Cross-Sectional Assessment of Fire Safety Awareness Among Petrol and LPG Filling Stations Operators in Akwa Ibom State, Nigeria

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ABSTRACT

Petrol (gasoline) and liquefied petroleum gas (LPG) filling stations are high-risk facilities due to the storage and handling of flammable liquids and pressurized gases in environments with frequent human activity. This study assessed fire safety awareness, emergency preparedness, and compliance among petrol and LPG filling station operators in Akwa Ibom State, Nigeria. A cross-sectional design was adopted, involving 100 respondents (50 petrol and 50 LPG operators) selected through simple random sampling across the three senatorial districts of the state. Data were collected using a structured Knowledge–Attitude–Practice (KAP)–based fire safety questionnaire and a fire safety observation checklist. Descriptive statistics and correlation analysis were employed. Findings revealed high awareness of inherent fire hazards in both petrol (100%) and LPG (94%) stations; however, this awareness did not translate into adequate emergency preparedness. Major gaps were identified in formal fire safety training, staffing adequacy, confidence in evacuation, knowledge of emergency contacts, routine fire drills, and understanding of emergency response procedures. Although fire extinguishers were widely available and accessible in both facility types (82%), operational knowledge, routine inspection, and maintenance were poor. LPG stations demonstrated slightly better training and procedural awareness than petrol stations, but compliance remained suboptimal across both sectors. Positive correlations among personnel factors, equipment management, and fire procedures indicate that fire safety performance is systemic rather than isolated. The study concluded that fire safety awareness in petrol and LPG filling stations in Akwa Ibom State is uneven and insufficient to ensure effective fire risk management. Targeted regulatory enforcement, mandatory training, routine fire drills, and strengthened safety culture are recommended to reduce fire and explosion risks and enhance safety in and around petrol and LPG filing stations.

Keywords— Petrol, LPG, fire safety, fire emergency response, fire drills, Knowledge–Attitude–Practice (KAP) model, Integrated Framework Logic.

INTRODUCTION

Petrol (also called gasoline or premium motor spirit) and liquefied petroleum gas (LPG) filling stations are vital components in the petroleum supply chain. They provide energy to households, transport and industry. However, stored within these facilities are huge volumes of flammable liquids and pressurized gases. In the presence of ignition sources and frequent human interaction, the facilities are potential sources of fire that escalation can lead to catastrophic outcomes if there is no effective emergency response plan in place [1]-[3]. The physical hazards at retail fuel sites span from static electricity, exposed electrical sources to vapour cloud formation due to leaks. If there is a fire incident, the consequences can include fatalities, severe burns, environmental pollution, large property losses, negative media publication, among other indirect impacts [3]-[5]. Internationally and within Nigeria, major accident investigation literature shows that human and organizational factors - particularly station operator awareness, training, and adherence to safety procedures - are repeatedly implicated as root and contributing causes of fires at fuel handling facilities [6][7].

The concept of fire safety awareness encompasses knowledge of the hazards, recognition of unsafe acts and conditions, competence in correct operation of safety equipment (e.g., fire extinguishers, emergency shut-off

valves), and an understanding of appropriate emergency response procedure. Empirical knowledge, attitude and practice (KAP) surveys conducted among petrol pump attendants and LPG workers in Nigeria and other West African settings commonly identify gaps in basic safety knowledge, limited practical training, and inconsistency in maintenance of firefighting equipment, all of which increase operational risk at petrol and LPG retail stations [5][6][8][9]. Studies also indicate that even where there are management-level safety policies, the policies are not always translated into on-the-ground competence because of poor enforcement, limited or no fire training, resource constraints, and weak safety culture [2][10][11].

Nigeria's regulatory and technical guidance documents define minimum environmental safety and fire-safety requirements such as siting setbacks, earthing/bonding, electrical safety, emergency equipment and training obligations for filling stations and LPG facilities [10][11]. However, persistent non-compliance and proliferation of filling stations in sub-optimal locations have been widely observed [2][9]-[11]. Comparative regional risk assessments in the Niger Delta identify geographic and operational variations in fire and explosion risk, with retail sites in certain urban and industrial corridors showing higher vulnerability due to dense development, site modifications, and mixed land use [3]. Tanker crashes, illegal bunkering, unsafe fuel transfer and substandard infrastructure further compound risk in many Nigerian states, an indication of the need for localized assessments to target interventions [12].

Multiple fuel-related incidents have occurred in Akwa Ibom State, a part of the Niger Delta region of Nigeria [7][12][13]. The fires include those involving tankers and retail fuel stations [14]-[17]. While news reports provide initial incident detail, peer-reviewed and government documentation such as Nigerian Upstream Regulatory Commission (NUPRC) guidelines, Federal Road Safety Commission (FRSC) and Nigerian Oil Spill Detection and Response Agency (NOSDRA) incident analyses, emphasize that preventing recurrence requires strengthening filling station operators competency, improving emergency preparedness, and tightening regulatory oversight [2][18][19]. LPG facilities present hazards of pressurized gases and rapid vapour release thereby necessitating tailored safety and emergency response measures that differ from conventional petrol dispensing stations [1][20]. Consequently, cross-sectoral comparisons of petrol and LPG are valuable because each facility type demands distinct awareness, operational checks and drills even though they may share common safety foundations [2].

Studies from other Nigerian states and comparable contexts show that effective training, regular drills, proper maintenance of fire-fighting equipment, and clear emergency response plans can significantly improve operators' performance during fire incidents [5][6]. Despite this, many fire interventions remain sporadic and lack systematic cross-sectional data comparing facility types and filling station operator level of fire awareness and emergency preparedness. A cross-sectional assessment in Akwa Ibom would therefore fill a critical empirical gap by identifying awareness levels, highlighting predominant unsafe conditions and practices, and revealing factors (e.g., training costs, regulatory enforcement lapses, equipment shortages) adversely impacting effective fire prevention and response [6]-[8].

From a policy and public safety lens, improved understanding of operator awareness and preparedness has multiple benefits such as enabling the regulators (e.g., NUPRC) to prioritize inspection and training resources, supporting filling station owners and managers in designing evidence-based safety programmes, and helping emergency response agencies to tailor response planning to the potential fire vulnerable areas [2]. Also, considering that many filling stations are sited near residential properties and commercial settings, strengthening on-site fire safety awareness can enhance broader community protection and environmental risk reduction [9].

In light of the above, this study aims to conduct a systematic cross-sectional assessment of fire safety awareness, attitudes and preparedness among petrol and LPG filling station operators in Akwa Ibom State. By using structured KAP instruments, observational checklists, and linkage to existing incident records and regulatory requirements, the research seeks to (a) assess current awareness and practice gaps, (b) compare petrol and LPG operator cohorts, and (c) recommend targeted interventions such training, equipment upgrade and regulatory enforcement measures to address Akwa Ibom State operational realities and the distinct hazards presented by petrol and LPG retail sites [2][3][6].

