

Assessment of Safety Practices in Filling Stations in Ile-Ife, South Western Nigeria

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ABSTRACT

Back ground

In many countries, urban growth has outpaced the ability of governments to build essential infrastructures; enact and enforce the legislation needed to make life in cities safe, rewarding, and healthy. This growth has increased use of automobiles, need for fuelling services and consequently, proliferation of filling stations most of which lack the minimum requirements for operation. The aim of the study was to determine the level of awareness of hazards and safety measures among filling station attendants and assess the prevailing safety practices in filling stations in Ile-Ife.

Methods

A descriptive cross-sectional study was conducted. Data was collected using an interviewer-administered questionnaire and an observational checklist. Data was analyzed using the SPSS version 16 software. Discrete variables were presented using tables and charts, Fisher's exact test was used to test association and level of significance was set at 5%.

Results

The median (range) age of respondents was 24 (18 - 57) years and 94% were aware of safety measures with fire extinguisher being the most common safety measure known (54%). Fire hazard was the most common hazard known (94%). Set backs from the road and residential areas were less than 30 metres in 90% and 48% of the filling stations respectively. Stations owned by conglomerates had better safety measures compared to those owned by independent private marketers.

Conclusion

INTRODUCTION

In many countries, urban growth has outpaced the ability of governments to build essential infrastructures; enact and enforce the legislation needed to make life in cities safe, rewarding, and healthy.¹ This urban growth has brought with it increased use of automobiles, the need for fuelling services and consequently, proliferation of filling stations. A number of these filling stations lack the requisite safety measures (fire standards, layout, location and waste management) for obtaining operational licenses from the

regulatory bodies. Filling stations are being built too close to each other and in residential areas against the guidelines for siting such accident-prone facilities. This practice portends a dangerous trend, putting the staff and residents of the vicinity at heightened public health risk.

A filling station by definition is a facility where fuel and lubricants for automobiles are sold. Fuels sold at these facilities include petrol (Premium Motor Spirit [PMS]), Liquefied Natural Gas [LNG], diesel (Automated Gas

Oil [AGO]) and kerosene (Dual Purpose Kerosene [DPK]).² These fuels are flammable liquids, which can give off flammable vapour, even at very low temperatures. This means there is always a risk of fire or explosion if a source of ignition is present. In addition, they float on the surface of water and may travel long distances, eventually causing danger away from the place where they have escaped.³

Principally composed of hydrocarbons, these fuels could cause dermatitis if they contact the skin of handlers.⁴ Cases of haematological disorders attributable to exposure of persons to benzene at filling stations in less developed countries have been reported.⁵ There is also evidence of health effects linked with low dose exposures to volatile organic compounds including benzene in PMS.⁶

The safety of people and protection of the environment are major concerns at petrol filling stations. Petrol and other motor fuels are potentially hazardous; at ambient temperature, petrol gives off vapours which, when mixed with air in appropriate proportions, can burn with explosive force if ignited. In addition, all petroleum products are potential pollutants which, if released, can cause damage to the environment. They are injurious to aquatic life, and can have harmful health-related effects on humans if incorrectly handled.⁴

An estimated 7,400 fires and explosions occurred at public service stations per year from 1994 through 1998 in the United States of America.⁷ Of those 7,400 fires, nearly two-thirds (4,620) involved vehicles. Vehicle fires led to an annual average of one civilian death, 37 civilian injuries and \$7.7 million in property damage. Mechanical or electrical problems caused three out of four vehicle fires at public service stations.⁷ Purported sources of ignition in filling stations include naked fires from cigarette smoking, sparks from electrical appliance, electrostatic discharge when refuelling and possibly cell phones.⁸ However, published literature contains no credible evidence of cell phones igniting a fire

at a gasoline station.⁸

Safety practice in filling stations both by the service provider and customer is of utmost importance so as to prevent unforeseen hazards that could affect human health and the environment.⁹ There are standard safety practices that must be strictly observed by both the service providers and customers as prescribed by various authorities.¹⁰ Fire risk assessment, staff training, vapour recovery systems, emergency response, alarm systems and escape route are some of the preconditions that should be met by a filling station business owner.¹⁰ The provision of fire fighting equipment at facilities where highly flammable, volatile organic compounds (VOC) form the stock in trade is not negotiable.¹⁰

These safety measures have both environmental and occupational health impacts and hence need to be studied. There is a dearth of knowledge on safety practices in filling stations and given its adverse public health consequences, an insight into the picture locally will help show ways to address it.

