# Risk Management in Siting Petrol and Gas Stations in Maiduguri Metropolis Borno State

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**Abstract:** This study assessed the risk management or preparedness measures in Liquefied Petroleum Gas (LPG) stations in Maiduguri metropolis. The sample size of this study comprised of 79 licensed Liquefied Petroleum Gas Stations located within the metropolis obtained from the regulatory agency. The data were collected, administered analysed using Kobocollect App, Spearman Rank Correlation and percentages. The findings reveal that 96.2% of gas stations were stand-alone while 3.8% are with petrol stations, the storage tanks are cylindrical and were placed above-ground. Majority (88.61%) of the staff have been trained in safety and firefighting with 65.82% possessing automated Gas detector, 21.52% having mechanical gas detector, 8.68% having both mechanical and automated gas detectors while 5.06% have no leak detection devices. Also, 88.61% of gas stations have emergency plans, 3.8% have no emergency plans while on how often drills were conducted; 50.63% of respondents indicated that drills were conducted once, 22.78% twice and 3.8% thrice a year. Finally, it was found that 86.7% of the vulnerability to LPG station risk is determined by the type of station. There is therefore the need for regular assessment and monitoring of facilities by the regulatory agency to mitigate potential disasters due to LPG stations for sustainable development in the metropolis.

**Keywords:** Hazardous Chemicals; Liquefied Petroleum Gas; Liquefied Petroleum Gas Stations

## INTRODUCTION

According to World Health Organization more than million lives and properties worth more than N4.5 billion are lost to fire outbreaks associated with petroleum product mishandling (Abbasi, 2017). As also reported by the European Environmental Agency besides creating environmental hazards, petrol and gas can also pose health hazards if inhaled, ingested, or come into contact with the skin or eye. European Fuel Oxygenates Association equally noted that exposure to petroleum vapor with a concentration of between 500ppm and 1000ppm could cause respiratory tract irritation. If the situations continue thereafter, such could lead to narcotics effects with headaches, nausea, dizziness and mental confusion (Laminu, 2023)

However, in the Nigeria, petrol and gas stations are being sited where they are obstruction to traffic and endanger people's lives. The siting of petrol and gas stations without compliance to the standard set by regulatory agencies and the environmental implications can pose danger to human and environment (Monney, 2015)

In Nigeria most petrol and gas stations are located along the roads often too close to each other and residential buildings, place of worship, schools, hospital and markets. These constitute potential danger such as fire incidence, which can destroy lives and properties. Inappropriate handling of petroleum products has the potential to create fire accidents. From 1993 to 2020, approximately 103 incidents related to fire explosion in petrol a gas stations in Nigeria(Khatsu 2017)

The study by Ulakpa et al., (2019) showed that the majority of Petroleum and gas Filling Stations in Nigeria were located close to residents, with setbacks from the road and residential areas of less than 30 metres recommended by department of petroleum resources (DPR) in 90% of the filling stations.

It is therefore necessary to plan petrol and gas station in best location to mitigate unnecessary environmental and human hazard in Nigeria.

### **Literature Review**

Considering the high risk and dangers associated with petroleum product as a highly inflammable product, its exploration, transportation, offloading, storing and sale points and facilities should not be taken for granted like other products. In most of the urban areas of developing countries, there has been a rapid increase in the growth of petrol filling stations which serves the transportation industry and other industries in the countries. This trend is however associated with issues and challenges that relates to environmental safety and health of the people within the vicinity. Since petrol is a mixture of many organic substances and has properties that can cause fire, explosion, health and environmental hazards if misused, any site chosen for petrol stations should be sufficiently spacious to minimize the risk of any unauthorized person to be at, or near them (EFOA, 1999)

similar effort would have been taken to supply gas and petrol to service stations, but instead, deliveries by petroleum tankers, via trucks had been in use. It is in the increasing number and frequency of these supplies to homes and service stations which had resulted in the increasing cases of crashes involving petroleum tankers. Without a new policy direction in place on the distribution of these products, it means that we will continue with the use of trucks with its attendant risks.