BACKGROUND TO THE STUDY

Petrol and LPG filling stations and facilities present a range of inherent fire and explosion hazards due to the presence of volatile hydrocarbons, pressurized gas, electrical ignition sources, mobile vehicles, and human activities [3]. Risk assessments in several Nigerian contexts and the Niger Delta region, in particular, have shown that petroleum products handling facilities are vulnerable to fire incidents during product unloading, storage and dispensing operations [3]. LPG operations add further complexity because of pressurized gas handling and potential for vapour cloud formation in the event of leakages [1].

In recent times, there have been reported fuel-related fires in Akwa Ibom State. For example, in December 2024, there was a petrol tanker-related fire that gutted a petrol filling station at Itam, near Uyo, the Akwa Ibom state capital [13][14]. The fire was so intense that it required a multi-agency firefighting response [13][14]. Such events are not isolated across Nigeria as there have been multiple incidents involving petrol tanker rollovers, dispensing accidents and LPG station explosions, many with casualties and widespread property damage. These occurrences highlight persistent operational risks at petrol filling stations and LPG retail sites and the need to understand and strengthen preventive measures [3].

The establishment of petrol or LPG filling station requires the approval of the relevant Nigerian petroleum regulatory body which sets guidelines including minimum site design, equipment and safety management practices applicable to filling stations [2]. These guidelines cover safe setbacks, bunding, earthing/bonding, electrical safety, fire-fighting equipment, staff training and emergency response requirements. However, field assessments repeatedly indicate shortfalls in compliance. These include non-compliance with siting requirements, poor maintenance of firefighting equipment, limited staff training, and weak emergency response planning [3][6].

Several empirical studies indicate that awareness, attitude and practice among petrol and LPG filling station workers are strong determinants of on-site safety. For instance, a recent KAP study among LPG station workers in Lagos identified gaps in emergency response knowledge and highlighted the need for improved training and drills [5]. Comparative risk assessments in the Niger Delta likewise point to operator behaviour and compliance as key contributors to incident frequency and severity [3]. Given the documented incidents in Akwa Ibom and the nationwide challenges in translating regulation into safe practice [21], targeted, location-specific assessments of operator awareness and preparedness are necessary to inform practical interventions for petrol and LPG filing stations.

AIM AND OBJECTIVES OF THE STUDY

Aim: To assess the level of fire safety compliance in petrol and LPG filling stations in Akwa Ibom State.

Specific Objectives were:

- Assess the level of fire safety knowledge, attitudes, and practices (KAP) among petrol and LPG filling station operators in Akwa Ibom State.
- Evaluate the availability, accessibility, and functionality of fire safety equipment in petrol and LPG filling stations.
- Determine the level of fire emergency preparedness of filling stations, including training, staffing adequacy, evacuation planning, and emergency response procedures.
- Examine the relationship between fire safety training and fire safety practices among petrol and LPG filling station operators.
- Compare fire safety awareness and preparedness between petrol and LPG filling stations, identifying key similarities and differences.
- Identify critical gaps in fire safety awareness and compliance and propose evidence-based recommendations for improving fire risk management in Akwa Ibom State.

SIGNIFICANCE OF THE STUDY

This study has practical and policy relevance. First, it will provide a cross-comparative empirical evidence (petrol vs LPG) on fire safety awareness and emergency preparedness among filling station operators in Akwa Ibom State, identifying specific knowledge and practice gaps that can be addressed through targeted training and capacity building. Second, the findings from this study will inform regulatory agencies and local authorities about compliance shortfalls and operational challenges, enabling evidence-based enforcement and guidance refinement. Third, by identifying deficiencies in petrol and LPG filling stations, the study will contribute to local risk reduction strategies and community safety planning, thereby enhancing proactive actions to prevent loss of lives, reduce economic losses, and limit environmental harm from fuel-related fires.

CONCEPTUAL FRAMEWORK

The conceptual framework guiding this study integrates the Knowledge–Attitude–Practice (KAP) model and organizational/regulatory influences. This framework explains how individual cognition (knowledge and attitudes) and contextual organizational factors (training, leadership, enforcement) jointly shape fire safety awareness and related practices.

KAP Model: The KAP model is foundational for examining how individuals become aware of hazards and translate that awareness into safety behaviours. The KAP model originated from public health research in the 1950s, particularly through World Health Organization-led health education and behavioural assessment initiatives. Rather than being attributed to a single author, the model evolved as a pragmatic framework for understanding how knowledge and attitudes influence behavioural practices [22]-[24]. Within occupational safety research, this model has been widely used to assess cognitive and behavioural responses to safety risks.

Fire safety awareness begins with knowledge - understanding hazards, safety procedures, and emergency responses. In studies of safety behaviour, higher knowledge levels are associated with improved recognition of risks and safer conduct [25][26]. Knowledge provides the cognitive base required to interpret and act on workplace safety requirements [25][27].

Attitude reflects how individuals feel about fire safety and its importance. Positive attitudes towards safety are critical because they influence willingness to follow procedures, adopt protective behaviours, and participate in drills [25][27]. Research consistently shows that attitude mediates between what individuals know and what they actually do in safety contexts [25]-[27].

Practice denotes the actual safety behaviours exhibited on the job, such as proper use of fire extinguishers, compliance with no-smoking rules, and participation in training. Higher knowledge and positive attitudes are predictive of better practices [25][27]. Therefore, the KAP model frames fire safety awareness as a sequential process: knowledge → attitudes → practice, making it suitable for cross-sectional measurement. Since the KAP model provides a clear structure to assess how awareness of fire safety develops and influences operators' behaviours and has been validated in occupational and disaster preparedness research, it is highly relevant to this study design [25]-[27].

Organizational and Regulatory Influences: Individual safety awareness is shaped not only by personal cognition but also by organizational structures and regulatory environments. Factors such as safety training, management commitment, and enforcement of safety rules significantly influence how knowledge and attitudes translate into practice [27]-[29].

Safety training plays a pivotal role in enhancing both knowledge and its application. Meta-analytic evidence shows that quality training significantly improves workers' safety learning and transfer to real job behaviours [28]. Training reinforces cognitive understanding and promotes safer work practices by equipping workers with practical skills and confidence to act safely.

Leadership and management commitment also shape individual safety outcomes. Strong commitment by leaders through clear communication, visible enforcement, and modeling of safety behaviour enhances workers'

awareness and encourages compliance with protocols [27]. Research on safety behaviour models demonstrate that managerial practices are foundational to shaping workers' safety awareness and subsequent behaviour [27].