This study therefore aimed to assess the prevailing safety practices in filling stations in Ife Central Local Government area of Osun State, Nigeria by assessing the awareness of safety measures among the attendants; identifying hazards present in the filling stations, determining the proportion of existing filling stations that meet the minimum required standard; and comparing these filling stations by ownership status. This study will highlight the measures needed to avoid these hazards and serve as a basis for policy decisions.

METHODOLOGY

The study which was a descriptive cross sectional type was carried out in filling stations located in Ife Central Local Government Area of Osun State between the months of April and May 2010. It is the largest local

government area in Osun State with a total population of 167,204 (male 88,403; female 78,801). The list of all approved filling stations and their boundaries were obtained from the Town Planning office and all filling stations in this local government area were included in the study. These included Conglomerates which are owned or run by multi-national oil producing companies (such as Mobil, Total, Agip) and independent petrol marketers (IPMs) run by private individuals. A total of 27 filling stations were studied.

Sample size was calculated using Windows program for Epidemiologists (WINPEPI)¹¹ for calculating simple proportion with level of confidence set at 95%, degree of precision at 0.05 and level of awareness of safety measures at 99.5%.¹² A sample size of 17 was obtained however, 27 filling stations were assessed.

A list of the attendants in each filling station was obtained to form the sampling frame and two were randomly selected using simple balloting thus generating 54 respondents from the 27 filling stations surveyed. Permission was obtained from the owners of the filling stations and informed consent obtained from the attendants before the data collection instrument was applied.

Data was collected with the use of an interviewer-administered questionnaire which had 2 sections. Section A contained socio-demographic characteristics of the respondents and section B contained questions on awareness of hazards as well as safety and preventive measures. A walk through survey was also done with the aid of a checklist which assessed the dimensions of the filling station, number of dispensers, fire extinguishers and their functionality, environmental parameters and practices of attendants during fuel dispensing. Adequate fire extinguisher-dispenser ratio in this study was defined as at least one fire extinguisher per dispenser. The data collected and entered into the computer

was analyzed using the Statistical Package for Social Sciences version 16 (SPSS 16 Chicago Illinois) software. Discrete variables were presented with use of tables and charts and bivariate analysis to test associations was done using the Fisher's exact test. Level of significance was set at 5%.

RESULTS

All the questionnaires administered to the 54 selected filling station attendants were retrieved and analysed. Median age was 24 years with majority (89%) aged between 18 and 31 years. Most (72%) of the respondents were males and almost all (98%) had educational attainment at least up to secondary school level (Table 1). The most common filling station hazard known to the respondents was fire hazard (94.4%); others include armed robbery attacks (27.8%), car accidents (13.0%), fuel spillage (11.1%) and health hazards (7.4%) such as fume inhalation (Table 1).

Majority (92.6%) of the respondents were aware of safety measures in filling stations. Of these, only 55.5%, 25.9% and 37% are aware of the use of fire extinguishers, switching off of the ignition before fuelling and displaying of 'No Smoking' labels in conspicuous places within filling stations respectively (Table 1).

Out of the 27 filling stations studied, 52% were owned or run by conglomerates while 48% were owned or run by Independent Petroleum Marketers (IPMs). Only 11.1% of filling stations had the minimum required distance of 30m between the edge of the road and the dispenser nearest to the road. All the filling stations had "No Smoking" signs as text or symbol displayed. About half (52%) of the filling stations were located less than 30m from residential areas, while about one-third (37%) had pumps close to the road that permit refuelling while still parked on the road and 55.6% had no 'IN and EXIT' signs. Three-quarters of the filling stations had adequate numbers of fire extinguishers but 63% of them

did not maintain the extinguishers in the last six months preceding the study (Table 2).

Only 10.5% of filling stations reported experiencing a fire incident in the past. These incidents were due to electrical faults from the dispensers or other electrical fittings in the

station and sparks from vehicles (Table 2).

There was a statistically significant difference ($p=0.007$) in training between the conglomerates and IPM owned/run filling stations with all respondents from filling

TABLE 1: Socio-demographic characteristics and selected safety attributes of filling station attendants in Ile-Ife, 2010

Variables	Characteristics	Frequency (N=54)	Percentage (%)
Age of respondents(Years)	18 -24	29	53.7
	25 - 31	19	35.1
	> 31	6	11.2
Sex of the respondents	Male	39	72
	Female	15	28
Educational attainment	Primary	1	1.9
	Secondary	36	66.7
	Tertiary	17	31.5
Hazards encountered in the station*	Fire hazard	51	94.4
	Robbery	15	27.8
	Car accident	7	13.0
	Fuel spillage	6	11.1
	Health hazard	4	7.4
	None	3	5.6
Awareness of safety measures	Yes	50	92.5
	No	4	7.5
Types of safety measures known*	Fire extinguisher	30	55.5
	No smoking	20	37.0
	Switch off engine	14	25.9
	Sandbox	10	18.5
	Good nozzle handling	5	9.3
	No phones	5	9.3
	None	5	9.3