In siting petrol stations, it is important to take some precautionary measures like locating them at a required distance from buildings; places of public assembly such as markets, hospitals and schools and areas of high traffic congestions and residential buildings. This should be in accordance with the guidelines provided by the Department of Petroleum Resources and Fire service safety rules that the distance between two nearest petrol stations should be 400m and between a petrol station to the nearest residential building should not be less than 50m to shun possible hazards. Unfortunately, these guidelines have not been followed. As a result, there have been proliferations of petrol stations that are located close to residential areas. This might have constituted serious hazards to residence in close proximity to such petrol stations. It is therefore imperative to provide mitigation approach in siting petrol and gas station in Nigeria

### **AIM**

The aim of this study is to manage risk associated with siting petrol and gas station in the study area with are view to providing best practice and sustainable petrol and gas location in Nigeria.

### **OBJECTIVES**

- i. To identify physical planning and department of petroleum resources standard in siting filling station in Nigeria
- ii. To investigate the compliance of the existing petrol and gas station to the physical planning and department of petroleum resources standard

### **Methodology**

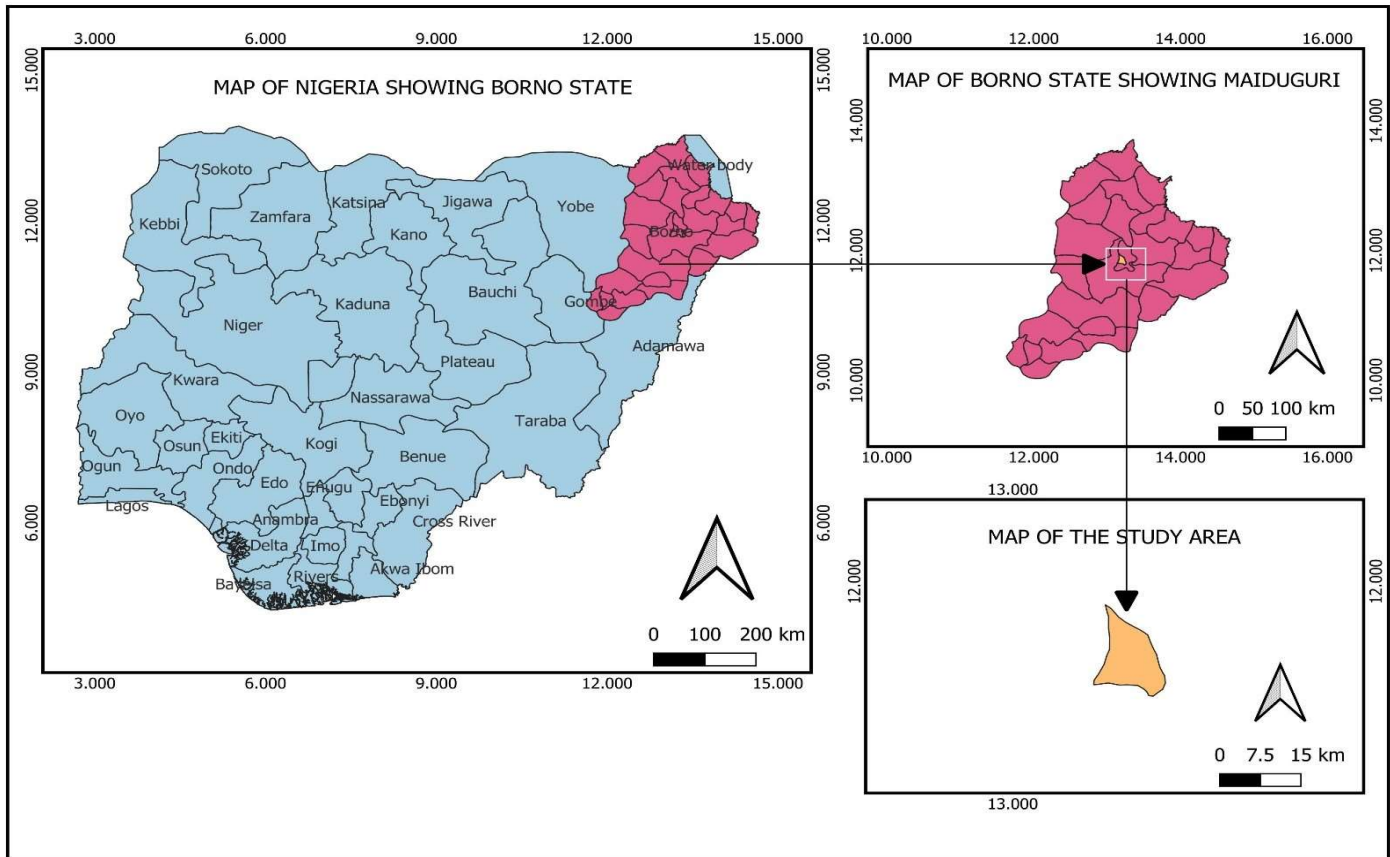
The study design consisted of a cross-sectional observational method. This design method was adopted because it is suitable and efficient in studies collecting data. The sample size of this study comprises of all (79) licensed Liquefied Petroleum Gas Stations and fill station located within the metropolis obtained from the regulatory agency. The data were collected and administered using Kobocollect. While the questionnaire was divided into two sections;