Regulatory enforcement and safety culture create the external pressures that motivate implementation of safety practices. Compliance with safety regulations and proactive safety culture within organizations fosters an environment where safe behaviour is expected and rewarded. Empirical research indicates that regulatory compliance is positively associated with safety performance and is more effective when combined with an internal proactive safety culture [27][28]. These organizational and environmental influences act as critical moderators between knowledge and practice by shaping the conditions that support or inhibit safety actions.

Integrating organizational and regulatory factors with the KAP model acknowledges that individual awareness and behaviour are embedded in broader institutional contexts [27]-[29].

Integrated Framework Logic: Therefore, the conceptual framework for this study can be visualized as: socio-demographic characteristics, training exposure, organizational commitment to safety, and regulatory enforcement → influence Knowledge of fire safety → shapes Attitudes towards fire safety → determines Safety Practices among petrol and LPG filling station operators.

This integrated model allowed the study to measure both individual cognitive responses and contextual factors that jointly determine fire safety awareness and behaviour and so supported the cross-sectional design.

STUDY DESIGN AND INSTRUMENT

Study Design: This study utilized a cross-section design. Cross-section designs are relevant when examining and comparing single variables across multiple subgroups with similar characteristics [30]. Since this study aimed to test the different aspects of fire safety among various petrol and LPG stations, the cross section design was considered appropriate.

Study Population: Population is the set of individuals of interest during a study [31][32]. The study population involves the group of individuals to which the researcher can legitimately apply the research conclusions [31]. The generalization of the study conclusions to the target population depends on the composition of the study population [31]. The study population for this research was the workers in petrol and LPG filling stations in Akwa Ibom State of Nigeria.

Selection Criteria: Sample refers to a set of individuals that are selected to represent the study population [31]. The workers selected for the study were those in petrol and LPG filling stations in the three senatorial districts of Akwa Ibom State.

Sample Size Determinations: The study employed a cross-sectional design, which is suitable for assessing the prevalence of outcomes and characteristics of a defined population at a specific point in time [33]. For such observational questionnaires and survey studies, the sample size must balance statistical precision, resource constraints, and feasibility. While larger samples often yield greater precision and generalizability, practical limitations in field settings - especially with occupational groups like filling station operators - can justify more modest sample sizes when backed by theoretical and methodological rationale [34].

In this study, 50 respondents from each of petrol and LPG filling stations in Akwa Ibom State were recruited. Although formal statistical estimation formulas (e.g., Cochran's formula or prevalence-based calculation) are recommended for large populations to achieve specific margins of error and confidence levels, smaller sample sizes can be justified when the goal is descriptive estimation of awareness levels rather than complex analytical modeling. In particular, as [33] noted, studies with focused occupational cohorts and limited total population may require smaller samples due to accessibility and logistical constraints, while still providing valuable snapshot insights into the targeted safety awareness domains.

From a methodological perspective, the main aim of this cross-sectional assessment was to estimate prevalence of fire safety awareness practices rather than test causal hypotheses; therefore, a total sample of 100 participants, drawn randomly across petrol and LPG filling stations, was considered adequate to provide preliminary prevalence estimates and identify key awareness gaps among workers in the sectors studied.

Sampling Technique: To select participants, the study used simple random sampling, a probability sampling method where every individual in the target population has an equal chance of being selected [34][35]. Simple random sampling is widely recommended in quantitative research for producing representative sample subsets and minimizing selection bias—essential to maintain the internal and external validity of cross-sectional survey findings [34][35].

In practice, a comprehensive consideration of different petrol and LPG filling station operators within Akwa Ibom State was done as the sampling frame. Each operator in the frame was assigned a unique identifier, and a random number generator was used to select 50 individuals in each of petrol and LPG filling stations without replacement for study inclusion. This procedure aligned with standard random sampling approaches that ensure equal probabilities of selection across all eligible participants, which strengthens the representativeness of the collected data and supports unbiased estimation of fire safety awareness prevalence [34][35].

Random sampling also enhances generalizability, especially in survey contexts where the target population is well defined but not overly large or stratified. By avoiding subjective selection criteria, this method, similar to the observation of some researchers [34][35], reduced the risk of systematic bias and increased confidence that observed patterns reflected the broader population of petrol and LPG filling station operators in Akwa Ibom State.

Data Collection Instrument: Data for this study were collected using a structured, self-administered *Fire Safety Assessment Questionnaire* and *Fire Safety Observations Checklist.* The questionnaire was considered appropriate for a cross-sectional assessment of fire safety awareness among petrol and LPG filling station operators as questionnaires are widely used in occupational safety and safety culture research since they allow for standardized data collection, facilitate comparison across respondents, and are effective for measuring perceptions, attitudes, and awareness levels within a defined population [36][37].

The questionnaire was carefully designed to enhance respondents' understanding of the objective of each question. Clear and simple wording was adopted to minimize ambiguity and reduce the risk of misinterpretation, particularly given the varied educational and professional backgrounds of filling station operators. This approach aligns with recommendations in safety research that emphasize clarity and relevance of survey items to improve response accuracy and reliability [38].

The *Fire Safety Assessment Questionnaire* consisted of 19 questions, a deliberate design choice aimed at reducing respondent fatigue while ensuring adequate coverage of key elements reflective of safety culture and fire safety awareness. Limiting the number of items is especially important in occupational field settings, where lengthy questionnaires may discourage participation or compromise response quality [39]. The *Fire Safety Observations Checklist* consisted of thirteen items. Despite their concise structure, the questionnaire and checklist captured core dimensions of fire safety culture, including awareness, attitudes, and perceived commitment to fire safety practices.

Responses to the questionnaire were measured using a five-point Likert-type scale, coded as follows: Strongly disagree = 0; Disagree = 1; Neutral = 2; Agree = 3; Strongly agree = 4. Likert-type scales are extensively validated and commonly employed in safety culture and behavioural research due to their simplicity, ease of administration, and ability to quantify subjective perceptions in a statistically analyzable form [40][41].

The questions were worded such that a response of "Strongly disagree" indicated a negative relationship between the applicable variable and fire safety awareness, while "Strongly agree" indicated a positive relationship. This directional framing allowed for intuitive interpretation of results and supported consistent scoring across items. The inclusion of a "Neutral" option was intentional for respondents with an alternative when they lacked sufficient information, felt indifferent to the issue, or perceived positive and negative considerations as equally balanced. The neutral midpoint is widely recognized as essential in attitudinal surveys to prevent forced responses that could otherwise introduce measurement bias [42].

Overall, the use of a structured questionnaire with a Likert-type scale was justified by its suitability for capturing subjective perceptions of fire safety awareness and safety culture, its consistency with established practices in occupational safety research, and its practicality for use in a cross-sectional study involving filling station

operators. Additionally, the use of *Fire Safety Observations Checklist* was considered relevant as an instrument used specifically to enhance data triangulation. It consisted of items the researchers were to observe in each filling station while administering the research questionnaire.