* multiple answers allowed

Table 2: Physical and Assessment of of filling stations in Ile-Ife, 2010

Variable/Charateristics	Frequency	Percentage
Type of facility		
Conglomerate	14	52.0
Independent Private Marketers (IPM)	13	48.0
Setback from the road		
< 30m	24	88.9
> 30m	3	11.1
Distance from residential area		
< 30m	14	52.0
> 30m	13	48.0
Pumps located close to the road		
Yes	10	37.0
No	17	63.0
Displayed NO SMOKING sign		
Yes	27	100
No	0	0
Displayed IN and EXIT signs		
Yes	12	44.4
No	15	55.6
Fire Extinguisher to dispenser ratio		
Adequate	20	74.0
Not adequate	7	26.0
Maintenance of Fire extinguisher		
< 6monthago	17	63.0
> 6monthago	10	37.0
Experienced fire incident		
Yes	4	10.5
No	23	89.5

Table 3: Relationship between ownership of filling station, form of training and duration of training on safety measures

Variable	Conglomerate N =28 (%)	IPM N=26 (%)	
Form of training			
Oral	5 (17.9)	7 (26.9)	
Demonstration	23 (82.1)	13 (50.0)	0.007
Nore	0 (0)	6 (23.1)	
Duration of training			
Less than 1 week	10 (35.7)	16 (61.5)	
Greater than 1 week	18 (64.3)	4 (15.4)	0.002
No training	0 (0)	6 (23.1)	

DISCUSSION

The World Health Organization (WHO) in 2010 made the World Health Day theme Urbanization and Health with the slogan “1000 cities 1000 lives” to draw attention to the impact of uncontrolled development of cities and urban areas on the health of Man¹. The increase in numbers of vehicles plying Nigerian roads due to poor transportation and non availability of other means of transportation apart from road transport translates to a higher consumption of premium motor spirit (PMS). This increased demand has to be met by creating more filling stations and in most instances without proper evaluation of the impact of siting of these filling stations on the health of man. The indiscriminate siting of filling stations within residential areas has increased the hazard level which may lead to disaster at some point. To mitigate this, this study assessed the safety practices in filling stations in order to have information that can guide policy formulation and intervention.

The median age of respondents in this study was 24 years with two-thirds having secondary education. The level of awareness of safety measures was 93% which is similar to 99.5% found in a study by Yassin et al among 200 gasoline station workers in the Gaza strip. Ninety- one percent of respondents in this study had attended some training compared to 33% in the Gaza study¹². The most known safety measure in this study was availability of functional fire extinguishers which stands to reason as the most frequent hazard reported in the study was fire hazard (94.4%).

Although it is mandatory to have an Environmental Impact Assessment report which would have shed light on requirements for siting a filling station, this study showed that most of the filling stations did not comply with laid down regulations regarding siting of filling stations. Only 11% of filling stations had a setback greater than 30m and about 52% were sited at a distance less than 30m from a residential area. This therefore makes the

houses close to these filling stations vulnerable to fire outbreaks and increase the probability of accidents in filling stations especially during festive seasons when children play with fireworks. Accidents had occurred in 11% of the stations in this study compared with 2.5% in the Gaza study¹². In view of the possibility of fire accidents, there was 100% compliance by all filling stations on display of “NO SMOKING” sign within their premises.

Filling stations owned by the conglomerates fared better in training of their staff with all their staff having had one form of training or the other compared to only 75% of IPM staff. They also complied better with regulations guiding the siting of filling stations and this may not be unconnected with adoption of good business practices to protect their names and integrity while the IPMs may be more motivated by profit motives than compliance with regulations.

C O N C L U S I O N A N D R E C O M M E N D A T I O N

A large proportion of stations do not meet the minimum required standard for safety in filling stations. Awareness of safety measures among filling station attendants was good however its scope was narrow. Filling stations owned/run by conglomerates had better standards than those owned by IPMs. Most filling stations owned by IPMs did not ensure adequate training of their staff, compared to their counterparts owned by conglomerates. More efforts should be made to train filling station attendants especially by IPMs and regular assessment of facilities should be conducted to ensure that safety standards are maintained. There is need for further studies to evaluate the reasons for non-compliance with regulations on siting of filling stations.

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