- Section A: contains station Characteristic information such as; nature of station, nature of tank, names and staff strength and placement of tank.
- Section B: contains the Risk management or preparedness information such staff training, devices available for leak detection, possession of emergency plan, how often drills are conducted, available emergency devices, possession of Personal Protective Equipment (PPE).

### **Study area**

Maiduguri Metropolis, a major city in the Northeastern corner of Nigerian, is located between latitudes 11°04'N and 11°44'N; and between longitudes 13°04'E and 13°44'E. It covers a total land area of 543 km<sup>2</sup>, which makes it the largest city in the Northeastern region of Nigeria (Daura, 2002). Maiduguri Urban now extends to four Local Government Areas (LGAs): Maiduguri Metropolitan, Jere, and Konduga and to a

smaller extent part of Mafa LGAs. Maiduguri was founded in 1907 as a military outpost of the British and has since grown rapidly with a population exceeding 1.7 million by 2023. The region was home to the Kanem-Bornu Empire for centuries, Maiduguri actually consists of the two cities: Yerwa to the west and old Maiduguri to the east. Old Maiduguri was selected by the British as their military headquarters while Yerwa was selected at approximately the same time by Shehu Abubakar Gabai of Borno replace Kukawa as the new traditional capital of the Kanuri people (Ellawala etal, 2016).



### Data Analysis

Once data collection was finalized, the electronic form is created on Microsoft Excel in xlsx standard format. The opinions of the respondents to the questionnaires were extracted and processed into raw data, and presented in figures, frequency distributions and percentage statistic. Effort was made to tabulate the collected raw data into a form of computation of tables with a view to presenting a vivid picture of the variables under investigation while the hypothesis was tested using the Spearman Rank Correlation Analysis.

H0: There is no statistically significant relationship between the type of station and gas station risk in the study area.

H1: There is statistically significant relationship between the type of station and gas station risk in the study area.

## Results and Discussion

Table 1. Characteristics of Liquefied Petroleum Gas (LPG) Stations.

S/N	Station Type	Frequency	Percentage
1	Stand-alone	76	96.2
2	With petrol station	3	3.8
Total	--	79	100
S/N	Nature of Tank	Frequency	Percentage
1	Cylindrical	79	100
2	Spherical	0	0
Total	--	79	100
S/N	Placement of Tank	Frequency	Percentage
1	Aboveground level	79	100
2	Belowground level	0	0
Total	--	79	100

Source: Author 2024

Table 1 presents the characteristics of the Liquefied Petroleum Gas Stations across Port Harcourt City. The study reveals that there are 76 (76.2%) stand-alone Liquefied Petroleum Gas stations while 3 (3.8%) are with petrol stations, with all the stations having cylindrical tanks and tanks placed above ground.