Data Collection Procedure: Data collection for this study followed a structured and ethically guided procedure consistent with best practices for cross-sectional survey research. Prior to data collection, permission was obtained from relevant filling station managements, and the purpose of the study was clearly explained to prospective participants. The data collection process was conducted over a defined period to ensure consistency and minimize temporal bias.

Participation in the study was entirely voluntary, and no form of coercion or inducement was used. Each eligible respondent was first provided with clear information regarding the objectives of the study, the nature of required involvement, and the right to decline or withdraw from participation at any stage without any negative consequences. This approach is consistent with ethical principles governing research involving human participants, particularly respect for autonomy and voluntariness [43][44].

The questionnaires were administered directly to the respondents and collected upon completion to minimize non-response and data loss. This standardized data collection procedure ensured uniformity in administration and helped reduce procedural bias, thereby supporting the reliability and validity of the collected data. Additionally, the researchers utilized the *Fire Safety Observations Checklist t*o gather data from each station based on physical observation while awaiting completion of the questionnaires by the research respondents.

Ethical Approval: Informed consent was obtained from each respondent prior to questionnaire administration. Only individuals who explicitly consented to participate were issued the questionnaire. The consent process ensured that participants understood the study objectives, the type of information being collected, and how the data would be used for research purposes. Informed consent is a fundamental requirement in social and occupational health research and is essential for safeguarding participants' rights and dignity [45].

To ensure data confidentiality and anonymity, respondents were not required to provide personal identifiers such as names or contact details. Completed questionnaires were handled securely, and access to the data was restricted to the researchers only. Data were used strictly for academic purposes, and findings were reported in aggregate form to prevent identification of individual respondents or specific filling stations. Ensuring confidentiality enhances respondents' willingness to provide honest responses and improves the overall quality and credibility of survey data [46].

Data Analysis: Data obtained from the completed questionnaires were coded and analyzed using appropriate statistical techniques consistent with the objectives of the study. Given the cross-sectional and descriptive nature of the research, descriptive statistics and correlation analysis were identified as suitable and were employed to analyze the data.

Descriptive statistics were used to summarize fire safety awareness variables. These statistics consisted of numerical techniques in the form of tables. Descriptive analysis is widely recommended in survey-based research because it provides a clear and concise summary of large datasets, facilitates comparison across variables, and enhances the interpretability of findings [47][48]. In the context of this study, descriptive statistics enabled the assessment of overall levels of fire safety awareness and safety culture in the studied sectors.

In addition to descriptive analysis, correlation analysis was employed to examine the relationships between selected variables reflective of fire safety awareness and safety culture. Correlation analysis is appropriate for determining the strength and direction of associations between variables measured on Likert-type scales, particularly in non-experimental and observational studies [47][49]. The use of correlation analysis allowed the study to explore whether increases in one safety-related variable were associated with corresponding increases or decreases in another, without implying causality.

Together, descriptive statistics and correlation analysis provided a robust analytical framework for achieving the study objectives. These methods offered both an overall snapshot of fire safety awareness levels and insights into the relationships among key safety culture elements, thereby supporting clear interpretation and meaningful

presentation of the study findings. To findings made using *Fire Safety Observations Checklist* were compared to the outcome of the data analysis to enhance data triangulation.

RESULTS AND FINDINGS

Table 1 shows a summary of the number of response to each of the questions on the fire safety assessment questionnaire for **petrol filling stations**.

S/N	Fire Safety Assessment Questionnaire - Petrol Filling Stations	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
	Personnel Issues:					
1	I have received adequate training on how to respond to a fire emergency	20	10	2	11	7
2	I know the location of assembly/muster point	17	10	8	9	6
3	I am confident in my ability to evacuate customers and colleagues safely if there is a fire	4	29	9	5	3
4	My station has enough people to respond if there is fire	27	12	5	3	3
5	I am aware of the specific fire risks associated with handling and dispensing fuel or gas.	0	0	0	20	30
6	I know who to contact in case of a fire emergency	20	5	18	4	3
7	I know the contact number for the nearest Fire Service Station	25	10	5	7	3
8	I am aware of the potential ignition or fire sources/fire hazards in or near my station	12	8	7	6	17
	Fire Equipment:					
9	I can identify the different types of fire extinguishers and know when to use each type	12	25	1	5	6
10	The fire extinguishers at my station are easily accessible and not blocked	3	4	2	20	21
11	I regularly check that the fire extinguishers are in good working condition.	25	10	4	6	5
12	My station has sufficient number of fire extinguishers for its size and layout.	15	6	0	20	9
13	The fire extinguishers at my station have been inspected and confirmed okay for use within the last one year	6	17	0	17	10
	Fire Procedure :					
14	I understand the fire emergency response plan of my station	21	11	6	6	6
15	I know what PASS means in use of portable fire extinguisher	12	16	7	10	5
16	I know the correct procedure for raising alarm or reporting a fire	30	6	2	8	4
17	My colleagues and I follow all fire safety rules, such as prohibiting smoking in designated areas.	13	10	7	10	10
18	There are clear signs and instructions on what to do in case of a fire.	22	10	5	13	10
19	I participate in regular fire drills to prepare for emergency	35	0	0	8	7

Table 1: Summary of the total number of responses from Petrol Filling Station Operators to each of the Fire Safety Assessment Questions.

Table 2 shows the summary of the percentage of responses to each of the fire safety assessment questions for petrol station operators.

S/N	Fire Safety Assessment Questionnaire - Petrol Filling Stations	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
	Personnel Issues:					
1	I have received adequate training on how to respond to a fire emergency	40%	0%	4%	22%	14%
2	I know the location of assembly/muster point	34%	20%	16%	18%	12%
3	I am confident in my ability to evacuate customers and colleagues safely if there is a fire	8%	58%	18%	10%	6%
4	My station has enough people to respond if there is fire	54%	24%	10%	6%	6%
5	I am aware of the specific fire risks associated with handling and dispensing fuel or gas.	0%	0%	0%	40%	60%
6	I know who to contact in case of a fire emergency	40%	10%	36%	8%	6%
7	I know the contact number for the nearest Fire Service Station	50%	20%	10%	14%	6%
8	I am aware of the potential ignition or fire sources/fire hazards in or near my station	24%	16%	14%	12%	34%
	Fire Equipment:					
9	I can identify the different types of fire extinguishers and know when to use each type	24%	50%	2%	10%	12%
10	The fire extinguishers at my station are easily accessible and not blocked	6%	8%	4%	40%	42%
11	I regularly check that the fire extinguishers are in good working condition.	50%	20%	8%	12%	10%
12	My station has sufficient number of fire extinguishers for its size and layout.	30%	12%	0%	40%	18%
13	The fire extinguishers at my station have been inspected and confirmed okay for use within the last one year	12%	34%	0%	34%	20%
	Fire Procedure :					
14	I understand the fire emergency response plan of my station	42%	22%	12%	12%	12%
15	I know what PASS means in use of portable fire extinguisher	24%	32%	14%	20%	10%
16	I know the correct procedure for raising alarm or reporting a fire	60%	12%	4%	16%	8%
17	My colleagues and I follow all fire safety rules, such as prohibiting smoking in designated areas.	26%	20%	14%	20%	20%
18	There are clear signs and instructions on what to do in case of a fire.	44%	20%	10%	26%	20%
19	I participate in regular fire drills to prepare for emergency	70%	0%	0%	16%	14%

Table 2: Summary of the percentage of responses at Petrol Filling Stations to each of the safety culture assessment questionnaire

Table 3 shows a summary of the number of response to each of the questions on the fire safety assessment questionnaire for **LPG filling stations**.

S/N	Fire Safety Assessment Questionnaire - LPG Filling Stations	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
	Personnel Issues:					
1	I have received adequate training on how to respond to a fire emergency	12	10	2	11	15
2	I know the location of assembly/muster point	14	9	9	9	9
3	I am confident in my ability to evacuate customers and colleagues safely if there is a fire	10	17	11	5	7
4	My station has enough people to respond if there is fire	27	12	5	3	3
5	I am aware of the specific fire risks associated with handling and dispensing fuel or gas.	0	0	3	20	27
6	I know who to contact in case of a fire emergency	20	5	18	4	3
7	I know the contact number for the nearest Fire Service Station	25	8	7	7	3
8	I am aware of the potential ignition or fire sources/fire hazards in or near my station	12	8	7	6	17
	Fire Equipment:					
9	I can identify the different types of fire extinguishers and know when to use each type	12	24	2	5	7
10	The fire extinguishers at my station are easily accessible and not blocked	3	4	2	20	21
11	I regularly check that the fire extinguishers are in good working condition.	20	10	9	6	5
12	My station has sufficient number of fire extinguishers for its size and layout.	13	6	2	18	11
13	The fire extinguishers at my station have been inspected and confirmed okay for use within the last one year	6	17	0	17	10
	Fire Procedure :					
14	I understand the fire emergency response plan of my station	21	11	6	6	6
15	I know what PASS means in use of portable fire extinguisher	12	16	7	10	5
16	I know the correct procedure for raising alarm or reporting a fire	30	6	1	9	4
17	My colleagues and I follow all fire safety rules, such as prohibiting smoking in designated areas.	13	10	11	8	8
18	There are clear signs and instructions on what to do in case of a fire.	22	0	7	11	10
19	I participate in regular fire drills to prepare for emergency	30	0	5	8	7

Table 3: Summary of the total number of responses from LPG Filling Station Operators to each of the Fire Safety Assessment Questions

Table 4 shows a summary of the percentage of responses to each of the questions on the *fire safety assessment questionnaire* for **LPG filling stations**.

S/N	***Fire Safety Assessment Questionnaire - LPG Filling Stations***	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
	Personnel Issues:					
1	I have received adequate training on how to respond to a fire emergency	24%	20%	4%	22%	30%
2	I know the location of assembly/muster point	28%	18%	18%	18%	18%
3	I am confident in my ability to evacuate customers and colleagues safely if there is a fire	20%	34%	22%	10%	14%
4	My station has enough people to respond if there is fire	54%	24%	10%	6%	6%
5	I am aware of the specific fire risks associated with handling and dispensing fuel or gas.	0%	0%	6%	40%	54%
6	I know who to contact in case of a fire emergency	40%	10%	36%	8%	6%
7	I know the contact number for the nearest Fire Service Station	50%	16%	14%	14%	6%
8	I am aware of the potential ignition or fire sources/fire hazards in or near my station	24%	16%	14%	12%	34%
	Fire Equipment:					
9	I can identify the different types of fire extinguishers and know when to use each type	24%	48%	4%	10%	14%
10	The fire extinguishers at my station are easily accessible and not blocked	6%	8%	4%	40%	42%
11	I regularly check that the fire extinguishers are in good working condition.	40%	20%	18%	12%	10%
12	My station has sufficient number of fire extinguishers for its size and layout.	26%	12%	4%	36%	22%
13	The fire extinguishers at my station have been inspected and confirmed okay for use within the last one year	12%	34%	0%	34%	20%
	Fire Procedure :					
14	I understand the fire emergency response plan of my station	42%	22%	12%	12%	12%
15	I know what PASS means in use of portable fire extinguisher	24%	32%	14%	20%	10%
16	I know the correct procedure for raising alarm or reporting a fire	60%	12%	2%	18%	8%
17	My colleagues and I follow all fire safety rules, such as prohibiting smoking in designated areas.	26%	20%	22%	16%	16%
18	There are clear signs and instructions on what to do in case of a fire.	44%	0%	14%	22%	20%
19	I participate in regular fire drills to prepare for emergency	60%	0%	10%	16%	14%

Table 4: Summary of the percentage of responses at LPG filing Stations to each of the safety culture assessment questionnaire

Table 5 shows the summary of the percentage of responses to each of the fire safety assessment questions for both petrol and LPG station operators.

S/N	**Fire Safety Assessment Questionnaire - Petrol and LPG Filling Stations**	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
	Personnel Issues:					
1	I have received adequate training on how to respond to a fire emergency	64%	40%	8%	44%	44%
2	I know the location of assembly/muster point	62%	38%	34%	36%	30%
3	I am confident in my ability to evacuate customers and colleagues safely if there is a fire	28%	92%	40%	20%	20%
4	My station has enough people to respond if there is fire	108%	48%	20%	12%	12%
5	I am aware of the specific fire risks associated with handling and dispensing fuel or gas.	0%	0%	6%	80%	114%
6	I know who to contact in case of a fire emergency	80%	20%	72%	16%	12%
7	I know the contact number for the nearest Fire Service Station	100%	36%	24%	28%	12%
8	I am aware of the potential ignition or fire sources/fire hazards in or near my station	48%	32%	28%	24%	68%
	Fire Equipment:					
9	I can identify the different types of fire extinguishers and know when to use each type	48%	98%	6%	20%	26%
10	The fire extinguishers at my station are easily accessible and not blocked	12%	16%	8%	80%	84%
11	I regularly check that the fire extinguishers are in good working condition.	90%	40%	26%	24%	20%
12	My station has sufficient number of fire extinguishers for its size and layout.	56%	24%	4%	76%	40%
13	The fire extinguishers at my station have been inspected and confirmed okay for use	24%	68%	0%	68%	40%
	Fire Procedure :					
14	I understand the fire emergency response plan of my station	84%	44%	24%	24%	24%
15	I know what PASS means in use of portable fire extinguisher	48%	64%	28%	40%	20%
16	I know the correct procedure for raising alarm or reporting a fire	120%	24%	6%	34%	16%
17	My colleagues and I follow all fire safety rules, such as prohibiting smoking in designated areas.	52%	40%	36%	36%	36%
18	There are clear signs and instructions on what to do in case of a fire.	88%	20%	24%	48%	40%
19	I participate in regular fire drills to prepare for emergency	130%	0%	10%	32%	28%