Table 2. Preparedness and Risk Management Measures in Liquefied Petroleum Gas Stations.

S/N	Had Safety and Fire Training	Frequency	Percentage
1	Yes	70	88.6
2	No	3	3.9
3	Unresponsive	6	7.6
Total	--	79	100
S/N	Devices for Gas leak detection	Frequency	Percentage
1	Automated Gas detector	52	65
2	Mechanical Leak detector	17	21.25
3	Both	7	8.75
4	None	4	5
Total	--	80	100
S/N	Possess Emergency/Response Plan	Frequency	Percentage
1	Yes	70	88.6
2	No	3	3.8

3	No Response	6	7.6
Total	--	79	100
S/N	How Often are Emergency Drills Carried out yearly	Frequency	Percentage
1	Once	40	65.6
2	Twice	18	29.5
3	Thrice	3	4.9
4	No response	18	29.5
Total	--	79	100
S/N	Devices Available for Emergency	Frequency	Percentage
1	Fire Extinguishers	72	46.5
2	Sprinklers	40	25.8
3	Fire Alarm Systems	37	23.8
4	No response	6	3.9
Total	--	155	100
S/N	Possession of Personal Protective Equipment	Frequency	Percentage
1	Yes	71	89.9
2	No	1	1.3
3	No response	7	8.9
Total	--	79	100

The analysis of table 2 reveals; that 70 (95.9%) had safety and firefighting training, 3 (4.1%) had no training while 6 (7.6) were unresponsive with 52 (65%) having automated gas leak detectors, 17 (21.25%) having mechanical leak detectors, 7 (8.75) having both automated and mechanical detectors while 4 (5%) had none. Furthermore, 70 (88.6%) of the stations possess Emergency/Response Plan while 3 (3.8%) had none and 6 (7.6) unresponsive with 40 (65.6%) of the gas stations testing the plan or conducting drills once a year, 18 (29.6%) of the stations conducted drills twice, 3 (4.9%) thrice while 18 (29.6%) had no response. On devices available for emergency, it was found that; 72 (46.5%) had fire extinguishers, 40 (25.8%) had sprinklers, 37 (23.8%) had alarm systems while 6 (3.9%) having no response with 71 (89.9 %) stations having personal Protective Equipment (PPE) while 1 (1.3%) had none with 7 (8.9%) having no response.

### Conclusions

The study assessed the risk management or preparedness measures associated with Liquefied Petroleum Gas stations in Maiduduri City, a major metropolis in Northeastern Nigeria. This was achieved with a cross-sectional observational design and the use of the Kobotoolbox and Kobocollect software. Knowledge of the preparedness levels of Liquefied Petroleum Gas stations have become paramount considering the recent spate of explosions of gas stations in the country to ascertain if stations can cope with an incident before aid or outside help comes. The study found that the presence of Liquefied Petroleum Gas stations predisposes the city to the effects of LPG risk but the preparedness measures in place (safety and firefighting training, formulation and implementation of emergency preparedness and response plans/drills, possession of devices for leak detection, possession of emergency devices for risk mitigation and Personal Protective Equipment (PPE) should be able to quell incidents until external help arrives. There is the need for regular monitoring of facilities by the regulatory agency Nigerian Midstream and Downstream Regulatory Agency, Collaboratory refresher trainings conducted between station owners and the regulatory agency

and map the area at risk and refrain from locating gas stations close to each other to avert the domino tendency of Liquefied Petroleum Gas Stations. Also, the government should create general awareness on the dangers of living too close gas stations while station owners should always wear and in script the importance of wearing PPE in pay slips and food vouchers to create a culture and avert the adverse health consequences that may arise from prolong exposure of Liquefied Petroleum Gas on personnel.

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