Table 5: Summary of the percentage of responses at both Petrol and LPG filing Stations to each of the safety culture assessment questionnaire

Table 6 shows the key findings from the *fire safety observation checklist used to assess* **Petrol and LPG filling stations**

S/N	Fire Safety Observations Checklist - Petrol and LPG Filling Stations	Yes	No	Comments
	Personnel Issues:			
1	The personnel at the station look confident and knowledgeable about fire safety		X	They did not look confident in fire fighting
2	The attendants at the station take precautions to prevent fire incidents			
3	There are enough personnel at the station to respond to fire		X	Mostly only attendants and managers available
	Fire Equipment:			
4	The relevant types of fire extinguishers are available at the station			Indifferent
5	The fire extinguishers at the stations are easily accessible and not blocked			Indifferent
6	The fire extinguishers are in good condition		X	Safety pin and tamper seal were broken on some
7	The fire extinguishers have current inspection record		X	Inspection record were mostly not upto date
8	The labels on the fire extinguishers are clear/legible			Indifferent
	Fire Procedure :			
9	There is an assembly/muster point - clearly labeled and at safe location			Indifferent
10	The stations have documented fire emergency response plan		X	Emergency response plan was not sighted
11	There are clear fire warning and caution signs at the stations			Indifferent
12	The number to call in case of fire emergency are clearly posted at the station		X	Emergency contact was not seen
13	There are no potential fire or ignition sources near the station			Indifferent

Table 6: Major findings during from observation done using fire safety observation checklist at both petrol and LPG filling stations.

DISCUSSION OF FINDINGS

Petrol Filling Stations:

Descriptive statistics were employed to summarize the responses obtained from petrol filling station operators regarding fire safety awareness across three key dimensions: personnel issues, fire equipment, and fire procedures. Percentages were used to describe response patterns, while mean scores were derived using the five-point Likert scale (Strongly disagree = 0 to Strongly agree = 4) to provide an overall assessment of awareness levels.

Personnel Issues: Findings under personnel-related issues reveal (see tables 1 and 2) generally low levels of preparedness, despite high awareness of inherent petrol fire risks. A large proportion of respondents (40%) strongly disagreed that they had received adequate training on fire emergency response, with only 36% agreeing or strongly agreeing. This suggests insufficient formal training among petrol filling station staff, which is concerning given the highly flammable nature of petrol operations.

Knowledge of assembly or muster points was also weak, with 54% either strongly disagreeing or disagreeing. This indicates poor emergency evacuation planning, which could significantly increase casualty risks during a petrol fire incident.

Confidence in evacuating customers and colleagues was notably low, as 66% of respondents disagreed or strongly disagreed. This lack of confidence may compromise crowd control and safe evacuation during emergencies, especially in petrol stations where customers are often present.

Staffing adequacy for emergency response was critically poor, with 78% of respondents indicating disagreement. This reflects a major operational weakness, as petrol station fires typically require rapid, coordinated response to prevent escalation. The observation from the *fire safety observation checklist* (see table 5) collaborated this finding as only the attendant and station mangers were mostly seen at the sites.

In contrast, awareness of fire risks associated with petrol handling was very high, with 100% of respondents agreeing or strongly agreeing. This suggests that operators recognize the hazards of petrol but lack the training and systems to manage them effectively.

Knowledge of emergency contacts and fire service numbers was inadequate, as over 60% of respondents disagreed or were neutral. In petrol station fire scenarios, delayed communication with emergency services can result in severe fire spread and explosions.

Awareness of ignition sources and fire hazards showed moderate awareness, with 46% agreeing or strongly agreeing. This indicates partial understanding of petrol-related ignition risks such as static electricity, vehicle engines, and electrical faults.

Fire Equipment: Results on fire equipment (see tables 1 and 2) show better physical availability than operational knowledge. Most respondents (82%) agreed or strongly agreed that fire extinguishers were easily accessible and not blocked. This indicates compliance with basic regulatory requirements in petrol filling stations.

However, 74% of respondents could not correctly identify fire extinguisher types or their appropriate use. This gap is critical in petrol fires, where incorrect extinguisher use (e.g., water on fuel fires) can worsen fire spread.

Routine checking of fire extinguishers was poor, with 70% disagreeing or strongly disagreeing. This raises concerns about equipment reliability during emergencies. Perceived adequacy of extinguisher numbers was moderate, with 58% agreeing or strongly agreeing, suggesting that while equipment may be present, maintenance and inspection remain weak. Inspection within the last year showed mixed responses, indicating inconsistent compliance with fire safety inspection requirements in petrol stations. These findings aligned with the findings from the site inspection done using the *fire safety observation checklist* (see table 5) that fire extinguishers inspection records were not up to date and that some fire extinguishers has missing activation pins.

Fire Procedures: Fire procedure awareness among petrol filling station operators was generally low (see tables 1 and 2). Understanding of the station's fire emergency response plan was poor, with 64% disagreeing or strongly disagreeing. This suggests that formal response plans either do not exist or are not communicated effectively. Knowledge of PASS (Pull the pin, Aim the nozzles at the base of the fire, Squeeze the handle, and Sweep from side to side) technique for extinguisher use was low, with over half of respondents lacking this basic operational knowledge, limiting effective first response in petrol fires. The non-sighting of fire emergency response plan during during observation done using the *fire safety observation checklist* (see table 5) collaborated the findings from the questionnaires. The lack of confidence by the station operators during site survey also indicated limited knowledge of fire emergency procedure.

Awareness of alarm-raising procedures was critically low, with 72% disagreeing or strongly disagreeing. This is particularly dangerous in petrol stations where early alarm activation is crucial.

Compliance with safety rules such as smoking prohibition showed moderate adherence, reflecting some limitations in behavioural control in petrol stations.

Presence of signage and instructions was moderate, while participation in regular fire drills was extremely poor, with 70% strongly disagreeing that they conduct regular fire drills. The absence of drills undermines readiness for real-life petrol fire emergencies.

Correlation Analysis: Correlation analysis was conducted to examine relationships among personnel issues, fire equipment, and fire procedures within petrol filling stations based on the data tables 1 and 2). The analysis revealed positive correlations across all three dimensions. Personnel issues were positively correlated with fire procedure awareness, indicating that stations with better-trained and informed staff tended to demonstrate stronger understanding of emergency procedures. Fire equipment awareness correlated positively with fire procedures, suggesting that knowledge and accessibility of equipment support compliance with safety protocols. Personnel issues also correlated positively with fire equipment management, implying that trained staff are more likely to inspect, maintain, and correctly use fire extinguishers.

These relationships highlight that fire safety in petrol filling stations is systemic, not isolated. Deficiencies in training directly affect procedural compliance and effective use of equipment. These findings align with those of previous studies that identified gaps in basic safety knowledge, limited practical training, and inconsistency in maintenance of firefighting equipment [5][6][8][9].

Fire safety awareness among petrol filling station operators is uneven, with strong hazard recognition but weak preparedness. Training, staffing adequacy, drills, and procedural knowledge are major gaps. Fire extinguishers are generally available but poorly understood and inadequately maintained. Positive correlations among safety dimensions suggest that improving training could simultaneously enhance equipment use and procedural compliance. This aligns with the conceptual framework of this study that integrated individual awareness and behaviour are embedded in broader institutional contexts [27]-[29] and correlates with previous studies that even where there are management-level safety policies, the policies are not always translated into on-the-ground competence because of poor enforcement, limited or no fire training, resource constraints, and weak safety culture [2][10][11].

LPG Filling Stations:

Descriptive statistics were used to assess fire safety awareness among LPG filling station operators across personnel issues, fire equipment, and fire procedures (see tables 3 and 4).

Personnel Issues: Findings on personnel-related fire safety awareness indicate low preparedness despite high hazard awareness. Regarding training on fire emergency response, only 52% of respondents agreed or strongly agreed that they had received adequate training, while 44% disagreed or strongly disagreed, suggesting uneven training coverage among LPG station operators.

Knowledge of assembly or muster points was limited, as only 36% of respondents agreed or strongly agreed, while 46% disagreed or strongly disagreed and 18% remained neutral. Confidence in evacuating customers and colleagues safely during a fire was similarly low, with just 24% expressing agreement and 54% indicating disagreement.

Staffing adequacy for fire response was a major weakness: 78% of respondents disagreed or strongly disagreed that their station had enough personnel to respond effectively during a fire. Such staffing gaps pose serious risks in LPG filling stations, where rapid escalation of fire incidents is common.

In contrast, awareness of the specific fire risks associated with handling and dispensing LPG was very high, with 94% of respondents agreeing or strongly agreeing. This demonstrates strong recognition of LPG-related hazards. However, this awareness did not translate into preparedness. Knowledge of who to contact during a fire emergency was low, with only 14% agreeing or strongly agreeing, while 50% disagreed or strongly disagreed and 36% were neutral. Similarly, only 20% of respondents knew the contact number of the nearest fire service station.

Awareness of potential ignition sources and fire hazards in or near LPG filling stations was moderate, with 46% agreeing or strongly agreeing, 40% disagreeing, and 14% neutral.

Fire Equipment: Results on fire equipment indicate better availability than operational competence. A large majority (82%) of respondents agreed or strongly agreed that fire extinguishers were easily accessible and not blocked, reflecting compliance with basic safety requirements.

However, only 24% of respondents could identify different types of fire extinguishers and know when to use each type, while 72% disagreed or strongly disagreed. Routine checking of fire extinguishers was also poor, as only 22% reported regular checks, compared to 60% who disagreed or strongly disagreed.

Perceptions of extinguisher adequacy were more favourable, with 58% of respondents agreeing or strongly agreeing that their station had a sufficient number of extinguishers. Similarly, 54% reported that extinguishers had been inspected and confirmed okay for use within the last year, although a substantial 34% disagreed, indicating inconsistent inspection practices across LPG stations.

Fire Procedures: Awareness of fire procedures among LPG filling station operators was generally low. Only 24% of respondents agreed or strongly agreed that they understood their station's fire emergency response plan, while 64% disagreed or strongly disagreed.

Knowledge of the PASS technique for portable fire extinguisher use was limited, with 30% agreeing or strongly agreeing and 56% disagreeing or strongly disagreeing. Awareness of the correct procedure for raising an alarm or reporting a fire was particularly weak, as only 26% of respondents agreed or strongly agreed, compared to 72% who disagreed or strongly disagreed.

Compliance with fire safety rules such as smoking prohibition showed moderate results, with 32% agreement and 46% disagreement. The presence of clear signage and instructions recorded 42% agreement, while 44% disagreed. Participation in regular fire drills was very poor, with only 30% agreeing or strongly agreeing and 60% strongly disagreeing.

Correlation analysis revealed positive relationships among personnel issues, fire equipment awareness, and fire procedure compliance. Stations with higher percentages of trained and informed personnel tended to record higher levels of awareness regarding fire procedures and better management of fire equipment. These associations indicate that improvements in personnel training and staffing are likely to yield broader improvements across other fire safety dimensions in LPG filling stations.

Overall, LPG filling station operators demonstrated very high awareness of fire and explosion risks (94%) but low levels of preparedness in training, staffing, emergency procedures, and drills. While fire extinguishers were widely accessible (82%), deficiencies in knowledge, inspection, and procedural compliance significantly undermined effective fire safety. The positive correlations among fire safety domains underscore the need for integrated fire safety interventions, particularly focused on training, drills, and systematic equipment management in LPG filling stations.

Petrol Vs LPG Filling Stations:

This study compared fire safety awareness among petrol and LPG filling station operators across three core dimensions: personnel issues, fire equipment, and fire procedures (see tables 2 and 4). Although both station types operate in high-risk environments involving flammable substances, the findings reveal important similarities and contrasts in awareness, preparedness, and safety practices.

Personnel Issues: Both petrol and LPG filling stations demonstrated high awareness of inherent fire risks, but this awareness was not matched by adequate preparedness. In petrol stations, 100% of respondents agreed or strongly agreed that they were aware of the fire risks associated with handling petrol, while in LPG stations, a similarly high proportion (94%) acknowledged awareness of gas-related fire and explosion risks. This indicates strong hazard recognition across both sectors.

However, gaps in training and operational readiness were evident in both settings, though more pronounced in LPG stations. In petrol filling stations, only 36% reported having received adequate fire emergency training, compared with 52% in LPG stations, suggesting relatively better - but still insufficient - training coverage in LPG facilities. Confidence in evacuating customers and colleagues was low in both station types, with only 16% agreement in petrol stations and 24% in LPG stations, highlighting a shared weakness in emergency evacuation competence.

Staffing adequacy emerged as a critical deficiency in both contexts. In petrol stations, 78% of respondents indicated insufficient personnel for fire response, a pattern mirrored in LPG stations with a similarly high proportion expressing disagreement. These also aligned with the observations from the *Fire safety observation checklist* (table 6). Given the rapid escalation potential of both petrol and LPG fires, inadequate staffing significantly compromises emergency response capacity in both settings.

Knowledge of emergency contacts and fire service numbers was poor across both station types, although petrol stations showed slightly lower awareness. This deficiency may delay external emergency response and exacerbate fire consequences, particularly in densely populated or high-traffic station locations. This finding aligns with the observation that participants were unprepared for a fire disaster in a study on disaster preparedness and response capacity to fire incidents among residential buildings in selected areas in Lagos and Akwa-Ibom States [13].

Fire Equipment: With respect to fire equipment, both petrol and LPG filling stations showed better availability than effective use. A large majority of respondents in petrol stations (82%) and LPG stations (82%) agreed that fire extinguishers were easily accessible and not blocked, indicating compliance with basic safety requirements and regulatory expectations.

Despite this, operational knowledge of fire extinguishers was weak in both settings. In petrol stations, only 22% of respondents could correctly identify different types of fire extinguishers and their appropriate use, compared

with 24% in LPG stations. This similarity suggests a systemic gap in practical fire-fighting knowledge across both sectors. Routine inspection and maintenance of fire extinguishers were also inadequate, with 70% of petrol station operators and 60% of LPG station operators reporting that extinguishers were not regularly checked.

Perceived adequacy of extinguisher numbers was moderate in both station types, though slightly higher in petrol stations. However, the inconsistent inspection practices observed in both contexts raise concerns about the actual functionality of installed equipment during emergencies.

Fire Procedures: Fire procedure awareness was generally low across both petrol and LPG filling stations, though some differences were observed. Understanding of documented fire emergency response plans was poor in both settings, with 64% of petrol station operators and 64% of LPG station operators indicating disagreement or strong disagreement. This suggests that formal fire response plans are either absent or poorly communicated across both sectors.

Knowledge of the PASS technique for extinguisher use was limited in both groups but marginally higher in LPG stations (30%) than in petrol stations (26%). Awareness of alarm-raising procedures was critically low in both contexts, with petrol stations recording 72% disagreement and LPG stations showing a comparable pattern. This weakness is particularly dangerous given the need for rapid alarm activation in flammable fuel environments.

Participation in regular fire drills was extremely poor across both station types, though slightly worse in petrol stations. In petrol filling stations, 70% strongly disagreed that they participated in drills, compared with 60% in LPG stations. The absence of drills undermines practical preparedness and may explain the low confidence levels observed in evacuation and emergency response.

Correlation analysis for both petrol and LPG stations revealed positive relationships among personnel issues, fire equipment awareness, and fire procedure compliance. This indicates that fire safety awareness operates as an integrated system in both station types. Improvements in training and staffing are likely to enhance procedural knowledge and effective use of equipment simultaneously. Conversely, deficiencies in personnel preparedness undermine the effectiveness of equipment and procedures.

Overall, the comparison shows that while LPG filling stations exhibit slightly better training and procedural awareness than petrol stations, both station types suffer from systemic weaknesses in emergency preparedness, drills, staffing adequacy, and practical fire-fighting competence (see tables 5 and 6). High hazard awareness alone has not translated into effective safety culture in either context. These findings align with the observation of low safety culture in Akwa Ibom public sector [21] and highlight the need for sector-wide, integrated fire safety interventions, including mandatory training, routine drills, clear emergency procedures, and strict enforcement of inspection and staffing requirements for both petrol and LPG filling stations to address the conclusions of past studies that management-level safety policies are not always translated into on-the-ground competence if there is poor regulatory oversight, inadequate fire training, resource constraints, and poor safety culture [2][10][11].

CONCLUSION

This study assessed fire safety awareness among petrol and LPG filling station operators in Akwa Ibom State, Nigeria, focusing on personnel issues, fire equipment, and fire procedures. The findings indicate that while respondents in both station types demonstrated a high level of awareness of the inherent fire hazards associated with petroleum products and liquefied petroleum gas, this awareness did not consistently translate into adequate preparedness or safe operational practices. Significant deficiencies were identified in training, staffing adequacy, emergency response confidence, and procedural knowledge, underscoring gaps between risk recognition and practical fire safety readiness.

A comparative analysis revealed that LPG filling stations generally exhibited slightly better performance than petrol stations in areas such as fire safety training, knowledge of extinguisher use, and participation in emergency procedures. Nevertheless, both station types showed weak compliance with critical fire safety practices, including routine fire drills, familiarity with emergency response plans, and regular inspection of fire-fighting equipment. These shortcomings expose filling stations, workers, customers, and surrounding communities to

elevated fire and explosion risks, particularly in environments where fuel handling is continuous and highly combustible.

Overall, the study showed that fire safety awareness in petrol and LPG filling stations remains uneven and insufficient to ensure effective fire risk management. The positive correlation observed among personnel issues, fire equipment awareness, and fire procedures suggests that fire safety culture in filling stations is systemic rather than fragmented. Consequently, improving one aspect of fire safety- particularly training and human capacity - is likely to enhance overall safety performance. Without deliberate institutional and regulatory interventions, however, current levels of preparedness are unlikely to meet acceptable safety standards.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed:

Mandatory Fire Safety Training: The Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) should mandate periodic, standardized fire safety training for all petrol and LPG filling station personnel as part of licensing and renewal requirements. Training programmes should be conducted in collaboration with State Fire Services and focus on emergency response, evacuation, PASS technique, and hazard control.

Regular Fire Drills: The Akwa Ibom State Fire Service should require filling stations to conduct documented fire drills at least twice a year. Evidence of drills should form part of routine fire safety inspections, in line with the Fire Service Acts and state-level fire safety regulations.

Improved Staffing for Emergency Response: NMDPRA should develop and enforce minimum staffing thresholds per operational shift for petrol and LPG filling stations to ensure adequate personnel are available for emergency response. Petrol and LPG stations that are nearby can consider having collaborative team of fire emergency responders to optimize cost.

Strengthening Fire Equipment Management: Routine inspection, servicing, and certification of fire extinguishers and related equipment should be enforced. Inspection records should be mandatory documentation during regulatory audits.

Clear Emergency Procedures and Signage: Filling station operators should be required to display clearly visible fire emergency response plans, alarm-raising procedures, evacuation routes, and emergency contact numbers in compliance with NMDPRA safety guidelines and state fire safety requirements.

Regulatory Oversight and Enforcement: Joint inspections by NMDPRA and State Fire Services should be considered, with penalties for non-compliance applied consistently. Compliance with fire safety requirements should be treated as a core operational condition, not a secondary administrative obligation.

Safety Culture Integration: Filling station owners and managers should integrate fire safety into daily operations through toolbox talks, supervision, and continuous safety communication, in line with NMDPRA's emphasis on safety management systems and risk-based regulation.

These measures, if effectively implemented, will significantly enhance fire safety awareness, emergency preparedness, and fire disaster resilience in both petrol and LPG filling stations, thereby reducing the likelihood and undesired consequences of fire incidents.

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